User-guided Database Schema Generation For Naive Database Developers

by

Wong Aun Chyi

14214

Dissertation submitted in partial fulfilment of

the requirements for the

Bachelor of Technology (Hons)

(Business Information System)

JANUARY 2014

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

User-guided Database Schema Generation For Naive Database Developers

by

Wong Aun Chyi

14214

A project dissertation to the

Information System Programme

Universiti Teknologi PETRONAS

in partial fulfilment of the requirement for the

BACHELOR OF TECHNOLOGY (Hons)

(Business Information System)

Approved by,

_____

(Dr. Rohiza Ahmad)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

JANUARY 2014

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work in my own except as specified in the references and acknowledgement, and that the orginal work contained herein have not been undertaken or done by unspecified sources or persons.

_____

WONG AUN CHYI

ABSTRACT

The world is abound with data. Data creates value and competitive edges to an organization when it turned into more strategic, customer-oriented, and competitive information, a great significant to the continued health and survival of an organization. Hence, almost every organization has employed a Database Management System (DBMS) to store and manage the huge amount of data. However, problem exists when the ability to leverage the latest techniques and basic features of the tools has historically fallen to a limited group of experts - the certified or database developer with great expertise gained through the years of experiences. Having the software available alone is not enough to support users' data storage intention due to the concept of database design itself will need to be understood and mastered by the users before they can use the software effectively. This would require formal database design training and cannot be done over a night. As such, the first problem lead to second issue - most users tend to avoid using DBMS but rather opt to keep their data using more familiar software such as Excel spreadsheet or Word processor. This decision even though seems to be appropriate to most users has its drawbacks due to the nature of the software themselves. The objective of this research is to solve the issue above by developing an approach method for users who has less experiences and understanding in database design to be able to develop their own database schema. This proposed user-guided approach will basically prompt users with successive relevant questions and from the feedbacks captured, a database schema will gradually be developed. The scope is first focusing on the database developer in Malaysia due to time constraints. The research method used will be exploratory and constructive where researcher are require to collect data such as survey on the students and naïve database developers and interview the database expert and then make a solution based on design thinking and rapid application development (RAD) of system development life cycle (SDLC). At the end of research, researcher are expected to the generate algorithms and initial prototype for the formulated method to provide a user-friendly platform for the developer or user to reduce the above issue. The technology advance will assist them to deploy a solution that best fit to their need with more scalable, secure, multi-user framework. In short, the research can provide a significant value to the new and less experiences database developer, business and IT research field to make the process simple and understandable.

ACKNOWLEDGEMENT

I would like to express my deepest appreciation and gratitude to the following people in helping me completing the whole final year project.

First of all, I would like to offer my sincere gratitude to my supervisor, Dr Rohiza Ahmad who has guided and assisted me throughout my final year project with patience and knowledge whilst allowing me to work in my own way and own creativity. She always offers her valuable time to assisting me in completing the whole project. It has been such a great opportunity to work under her supervision. I also would like to express my appreciation to both FYP 1 and FYP 2 coordinators.

Besides that, I would like to thank all the parties and friends who willing to assist me in completing the research survey and system evaluation. These responses helped me to acquire as much data and information as much as possible. Additionally, I would like to thank the lecturers and database experts from various industry who willing to spend their valuable time in answering my interview question by email.

Other than that, I would like to thank my parents for giving me the moral support along the completion of my final year project. Without their support, I would not make it this far in completing the whole final year project. Last but not least, thank God for giving His strength in solving all the challenge in this final year project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.0 Introduction
1.1 Background Study

The world is teeming with data. International Data Corporation (IDC), an American market research and advisory firm, predicts that data volumes will experience a 44-fold increase between 2009 and 2020 [1]. According to [2], data is defined as the factual information in qualitative or quantitative variables and it is normally represented in a form of structure of table, graph, tree or images. Data is the lowest level of abstraction, followed by information which, after interpretation, is turned into knowledge. Raw data cannot stand alone by itself until it is transformed into meaningful information for wealth of decision-making.

Data is vitally important to the business as an intangible corporate asset especially the shift of business nature from product economy to service economy with the new information age at the beginning of 21th century. In contrary, about the 80th years of last century, the industrial era highly prioritized the superior value on tangible assets including land, building, equipment and supplies. With the growth in complexity of business, corporation spread globally which inevitability lead to higher levels of competition, working with data has become more frequent and necessary not only for ensuring smooth day to day business operations but also in making strategic decisions in the formulation and execution of business strategies and business objectives that comprises the whole organization.

We may call this type of information as strategy information. It is different from daily operational information. Information is the message interpreted from raw data and being delivered [3]. Strategic information does not run daily operation. It is however of great significant to the continued health and survival of an organization as it is thorough understanding of the particular group.

In attempt to enrich corporate high-quality performance, many enterprises rapidly begin to move toward the global business trend by investing in knowledge management. All employees from multiple levels of leadership management, diverse skills and professional background are empowered to share their knowledge and experiences where beneficial to others. According to the IDC, Fortune 500 companies may reap benefits of $31.5 billion a year by adequately sharing and collecting information from employees [4]. Quast, a former Fortune 500 executive with 20 years of experiences in leadership role, believes that proactively controlling and managing knowledge is the success key factor for an organization [5]. The action granted with the competency of delivers informed strategic decision-making, develop learning organization by regularly practice learning and finally promote the changes of cultural and innovation in the business. The success example in challenging Oil and Gas industry – PETRONAS- positioning themselves by placing focus on improved knowledge and information management which including the process of capturing, maintaining and leveraging knowledge in order to drive profit and robust business growth in the right direction as well as boost its strategic competitiveness [6].

Due to the importance of data, a dedicated type of software which is totally meant for storing and managing huge amount of data has been made available in the market. This software is commonly referred to as Database Management System (DBMS). It is an especially tailored database program that allows the interaction between multiple users, additional enterprise applications, and the database itself to catalog, retrieve, and run queries on data within database [7]. Database is defined as structured collection of data. Some popular examples of such software are Oracle, SQL Server, SAP, Microsoft Access and MySQL. MySQL is the world's well-known open sources DBMS recently acquired by Oracle. DBMS is designed into four different level of architecture including enterprise, departmental, personal and mobile. The supporting architecture for the DBMS environment is very important as a wrong decision can result in poor performances and downtime which might lead to huge business losses. Hence, selected DBMS must be appropriate for the nature and type of processing that one plan to employ.

However, having the software available alone is not enough to support users' data storage intention. The reason being, the concept of database design itself will need to

be understood and mastered by the users before they can use the software effectively. Hence, the structure of the data storage (referred to as database schema in database terminology) would need to be designed first before any data can be entered; and, this would require formal database design training. Database schema outlines the type and structure of the high-level logical model of the database, the types of the entities being modeled and the relationships between the entities. The structure of the underlying data may be very simple (just one table) or more complex (consisting of several related tables often according to normalization rules). As such, most users tend to avoid using DBMS but rather opt to keep their data using more familiar software such as Excel spreadsheet or Word processor. This decision even though seems to be appropriate to most users has its drawbacks. One of them of course is due to the nature of the software themselves. Since they are built for some other purposes than data management, they will not provide or support all possible functions which are available in any DBMS.

Therefore, this project intends to develop a method for users who are naive in database design to be able to develop their own database schema. User guided approach is proposed as a possible solution. The approach will basically prompt users with successive relevant questions and from the feedbacks captured, a database schema will gradually be developed. Once the schema has been completed (in SQL format), it can then be entered into a DBMS for database creation and further data entry and manipulation. It is expected that the study will contributes to the development of the society including technology and business area. With the outputs of the project, possible commercialization and further grant submissions are anticipated.

1.2 Problem Statement

Excel spreadsheet, a powerful widely-used tool best for independent lists and mathematical calculations, is misused by novices as lightweight database and slowly this became the norm. Allen, who has 20 years working experiences in administrative support field, Microsoft Excel is not a database but spreadsheet software [8]. Both of them have its own strengths in term of scale and manageability despite there is some overlap between the two in terms of functionality.

It is an alarmingly situation that huge number of users use Excel spreadsheet to store non-numeric arrays of information that should most likely be stored in database. One of the critical problems - The spreadsheet is nevertheless used so often when a database is more appropriate. User is not certain which option is best fit to their business need and misleading by the current practice.

Cannot be denied that problem above is due to scarcity of sound technical skills, one of the 10 most common IT challenges faced by Small to Medium Enterprises (SMEs) today [9]. A shortage of experience, insufficiency of essential skills, inflexibly timelines and lack of resources are main key obstacles of designing a superior database. Poor database design will affect the application performance and produce low quality data which lead to wasting in time and money. Database logical and physical schema design needs a wealth of knowledge and experiences. Nevertheless, this skill cannot be obtained overnight and requires special formal training in order to be mastered. Besides that, database administrative (DBAs) required to learn and expert new programs every 6 to 9 months as the technology keep changing rapidly. It is not an easy career; hence it is ranked as number 5 of best job in America which provides attractive opportunities growth and great compensation package [10].

The previous problem leads to another issue. The technical complexities of coding, security, hosting and necessary knowledge frighten people and initiate the incentive of choosing available familiar option which is Excel spreadsheet and Word processing. They are the simplest solution out there to get job done as the easiness of the software to be able to append, update, sort, filter and analyze data. However, the solution only works for short-run; either Excel spreadsheet or Word processing is poor choices for long run. Roger Hautle, the founder of excel work Ltd who master in professional excel development and VBA programming Visual Basic for Applications is not supportive toward the usage of excel spreadsheet to store million record of data and strongly emphasizes that spreadsheet is not a substitution of database [11]. If the situation calls for a database, then should use one. One evade problem and ignore the feeling of fear is not an appropriate resolution. Next issue faced by database user in non-IT department of some organization, due to security and validation purposes, there is something that needs to leave to the IT department to do and it takes a very

long time to finish the whole development. In order to sit down with IT, other option gains a large majority of time before it officially roll out.

Lastly, it is very time and cost consuming for any database schema changes. It can be solved by manually writing SQL scripts but tricky to maintain. Any errors can cause downtime, delays in implementation, raise unnecessary costs or critical data loss [12]. In additional, due to the nature of software itself, use inappropriate software which does not fully utilize the features build for other purposes is wasting resources. According to YCombinator Idea #22, Graham believes there is an opportunity to build a program such users wished to be real if it were web-based and easier to get data into it, through forms or scraping. The key is do not make it feel like a database that frightens people and let people do without defining structure [13]. Besides, there is a market survey found that the demand and supply of skilled DBAs is not balancing and lead to a phenemona of workforce overdemand crisis. Demand for DBAs has risen sharply and shorter supply over the last year.

In short, with such a major problem that exists at IT and business world, it is necessary to study those problems in detail and solve it by developing an IT solution. A user-guided application will be a perfect platform for the developer or user to reduce the above issue and the technology advance will assist them to deploy a solution that best fit to their need with more scalable, secure, multi-user framework.

1.3 Significant of Project

According to the research's observation, this study will provide a significant contribution to the IT and business world which includes database user and also the developer.

From the enterprise employer perspective, the research on the problem will expect to have a better solution that ease to use and do not required highest level of skills in programming. According to Richard Nott, the website director at online IT specialist recruiter CWjobs.co.uk, said that the demand of high skilled database professional with rich experiences growing for the past 2 years [14]. Majority skilled DBAs have been taken by companies and it is very hard to recruit one from the workforce market

supply. This concludes that researcher will takes opportunity to provide an easier solution to entry-level DBAs or developer. Employer will more easily to recruit fresh graduate from the workforce market for the role if the software application became more user friendly, ease to use and then fit to business need. This will reduce the anxiety of employer on DBAs's competency to design and maintain a database schema if the process is globally standardize.

From the database developer perspective, if it is story-telling approach, this outcome of the study can help them to ensure none of the important elements is miss out during the process of developing database schema such as primary key, secondary key, entity and its relationship. At the end, with the guidance, database developer can identifies how data relates to other data in the system and structures it in more easier way accordingly. The back-end and front-end of a database can be developed and maintained to meet the particular data needs of a company or an organization. The feeling of fear can be minimized as lesser technical knowledge is required to develop the database schema and less stressful when everyone is easier to muck in and know how things work, so that organization is not just reliant on one team member knowing one database platform or one version of a development language.

From the non-IT database user perspective, now they don't have to ask the IT department to do anything if the study can provide a solution that easily being understood in non-programming language. Besides that, they can make sure that the database is exactly meeting their requirement and cut unnecessary time during development.

Lastly, from the research perspective, this provides an opportunity for other researcher to think on the new way of doing thing. In this study, it is tried to simplify the way of design database schema with a more human-oriented approach for a database developer beginner. In additional, from the marketing and management perspective, it is able to study the data that is being stored into the database so that there will be more marketing strategies that may be coming out by analyzing those data. While the database schema matching with exactly what a company need, the more accurate the information obtained.

Through this research, the researcher believes that it will provide more contribution other than the 4 parties that is being stated above.

1.4 Objective of Study

The main objective of the study is to research on the problem and challenges faced by the beginner of database developer today and to develop a method for users who are naïve in database design to be able to develop schema. Therefore, it can be further divide into sub-objectives in order to achieve the main objectives:

a) To develop a user guided method for database schema generation.

In this study, researcher will be expected to develop a method for the database developer beginner to create database schema accurately and effectively. The method must be very attractive and easier to understand by both technical and non-technical users. This objective will solve the problem of scarcity of technical skills and knowledge. Researcher will study the existing approaches and identify the suitable one to be the final solution method. However, user guided approach is proposed as a possible solution. This approach will basically prompt users with successive relevant questions from the feedbacks captured and then database schema will gradually be developed.

b) To develop a prototype which implements the developed method

This objective is to generate the algorithms and initial prototype for the formulated method for objective 1. Prior that, researcher will collect the data to understand the requirement of creating database schema. For example, the basic elements required are primary key, foreign key, entity and its relationship. Besides that, researcher needs to study the element for database schema, how the element is captured from users and integrated into a database and how the input matches with developed method. The prototype is expected to be user-friendly and ease to use.

c) To evaluate the developed prototype

After the prototype implementation, simulations will be carrying out in order to check the validity, performance of the prototype and evaluate the user acceptance. In summary, it is a testing analysis on the implemented prototype. If it is not working, further study need to be done.

1.5 Scope of Study

The area of study will be first focus on the database developer in Malaysia. Researcher will be gathering the requirement and data through any available sources throughout the whole country. However, due to time constraints, researcher is expected to only gather the requirement from the UTP CIS lecturer who expert in database. If time allow, next sources are IT expert in the industry by teleconference or email and entry-level database developer. Researchers will ensure the number of sample is reasonable in order to provide a more accurate analysis on the data. The scope of study will be as below:

a) Studied on current practice of storing data and existing method

Researcher is expected to study how database user stores their data and what software system is commonly used, then analyze how effective the method is. Researcher will also study on the weakness of using current practice. Besides, researcher will study the existing approach and identification of suitable approaches that can be extended as well as formulating the solution method.

b) Current problem faced by naïve database developers

Survey in term of Questionnaire or interview will be carried out to understand the current problem that is being faced by the database user and developer when design database. The study will be carried out to find out the problem and provide a solution to solve it.

c) Technology perspective of the prototype

The expected system will be developed as websites system, desktop system or others. All depends on the developed method which needs to be done at phase 1 of this study. Researcher need to study the technical technology and perform the functionality expected by the user.

1.6 Relevancy of Study

The project is relevant from the different perspective as below:

a) Database developer & User

The project is directly relevant to the database developer and user as throughout this study, they are the parties which are being directly affected by the problem. The scarcity of technical knowledge and feeling of fear are leading them toward using inappropriate software which is not effective. They prefer to use more familiar and simple software such as Excel spreadsheet. With this mindset, it reduces the effectiveness of the data management performances. Therefore, the study will help to database developer to reduce the burden of creating database schema and willing to use database when the organization need it.

b) Employer

According to Richard Nott, the website director at online IT specialist recruiter CWjobs.co.uk, said that the demand of high skilled database professional with rich experiences growing for the past 2 years [14]. Majority skilled DBAs have been taken by companies and it is very hard to recruit one from the workforce market supply. The study will allow employer will more easily to recruit fresh graduate from the workforce market for the role if the software application became more user friendly, ease to use and then fit to business need. This will reduce the anxiety of employer on DBAs's competency to design and maintain a database schema if the process is globally standardize.

c) Society

The outputs from this research can be beneficial to the society and the world at large since database is needed in all aspects of organizations and not all organizations especially the SMEs are capable of hiring a dedicated database developer. This is in line with the Digital Lifestyle Malaysia (DLM) initiaive championed by the Malaysian Communications and Multimedia Commissions (MCMC) which aims to promote the use of IT in the workplace (DL-Work). Besides, the study helps the society to changing the current way of doing thing.

d) University and Research Society

The study carried out to provide a user guided database schema generation for naïve database developer. Nowadays, the university is carrying out the researches that try to improve the existing practice to contribute to the database design in various ways. Researcher believes that this study will directly or indirectly relevant to the objectives of all research institution. Besides that, the introduction of the new solution method will affect the solution provided by other research.

e) Researcher

As researcher is from computer science background, the study is relevant to the researcher itself because the study is expected to produce a database-related solution to solve the problem statement listed. Besides that, research is expected to gain some knowledge on the database schema and the development process of an application.

1.7 Feasibility Study

Before starting the initial phase of the study, the feasibility study is required in order to ensure that the study is possible and smoothen the development cycle of the study. It is being separate into 5 categorize as below:

a) Technical Feasibility

From the technical point of view, the study is feasible. The technical part of the study occur in the implementation phase in the SDLC where the study is expected to developed a user-guided method for database schema generation and a prototype which implements the developed method. The delivery must able to capture input from user and integrate into the database schema. Technically, the prototype can be developed as the researchers have the programming knowledge and experience in developing the system. Depends on final selected method, the prototype might be involve the managing of the network server in order for the architecture to function.

b) Economic Feasibility

It is expected that development cost for the project will be low. If neglect the development cost of the programmer, the only cost involve will be the DBMS for

testing database schema purpose. Perhaps we can first test with open-sources DBMS and the cost will not be counted in record-keeping.

Another cost that may involve is data gathering transportation cost. If the interviewee is outside Ipoh area, researcher is expected to do interview via teleconference and email. However, if being requested to travel to different area to conduct the interview, transportation cost incurred.

Another prototype cost that may incur is the hardware and software cost of the server that need to support the prototype. However, all is depends on the developed method which need to be done at phase 1 of this study. If server is required, the researcher is expected to use a laptop as the local host server to cut cost. In short, all cost will be cover under the research institution and the research will not face any financial obstacle.

c) **Organizational Feasibility**

In the pre-research, the study shows that the major problem faced by organization all around the world is wasting time and money for database schema changes and lead to performances downtime and worst situation – data losses. Besides that, they prefer to use a simple and familiar tool for data storage and management which is inappropriate. So, researcher expects that the study will be support by the IT and business industry. Employer also faced the shortage of high skilled DBAs talent from the talent pool. Therefore, the expectation of the system is to simplify and customized the way to create database schema.

Furthermore, the study is supported by the research institution as the project is being approved by the research committee and they will provide necessary assistance in term of spending and letter of approval. With a variety of support from the stakeholder and university, this research can be carrying out smoothly.

d) **Scope Feasibility**

The scope that is being listed out is possible to be achieved by the researcher. The area of research even though is cover on Malaysia but it focus on the research in the campus to receive a large sample but save the data collection time.

Besides that, the focus on the research will be focus on the user guided method and the elements that needed to included building a database schema which can be done through the interview of some database expert and entry-developer of database developer. The scope is niche enough for the researcher to achieve the objectives of the study.

The development prototype will be under the technical capability of the researcher. Besides that, researchers have both business and technology knowledge in order to understand the problem faced by both IT and enterprise and then implement IT-solution on it.

e) Time Feasibility

The time provided by the research institution for the study is 8 month and researcher believe that the time provided is sufficient to complete all project activities in the Gantt chart.

Researcher initially will collect the data from various source before start the analysis phase which will not take for more than 1 month. The analysis phase can be done through the Microsoft Excel software. Research on the pass work can be done easily through Internet Search.

The programming language used for development of the software will be depends on the developed solution method which need to be done at phase 1 of this study. The system expected to be developed within the time as shown in Gantt chart. With the 8 month provided, it is expected every activities can be done according the schedule.

CHAPTER 2

LITERATURE REVIEW

2.0 Literature Review

From Chapter 1, we strongly understand the highly need of data and database for an organization. Database schema which describes the structure of database is very important as accurate and useful information only available from well-designed database. However, ability to develop the structure or schema for a database is not a skill which can be learnt overnight. It requires special training in order to be mastered. According to [15], the Oracle Certified Associate (OCA) certificate is also a must for an entry-level database administrator and it allows the users that know the basics, but have not yet obtained the experience gained by professional MySQL DBAs or Developers. To be a database developer who can master the database, Figure 1 is the java certificate path, which is very difficult and time consuming but this compensated with a very attractive salary. Alternatively, ones should have many years of database working experiences to know well on generating a database schema in an effective and optimize way.
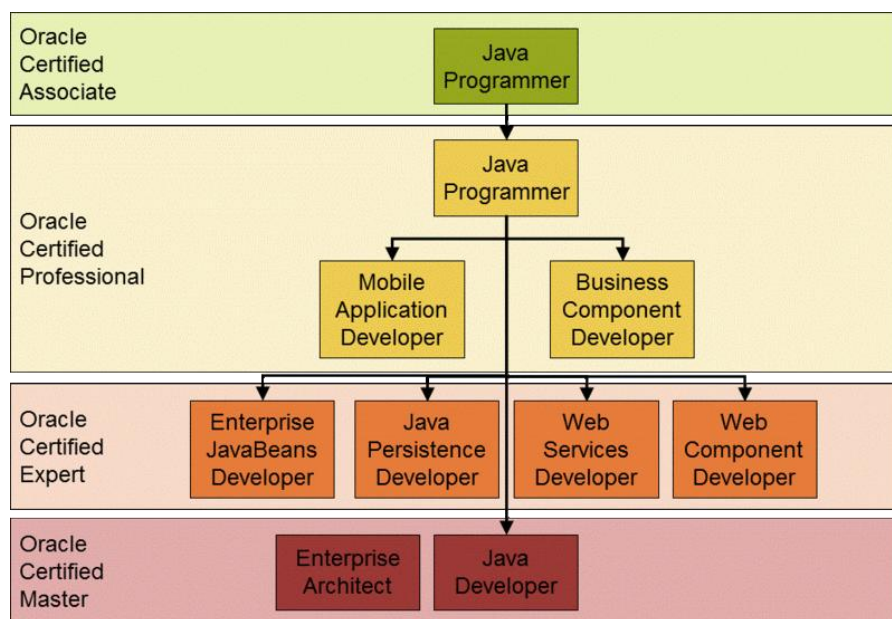

Figure 1 : Java Certificate Path

Hence, many researchers have proposed some methods for aiding database developers especially those who are not fluent in database design in designing the correctly normalized schema (Note: Normalized schema takes care of problems which might happen due to new data insertions, modifications and deletions). Yang [16] for example, has come out with a virtual tutor which can teach database developers the technique of schema normalization. By following the virtual tour, developers can learn and apply the technique in their database schema development.

Rather than teaching how to develop a database schema and then let the developers to develop the schema on their own, there are also works which develop a tool which can guide users during their database schema development. SVTe [17] is an example of that. SVTe is a tool which can be used to validate an already designed schema. If a schema is still incorrect, explanations will be given to the users for them to improve the schema. The tool can be used repeatedly until the correct schema has been achieved.

Saringat et al. [18] on the other hand, have proposed a method which uses UML class diagram and user output interfaces as the basis for generating normalized schema. Based on the two items, commonly shared data elements will be included in the normalized schema, and the rests will be discarded. An almost similar approach was also suggested by Alsaadi [19]. In his proposed method, UML class diagram is used to produce an initial database schema and a sequence diagram is used to check the integrity of the schema for final version. Ni et al. [20] work on database schema generation deals with the issues of scalability versus performance and space when multiple tenants use cloud facility to store their databases. They proposed a method which is adaptive according to database schemas of different tenants and query workloads. The method identifies important attributes to generate a base table and leaves the rests in supplementary.

Due to the believe that developers prefer spreadsheet in keeping data, Qian, LeFevre and Jagadish [21] have developed a prototype named CRIUS which provides a spreadsheet like interface for schema evolution. Using the interface, developers can modify the schema associated with the data only by a single drag-and-drop of the mouse. In doing so, functional dependencies are used to guide the normalization process. As what has been mentioned by Waseem, Hussain and Shaikh in [22],

functional dependencies (FD) or functional relationships among database attributes have been popularly used by researchers to guide the process of normalizing database schema. Many algorithms have been produced and extended to create schema from FDs such as the ones presented in [22] and [23].

TryGit [24], uses the introductory teaching with story-telling method to allow the newbie learning how to use Git by reviewing the basic concept of Git version control. It has 25 steps to be finished and user only need to follow to step to click a button, commands will prompt out. User just need to click enter (user expected to learn the command code during this time) and data repository will be created as shown in figure 4. Figure 3 shows advice is given for each step.
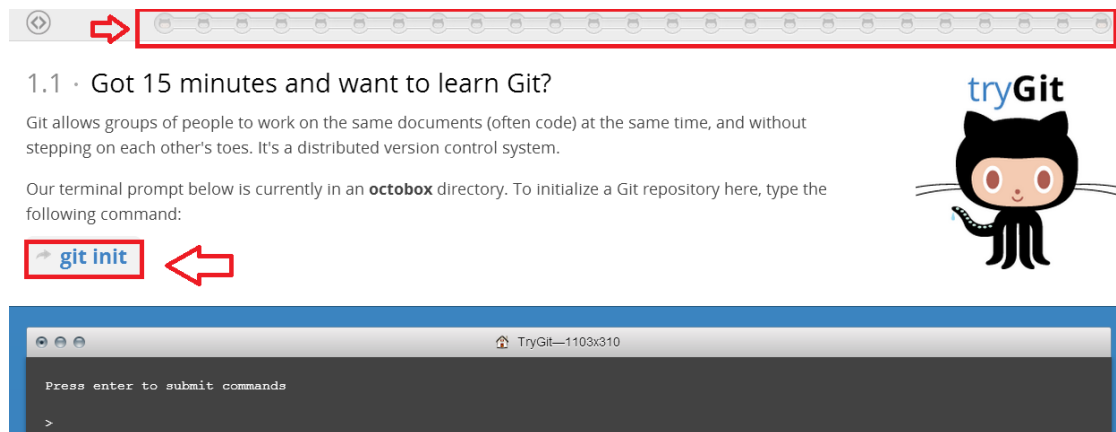

Figure 2 : TryGit Story-telling method
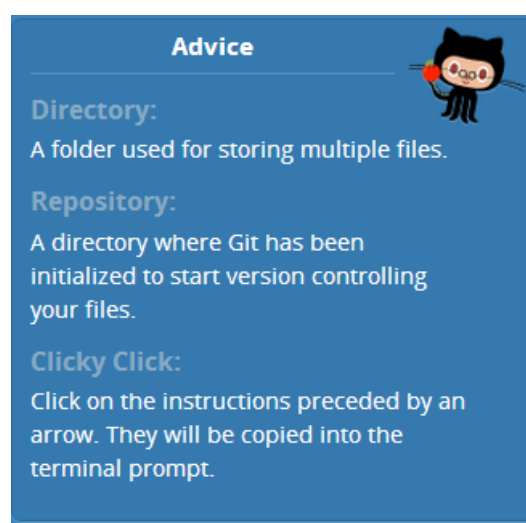
Figure 3 : Advice of each step
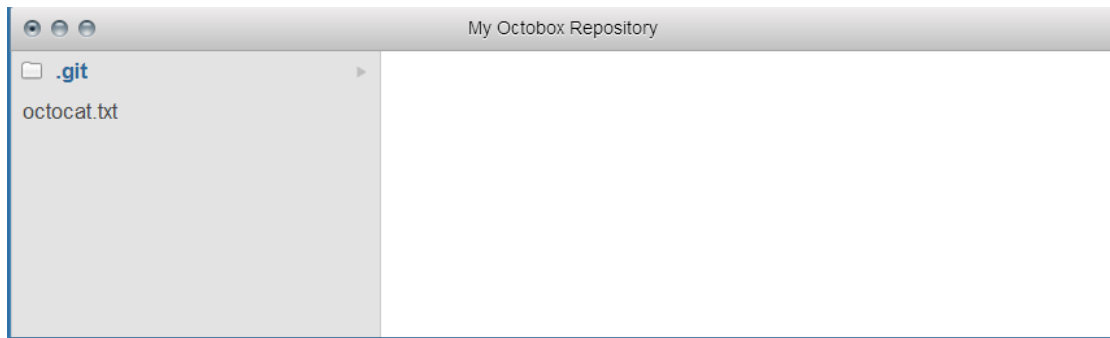
Figure 4 : Octobox repository

Besides, due to millions of business using excel to manage their data because of its simplicity, Ragic! [25], automatically build a web database right after the user create a form online and key in data. With Ragic, users are allowed to send out their requests and feedback, and view updated product and company information in the web database. Self help searches and queries can be done to find the any information needed as data is stored in the web database. User can regularly update the information in the web database without any technical assistance through the simple spreadsheet interface. In additional, with simple spreadsheet style builders, user can save coding time to create and customize the cloud database. The advantages of this tool not only the reporting tool, but also the features of linked fields and forms as show in Figure 3. Also, the tool allow user import from excel and export to excel format. This user-guided method is works and perhaps researcher can use the same method but create database scheme and save in local database file instead web database. Besides Ragic, Wufoo [26] also uses online form builder method to automate the creation of database.
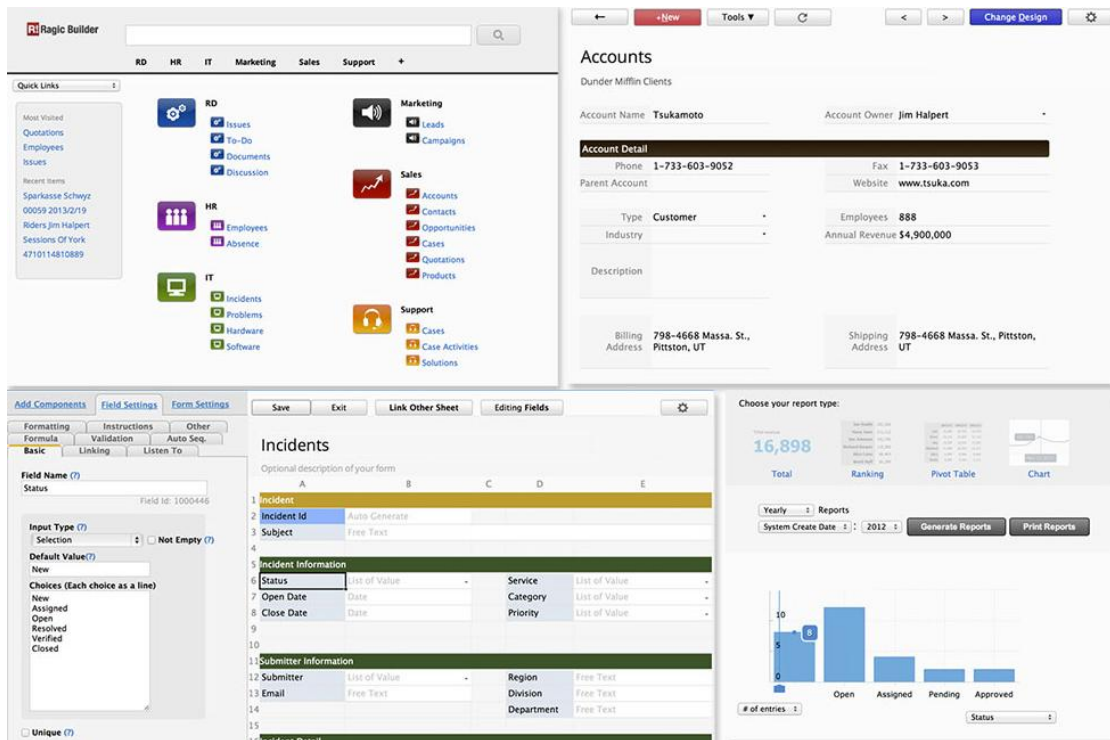
Figure 5 : Features of Ragic!
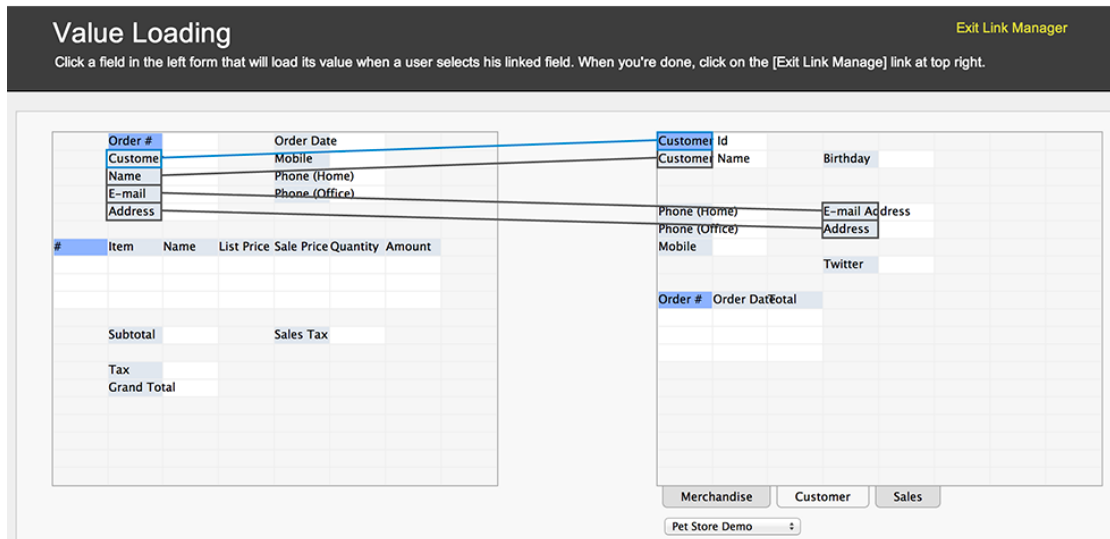
Figure 6 : Linked fields and forms

Figure 7 : Powerful data backend that allow good management of data

Figure 8 : Web embed form to key in data

Based on the reviews above, we believe that the available methods are still very much require database developers to know at least some basic database design concepts such as conceptual model, i.e., UML diagrams, FDs etc. before they can create a normalized database schema. How to come out with such basic foundations itself is still lacking in the literature. Hence, we believe a user guided approach is needed to direct database developers in developing normalized database schema. Same approach used by TryGit believed to be used in the prototype development, which is a best and interesting database schema creation and learning platform.

CHAPTER 3

METHODOLOGY

3.0 Methodology
3.1 Research Methodology

In this research, there are two (2) research methodology is being used. The first research method is exploratory research. The research method assists to identify and define the question or problem of the research. It is being used in the first 4 phase (empathize, define, planning and analysis) in the system methodology. In this research, exploratory research have been carried out through quantitative and qualitative data gathering where the researcher have conducted a survey on the problem that have been faced by the less experiences database developer and their supportive response on the proposed solution. In quantitative research, researcher has distributed the online Google spreadsheet questionnaire form to be filled by selected candidates. Researcher is expected to collect at least 100 samples in order to ensure that the data collected is accurate. In the qualitative research, the researcher will review the document and research paper that is relevant to the research. Besides that, researcher conducted interview with the database experts in the way on their view on proposed solution and important entity to create database schema. Researcher will set an appointment with the relevant parties and conducted an informal interview with them that can contribute information to the research. Researcher is expected to interview at least 5 database experts. Furthermore, researcher can identify the problems faced by less experiences database developer through observation and empathy.

The second research methodology is constructive research which tests the theories and the solution that is being proposed and complete in the design and implementation phase and applies it to the problem that is being identify in the exploratory research. This research methodology will only being conducted after the exploratory research is completed. These researches are expected to design the solution through the design diagram such as activity, use case, class and behavioral

diagram. The interface will be design and a prototype needs to be completed for user testing. The solution or prototype may be changed when it do not fulfill the objectives of the user and required a new or modified design for a new solution. The research process may be repeated whenever new requirement or new problem occurs immediately or in the future.

3.2 System Methodology & Project Activities

The research methodology that will be used in this study is the combination of Design Thinking and Rapid Application Development (RAD). This method is suitable for the research with quick development prototype. The advantage of using this model is it allow the study to evolve when it receive the changing in the requirement. So, it allows the researcher to adapt to changing in environment faster and achieve the objectives within the time. Design thinking process guides researcher to create meaningful innovations by knowing the users and care about their lives.
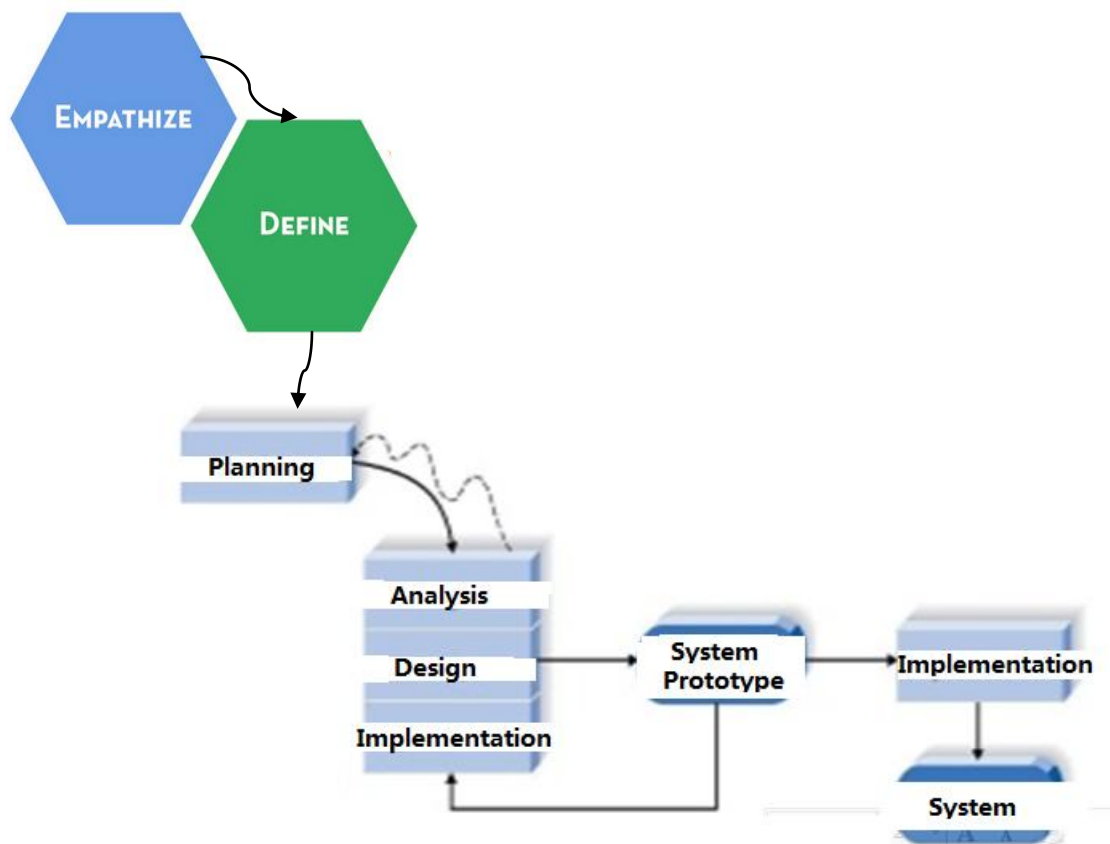
Figure 9 : Design Thinking and Rapid Application Development (RAD)

Figure 9 show the phases that will be undergoes in the design thinking and rapid application development. There are 4 phases by using this methodology: Planning, Analysis, Design and Implementation [27].

a) **Empathize & Define Phase**

This phase is the centerpiece of human-centered design process because this is the learning about the user for whom researcher are designing. In this phase, researchers are required to understand people, within the context of the design challenge. To empathize, researcher observes, engage and watch and listen. Use the environment to prompt deeper questions. The Define mode of the design process is all about bringing clarity and focus to the design space. This stage is about making sense of the widespread information researcher have gathered. The primary goal of this phase is to craft a meaningful and actionable problem statement – this is what we call a point-of-view.

b) **Planning Phase**

In this phase, researchers are required to choose the area of research topic and to be submitted for the approval by the research committee. Once particular supervisor assigned, the researcher needs to discuss with SV on the research area and then finalize the research topic. Firstly, identify the problem statement on the topic selected. After the problem is being clearly defined through the online research, the research are require to come out with the objectives and scope that need to be completed within the period of research. The researcher needs to come out with a proposal that list out the requirement of the project and the scope to be covered in order to review by the research supervisor. The discussion will be involved with the research supervisor before proceed to research on past work to avoid coming back to the planning phase. After that, researcher need to perform the pre-feasibility analysis to identify whether the project is possible to be achieve from the technical, economic, organizational, time and scope perspective. Either one perspective of the feasibility cannot be achieved; the objectives and scope may need to be reviewed. At the end of the planning phase, research are required to, researcher is expected to finish the literature review by analyzing the past work and resources that support the study and come out with a specific timeline on the milestones to be achieved.

c) Analysis Phase

In this phase, researchers are requiring to gather the information necessary to iterate the requirement from the user point of view. Even though pre-research may prove the worthiness of the study, but gathering the existing information will get a clearer picture of the study and further support the study based on the updated problem in the related parties. Research will gather the information at the 3 main areas: UTP CIS Lecturers, Industry IT expert and entry-level database developer. The gathering of information will be done distributing the questionnaire and interview or teleconference, depends on the location of interviewee. After the gathering of information, researches are required to analyze the information and list out the system requirement to be done in the design and implementation phase. When the analysis of data is completed, the method will be analyzed by observing the existing approach in order to stimulate the design in the next phase.

d) Design Phase

In this phase, research will start modeling a new method by designing the activity diagram and will be further supported by the use case diagram, behavioral diagram, class diagram and ERD diagram. The diagram will be used as the reference for the design of the prototype and the algorithm. After the modeling of developed method, it will proceed to technical design which involves the sketching and designing the interface of the prototype. Besides that, it also includes the design of database structure and hardware that is required to support the implementation phase, if required. The design will be reviewed and discussed with the supervisor and the stakeholder in order to verify the requirement and to avoid the turning back in this project. At the end of the design phase, researches are required to submit the report on all the system, analysis and design result as the final delivery for a 4 month period.

e) Implementation Phase

Based on the design in last phase, the researcher will first start to develop the method and then prototype based on the design on the previous phase. In this phase, only functionality will be developed as interfaces have been developed in last phase. Changing of interface may be required if certain function that is not planned in the design phase. After the development is done, deployment of the whole system will be

done of the place of the user. Then the usability testing will be performing at the same time. The data and feedback of the user will be collected for 2 weeks. The activities involved the preparation of the evaluation set up, conduct the evaluation and present the result of evaluation. If there is any bug and improvement in the system, change will need to be done. Since it is in RAD methodology, most probably it will be back to analysis or design phase to change the design of the original system and come back to the development of the project. Although at the end of implementation, the prototype will become the system but that depend on the decision make the research committee whether to implement the system in real life after the research complete.

3.3 System Architecture Design
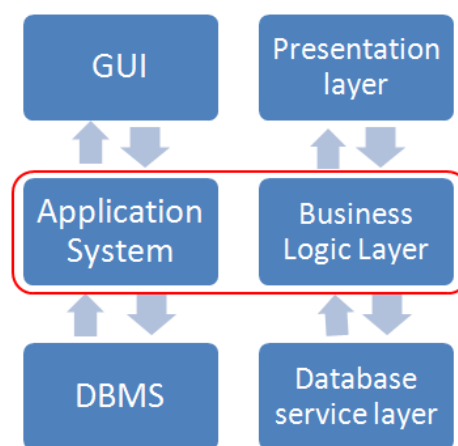
Figure 10 : Proposed intelligent

The part with red highlight is the intelligent researcher need to work on, between developed system and the database.

Figure 11 : System Design

Figure 11 shows the architecture of the project. In order to use the user-guided database schema generator application, the user required a laptop or computer installed with XAMPP, mySQL connector and the application. XAMPP is used to run own laptop as a server. The process starts when user run the application and must be connected to database. Multiple options of functionality such as view database, create database, view table, create table etc are provided by the application to the user. The user has the right to choose any action and each step is automatically updated to the mySQL database. For example, if user create new database, the database will created and exists in the database, not only for display purpose.

There is a story board on the right hand side of application to telling the database schema related story to the user. Besides, real SQL command will show in a box as well, which is good learning for new database developer. In the end, once the application closed, a database schema in SQL format will be generated and stored at desktop of C-Drive. The database schema will store all the SQL command of all actions that have been taken before application closed. It can be copy and paste to other laptop which would like to use same database schema. Each database schema is unique as it stored as name with format of "yyyymmddhhmmss".

3.4 Activity Diagram

In this project, it can be separate into 2 major processes. The first process is the installation process as the installation prerequisite exists and the second one is the database schema creation process. Below diagram show the activity diagram for the both processes.
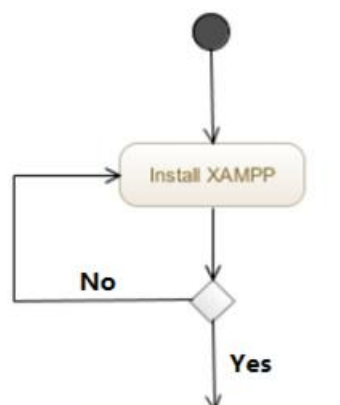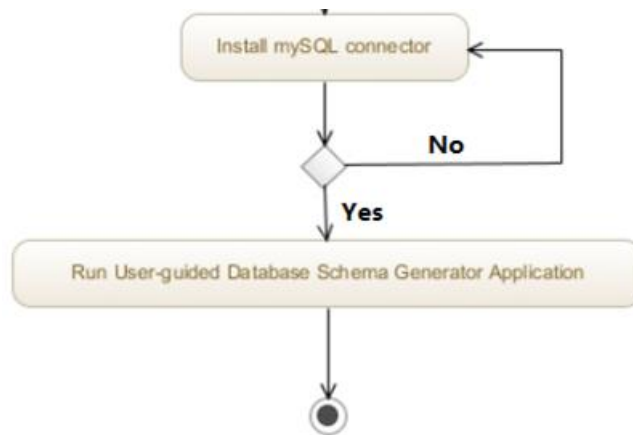
Figure 12 : Activity diagram - Installation Process
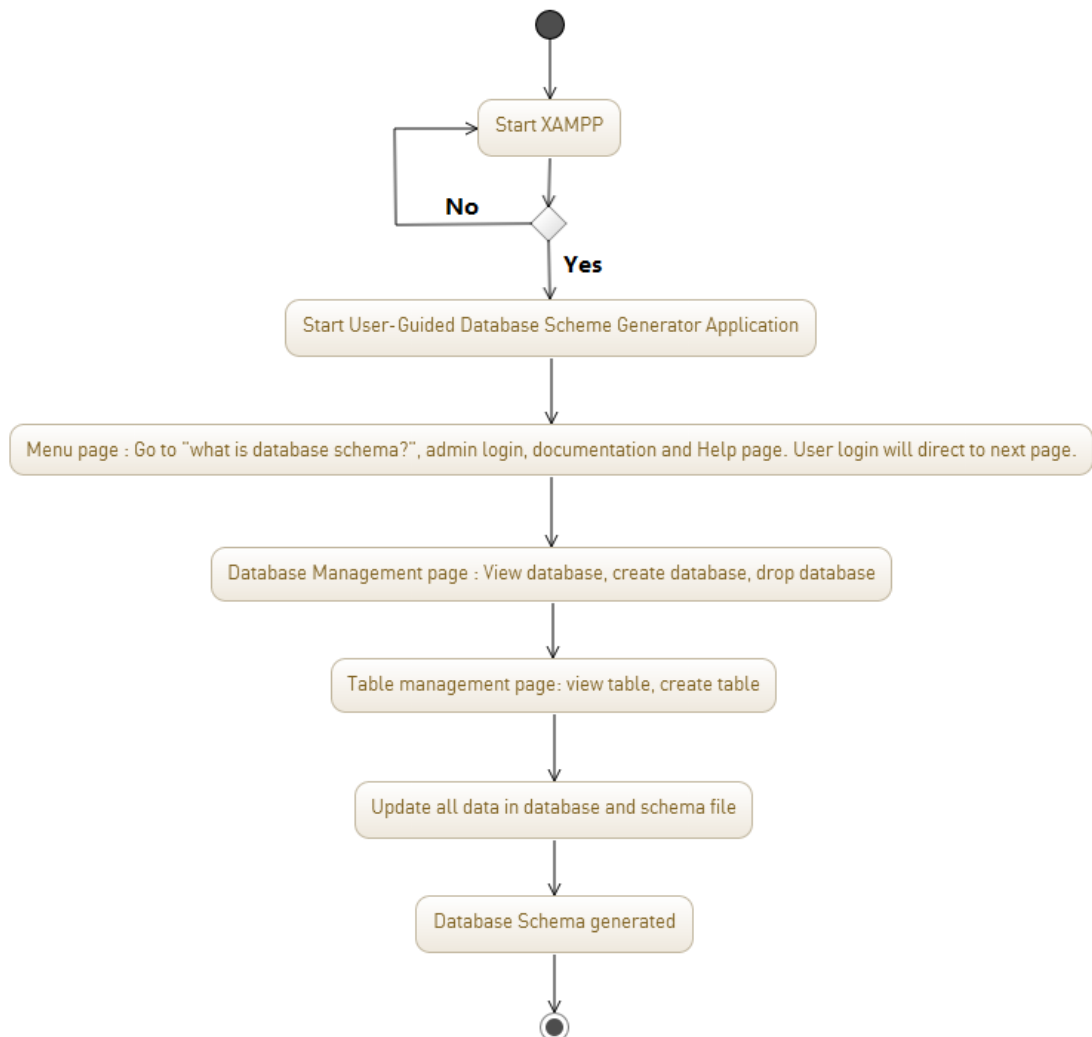
Figure 13 : Activity Diagram - Database Schema Creation Process

3.5 Use Case Diagram
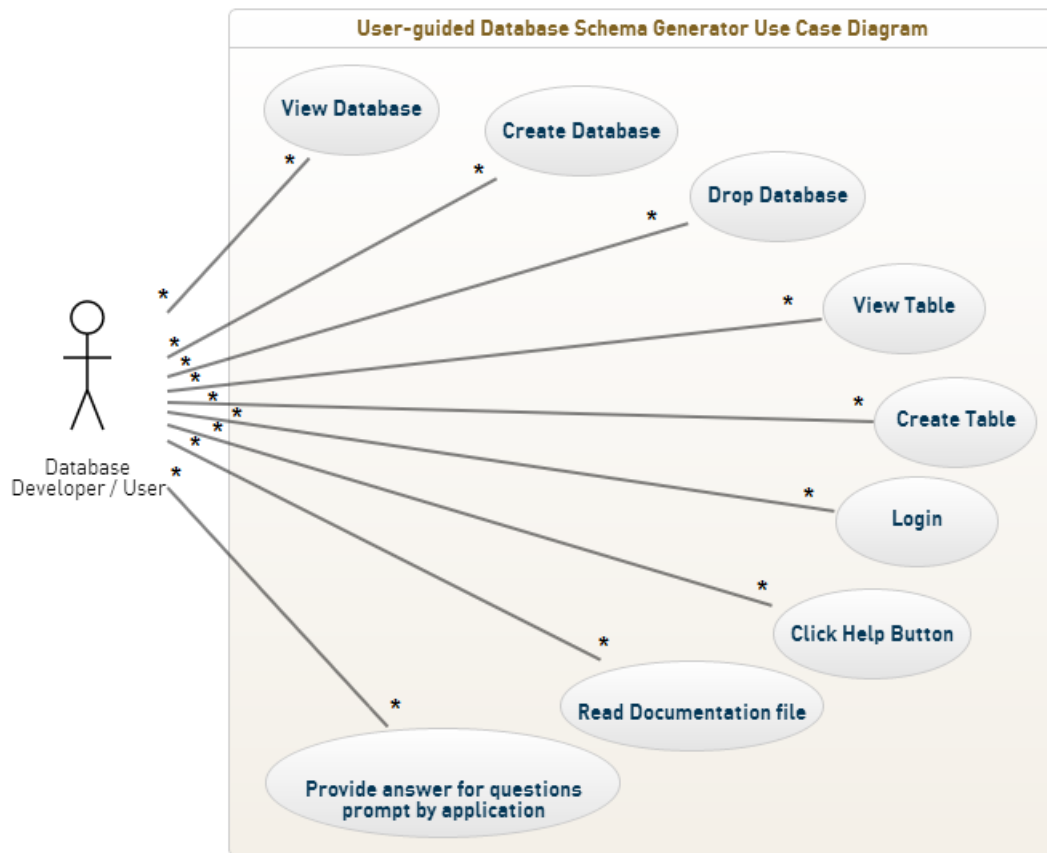
Figure 14 : User-guided Database Schema Generator Use Case Diagram

3.6 Requirement Analysis and Specification

After the gathering the survey data from the candidate, conduct interview with the database expert, and observing the basic business process conducted in database schema creation, the researcher have identify the requirement for the prototype. Researcher add multiple extra requirements to the list as well, which is benefit to all users. The requirement can be divided into functional and non-functional requirement as shown in Table 1 to Table 8 below:

Table 1 : Funtional Requirement 1

Function	Ability to login and connected to mySQL database
Area	Functional
Description	Login as root with empty password allows user to do all things

Table 2 : Funtional Requirement 2

Function	Ability to provide documentation file
Area	Functional
Description	The system provides all helpful documentation file, it might including user manual, solved problems faced by similar user and other helpful information.

Table 3 : Funtional Requirement 3

Function	Ability to request 'HELP'
Area	Functional
Description	The system provide user the option to request help by clicking a SOS button. The system will direct guide the user to contact the system admin by call or email.

Table 4 : Funtional Requirement 4

Function	Ability to provide user a learning oppurtunity and better understanding on database schema
Area	Functional
Description	The system will show the real SQL command of each action taken in a box for self-learning purpose. Besides, the story board is for story-telling purpose.

Table 5 :Funtional Requirement 5

Function	Ability to guide the system
Area	Functional
Description	The system will prompt the user few questions and from the feedback captured, action taken as desired by user. Besides, The system provide user few options to choose and text bar to capture input from user. For example, define the name of entity

Table 6 : Funtional Requirement 6

Function	Ability to create database schema
Area	Functional
Description	The system will createa database schema in SQL format at desktop of C-Drive right after user close the applocation. The database schema will store all the SQL command run during the creating process.

Table 7 : Non-Funtional Requirement 1

Function	Confirmation and notification
Area	Non- functional – performances and security
Description	Provide message box of confirmation to ensure the customer are confirm with the action. Notification inform the user when the mandatory step is not followed and logout the system

Table 8 : Non-Funtional Requirement 2

Function	System run in any OS platform
Area	Non- functional – Operational
Description	All OS can run the system and mySQL database must be installed.

3.7 Key Milestones

Table 9 shows the milestones of the study:

Table 9 : Key Milestones of Study

No	Deliverables/Activities	Schedule
1	Title Selection and Proposal	Week 2
2	Project Approval	Week 4
3	Problem Identification and Feasibility Study	Week 5
4	Extended Proposal	Week 6
5	Requirement Gathering from Expert	Week 8
6	Process and System Modelling	Week 10
7	Interface Design	Week 12
8	Proposal Defense	Week 12
9	Interim Report	Week 14
10	Architecture and System Design	Week 15
11	System Complete	Week 17
12	Progress Report	Week 20
13	Usability Testing	Week 21
14	Pre-Sedex	Week 24
15	Viva	Week 27
16	Final Dissertation	Week 28

The yellow background row is the milestones decided and completed by researcher. The green background row is the deliverable to be delivered to FYP committee.

3.8 Gantt Chart

Table 10 : Gantt Chart

Detail Week	FYP 1														FYP 2													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Planning Phase																												
Problem Identification & Feasibility Study	■	■																										
Initial Background Study		■	■																									
Project Approval				■																								
Literature Review				■	■	■																						
Submission of Extended Proposal						■																						
Analysis Phase																												
Interview with DB Expert							■																					
Interview with DB Expert								■																				
Interview with DB Expert									■																			
Tabulation of data										■																		
Analysis of method and finalize the approach										■																		

Task	Design Phase														Implemenation Phase													
Modelling and Stimulation of business process						■	■																					
Interface Sketch and Design							■																					
Proposal Defence								■																				
Submission of Interim Report									■																			
Database and Class Design								■	■																			
Design of System Architecture								■	■																			
System Development															■	■	■											
System Deployment																		■										
Usability Testing																			■	■	■							
Progress Report Submission																				■								
Tabulation of usability data & feedback																						■	■					
Improvement of prototype																								■	■			
Pre-Sedex																								■				
Viva																										■		
Project Dissertation Submission																											■	■

32

3.9 Tool and Equipment

Hardware

- **Stand-alone personal laptop** for system and database installation platform

Software

- **mySQL** will be used as database connected to the system. The reason of select this because it is open-sources and free.
- **Microsoft Visual Studio** used to program the prototype.
- **XAMPP** run as server.
- **MYSQL connector/ Net 6.8.3** used to connect mySQl to Microsoft Visual Studio

Programming Language

- **Vb.net** will be used to develop the system
- **SQL** will be used to develop the prototype database

CHAPTER 4

RESULT AND FINDINGS

4.0 Result and Findings

4.1 Data Gathering and Analysis

Throughout this project, the researcher have conduct both questionnaire survey and interview in order to gather data to identify the existing problem that is faced by the naive database developer and their view on proposed solution. In the questionnaire survey, 100 candidates (students and new database developers) have being surveyed on their supportive on proposed solution and their preferred method. Below are the survey result related to the research question:
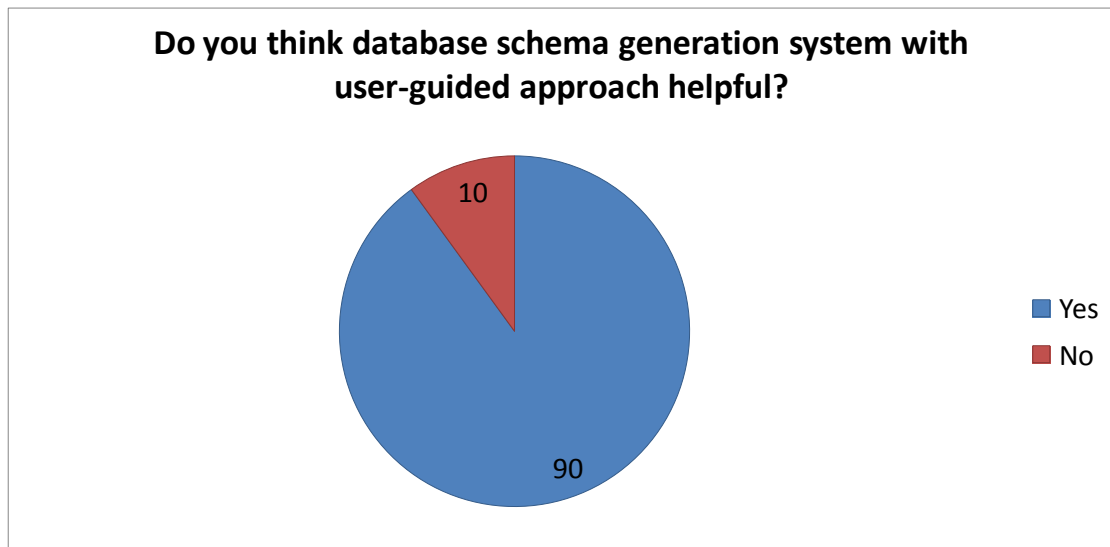
Figure 15 : User who support database schema generation system with user-guided approach

It is shown that 90% of the candidates surveryed believes that database schema generation system with user-guided approach is helpful. However, it cannot be denied that 10% of the candidates is not supporting the proposed solution. Therefore, it can be conclude that database schema generation system with user-guided approach is actually supported by majority of the group.
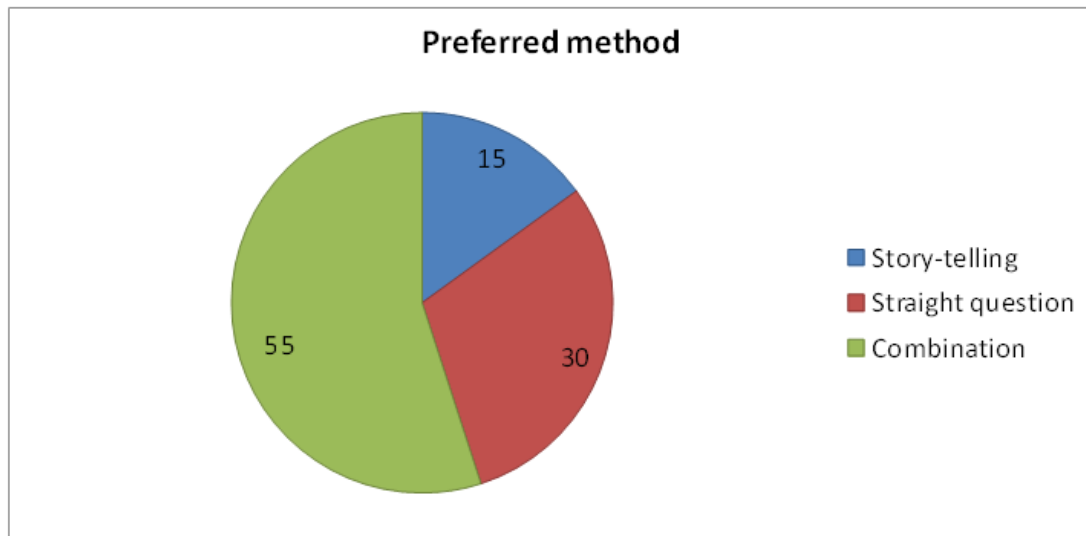
Figure 16 : Method preferred by user

2 method of user-guided approaches are finalized after studies have been carried out during FYP I. Candidates are surveyed on their preferences of method and figure 16 shows the result. 30% of candidates likes straight question method, 15 % chooses story-telling and 55% prefer the combinaton of story-telling method and some straight question, which earlier for database schema understanding and creation.

4.2 Interview Result

The interview mainly target on the database experts in the working industry, univeristy lecturers and top students in the class, in order to understand the important element they looking for when they develop a database schema. Besides, researchers would like to listen to their advices on this project. About 89% of the interviwees support this project will help the naive or less experiences database developers in order to create database schema. They agree that this is a good learning tool as well. The full transcript of the interview is shown in the **Appendix 7.2** section.

Researcher has interview 13 database expert/ high experiences database developers. 9 of them completed the interview, 1 of them refuse to answer the interview due to the reason of do to use database for recently few years, and 2 of them do not respond any up to today. Researcher conclude that only 9 experts join the pool to answer the interview form.

From the interview, researcher summarize and generate diagrams below:-
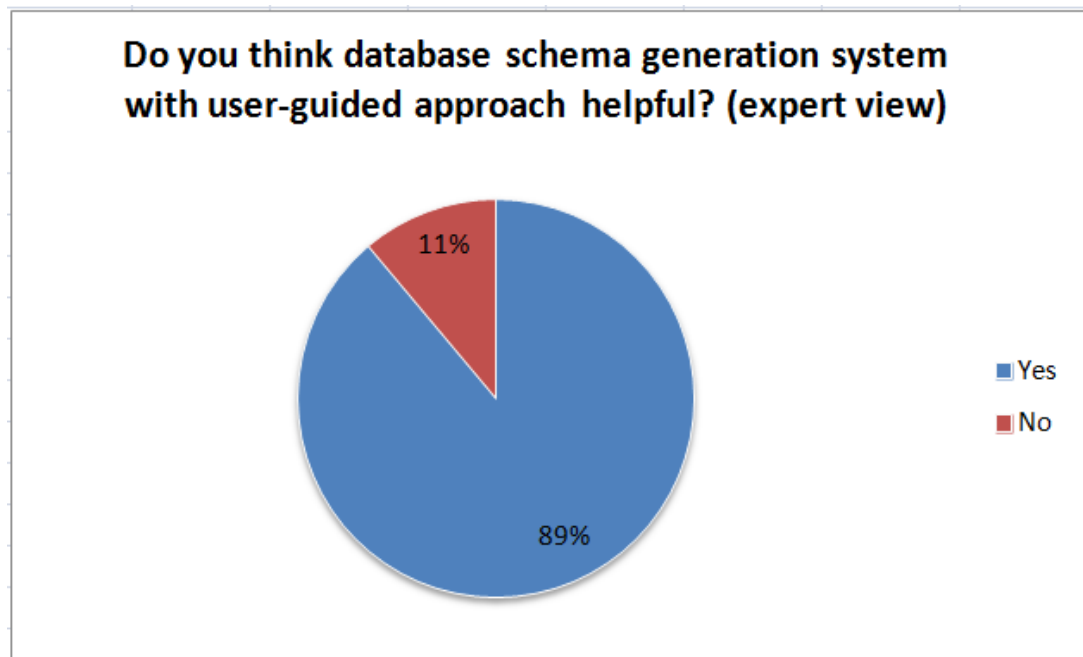
Figure 17 : Expert view on database schema generation system with user-guided approach
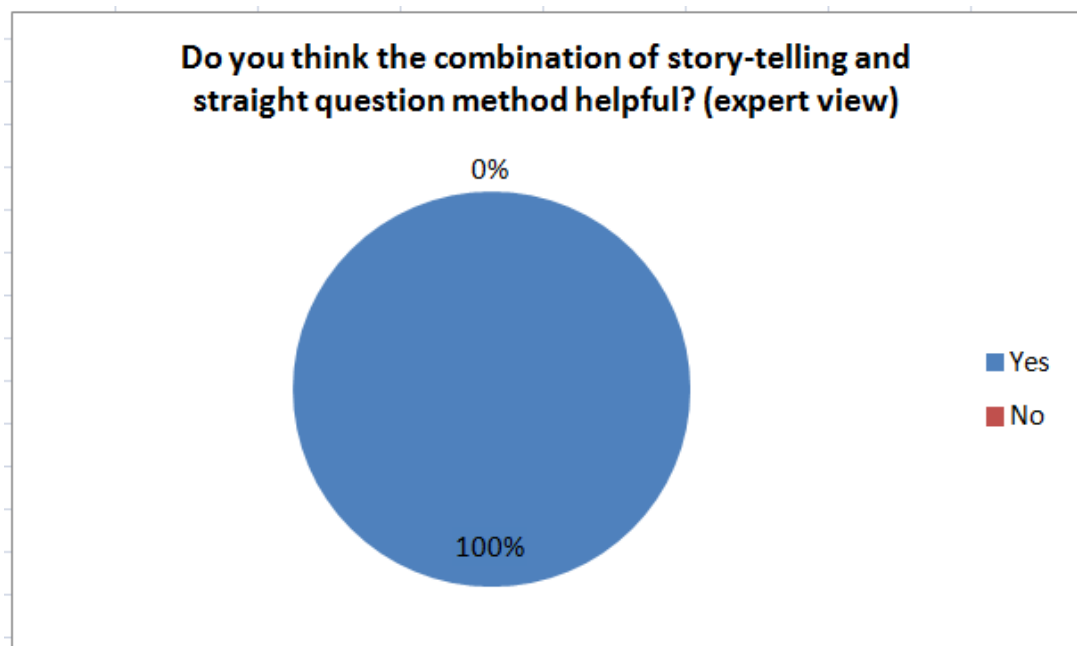
Figure 18 : Expert view on combinaton of story-telling and straight question mehod

All 9 experts believe that the combination of story-telling and straight question method will help the user and make the database creation process more interesting. Besides, from their input, researcher find out that most of the interviewees have different point of view based on their experiences and working industry on which element is important and need to be captured from the application. The task is

challenging but researcher manage to finalize top 5 priority of element that need to captured input from users. This result highly contributed to the content of prototype.

Priority	Element
1st	Attribute of entity
2nd	Normalize 1NF
3rd	Unique IDs
4th	Relationship
5th	Normalize 2NF

Table 11 : Top 5 Priority of Element

4.3 System Interface Design

Own design logo is used as the icon of the application. This bring uniqueness to the application when putting a shortcut at desktop. The drawing human symbol sitting in the middle of the logo represent user-guided and the colorful star means the application bring different hope to the user.

Figure 19: Application Shortcut Icon at desktop

Figure 20 shows the first interface, which is welcome page. The application display the welcoming message, application name, logo, application basic description and description on main functionality provided by the application. This is to ensure the user is fully understand, clear and guided by the application they are using now. Installation prerequisite is clearly stated at the first page too. Researcher believe this can minimize the common technical issues faced by user. XAMPP and MySQL need to be started in advances, as shown in activity diagram earlier.
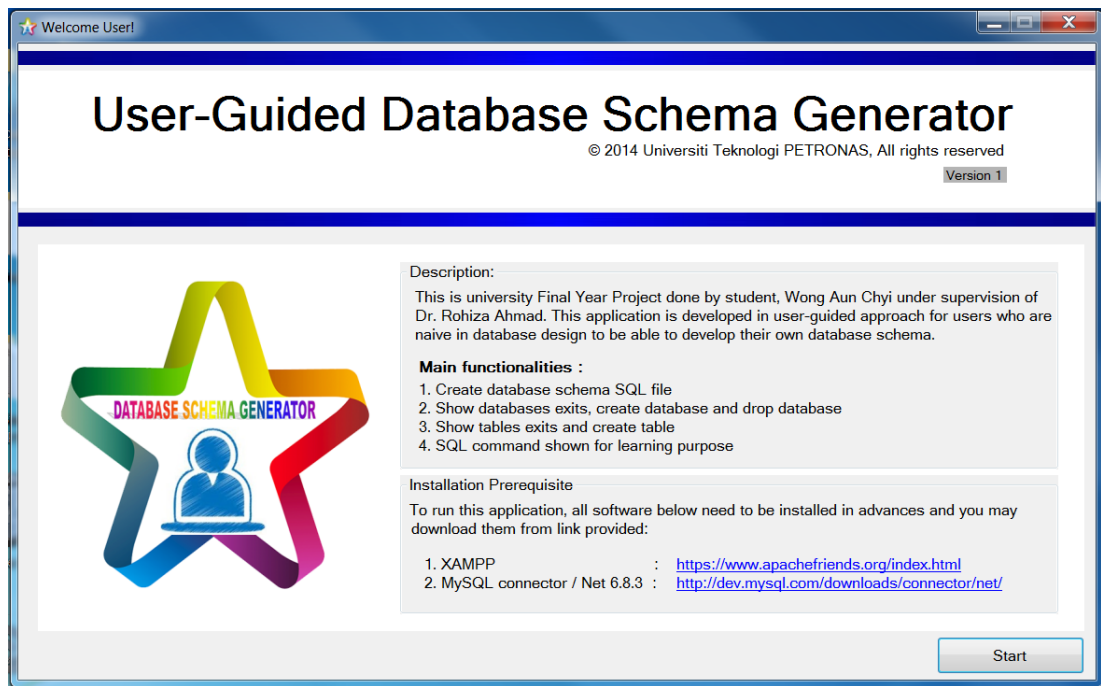
Figure 20 : Welcome page interface

After click the "Start" button, the system will direct user to interface Figure 21. Left-hand side is a long list of menu option and right-hand side of the applicaton is a story board. The story board will remain same position of each page and it tells database schema related story to the user.
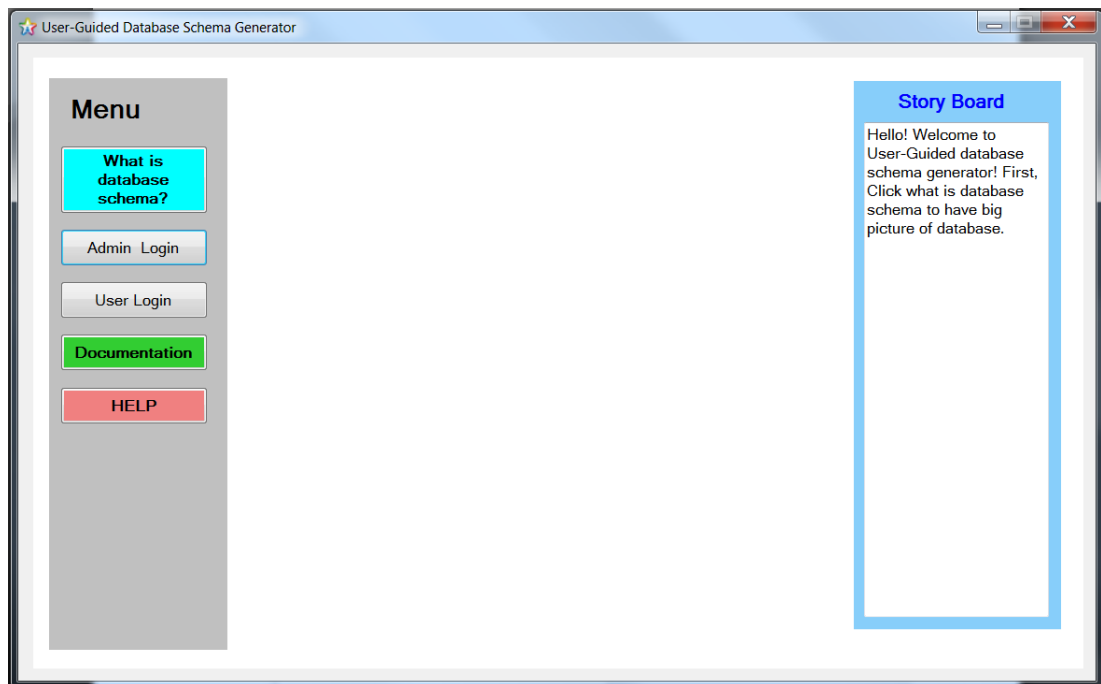
Figure 21 : Menu page interface

If user choose "What is database schema?" , a dialog will pop out and show the explaination of database schema. User just need to close the dialog after finish reading. This is an example of way of doing thing, researcher may use the same technique for any explaination required situtation.
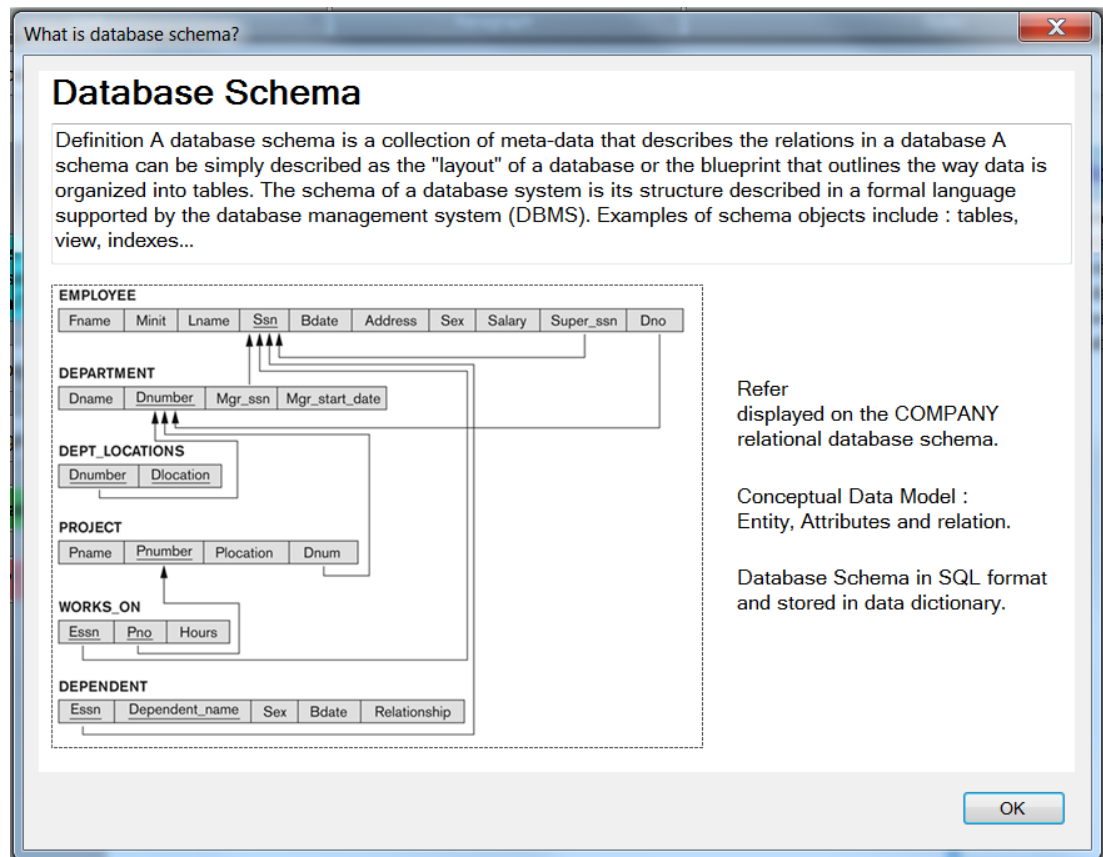
Figure 22 : Dialog of What is Database Schema

User is given an option to request help if they have any additional inquries, by clicking the 'Help' button. A SOS message will pop out and show system admin's contact number and email address.
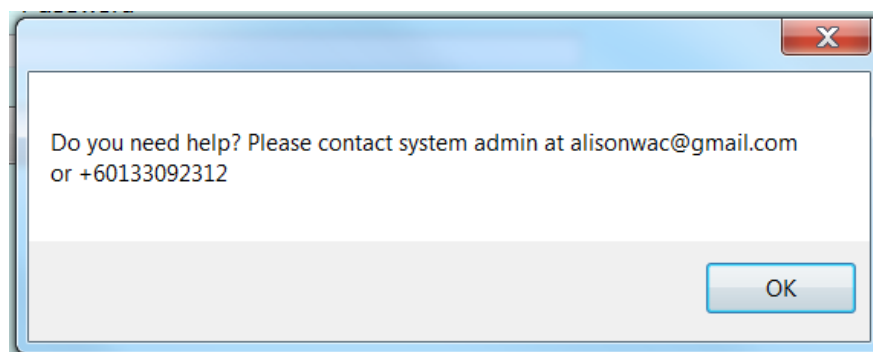
Figure 23 : SOS Message

To enhance the knowledge and basic understanding of user on database schema, the application can include numerous of documentation file. Any topic can be included, it is kind of knowledge managment and help for an user. If the article is too long, the application apply scroll function.
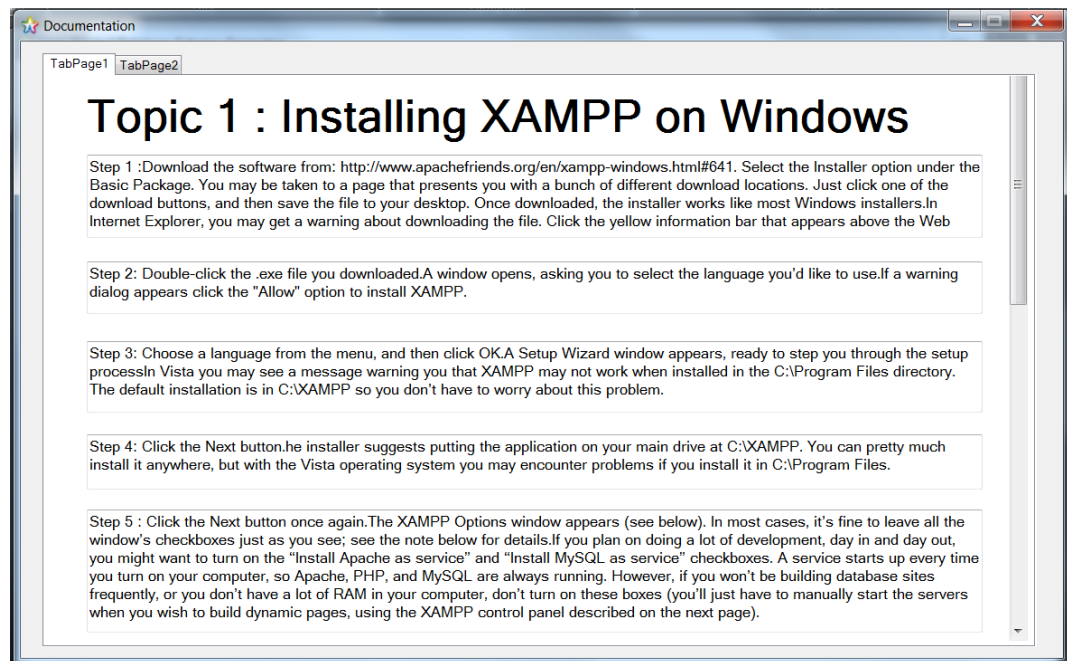
Figure 24 : Documentation Interface

Nothing special, the interface below is to teach user what is admin login and let them have a try. A message of "connection to mySQL is open" will displayed.
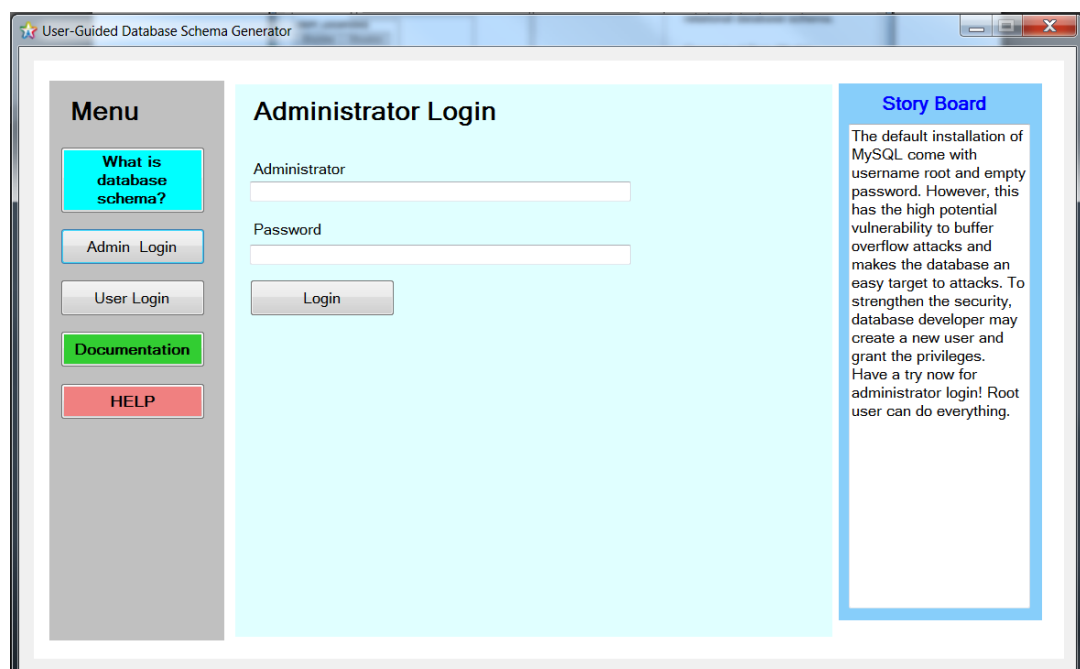
Figure 25 : Administrator Login Interface

Figure 26 is for user login, the username is root with empty password. This is default setting when one installed the database. This application do not provide option for user to create an user and grant priviledge. However, if one have multiple users in database, he or she can login with the username and password.
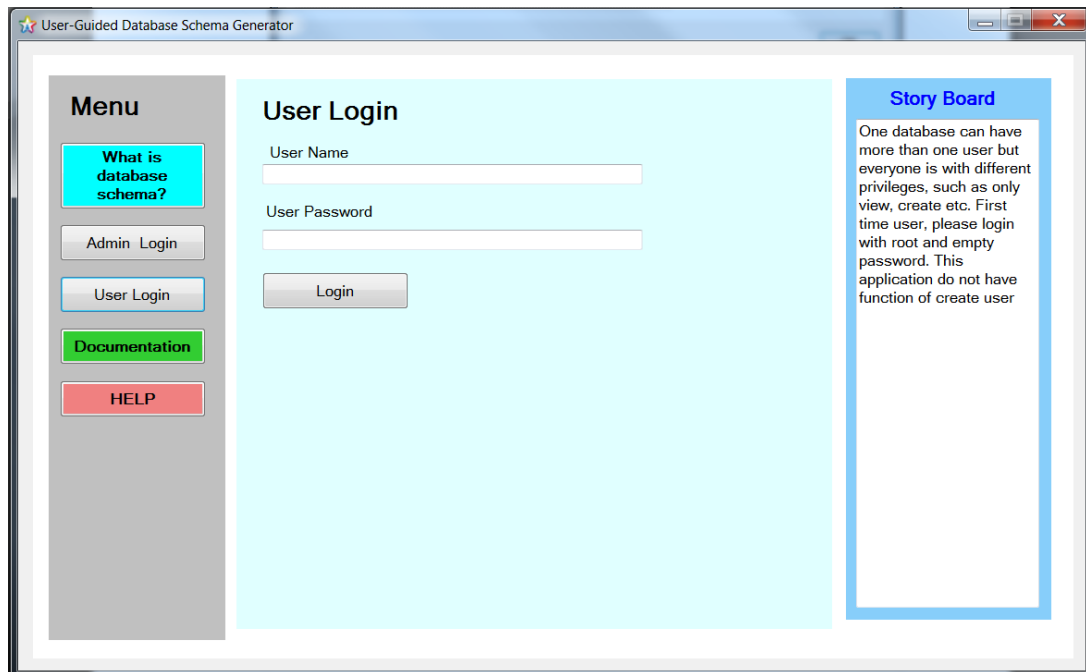
Figure 26 : User Login Interface
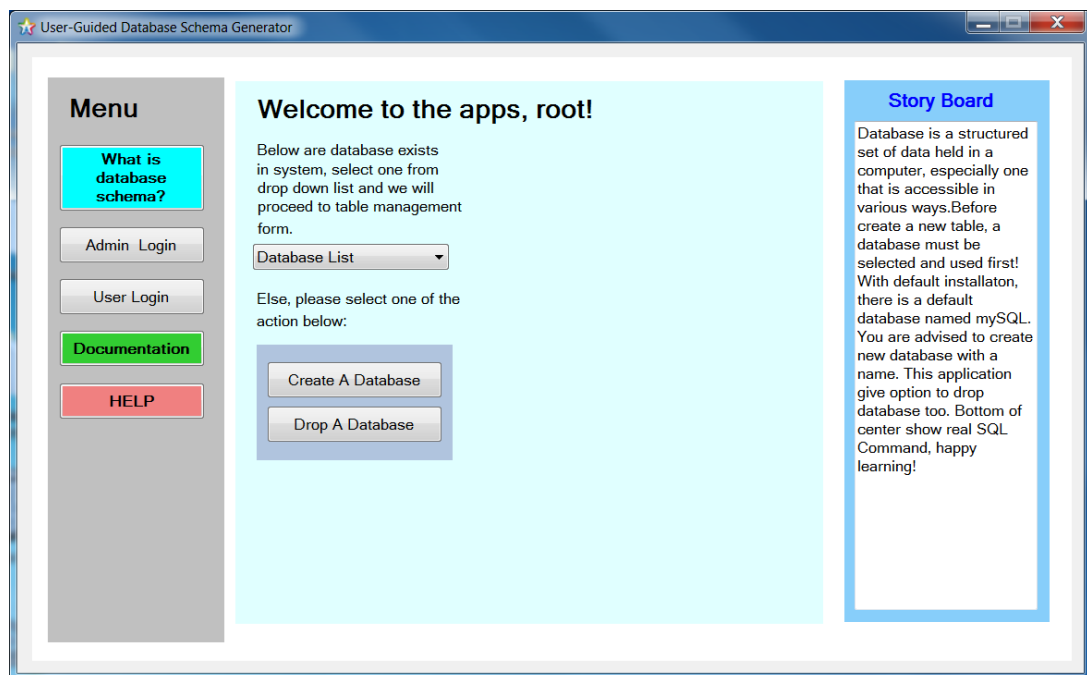
Figure 27 : Database Management Page Interface
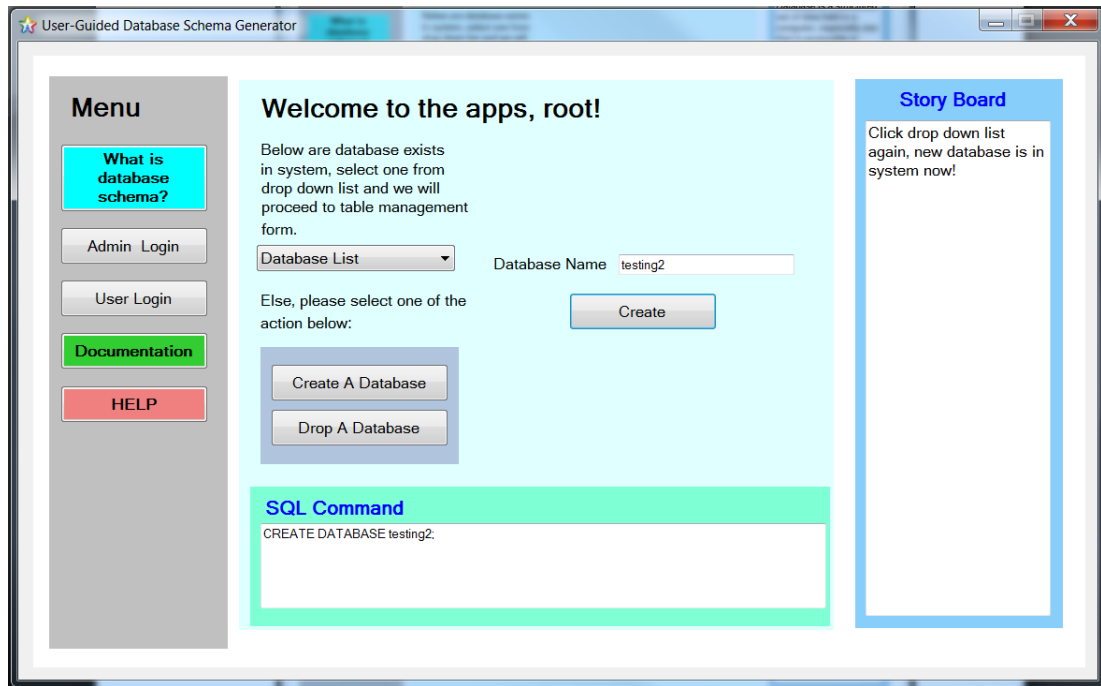
Figure 28 : Database Management Page Interface 2

Both figure 27 and 28 is database management page. User able to view the existing database from the dropdown list. If the user select one of the database from drop down list, the application will guide user to table management page, as shown in Figure 29. In this page, user allowed to create a database and drop a database, just need to key in a name and click the button. Please note that there is a SQL Command box at the center bottom of the interface. This box will show the real SQL command used to communicate with the database; this is a very good learning opportunity to the user.

Table management page is actually much more similar to database management page. User is allowed to view the existing table in the database. If the user selects one of the tables from drop down list, the box in the middle will describe the structure of the table. SQL Command box at the bottom left-hand side will also display real SQL command for learning.

Figure 30 is to create table. Firstly, user is prompt to enter table name and number of attribute. The element included in table creation such as primary key, foreign key, not null, relationship, unique ID and data type is based on the result we found from interview with experts. Once user close the whole application, database schema will be generated, as Figure 31.
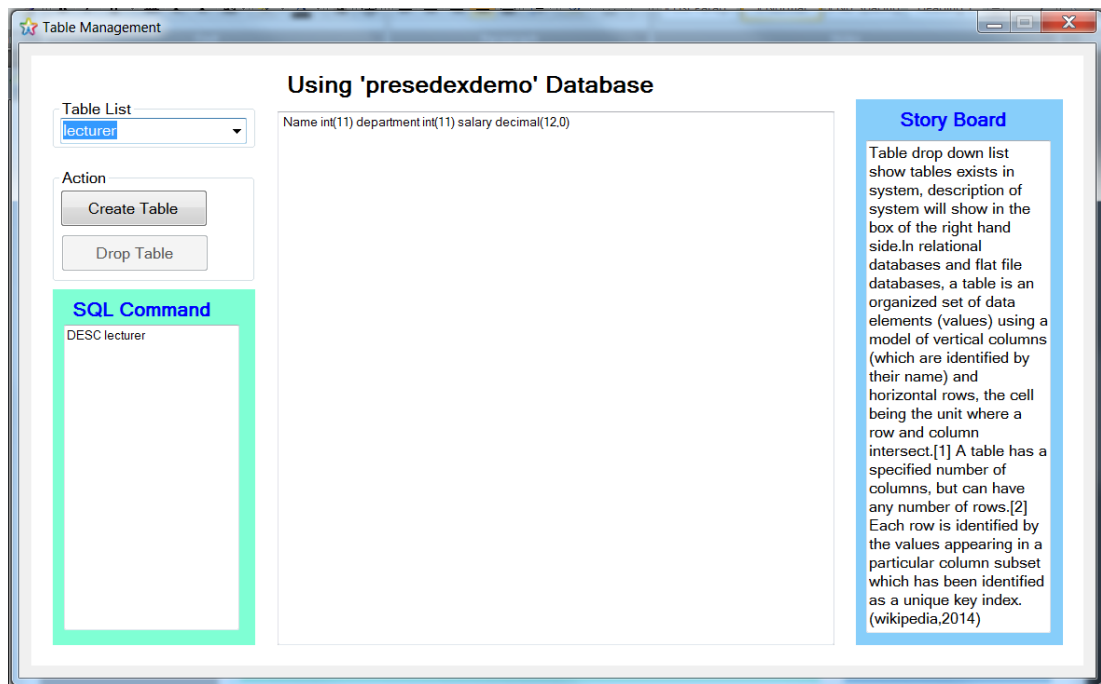
Figure 29 : Table Management Page Interface
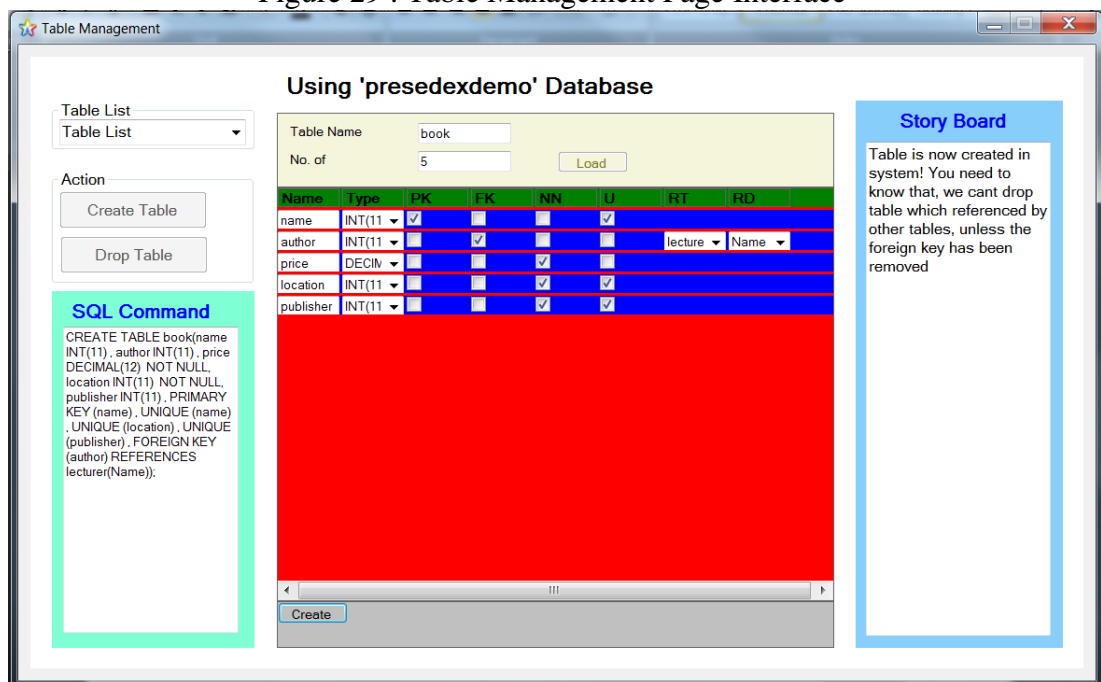
Figure 30 : Create table interface
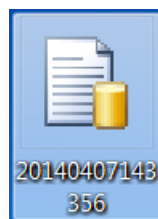
Figure 31 : Database Schema in SQL format generated

Let have a testing by running the SQL command, table with all attributes described is created in database.

Figure 32 : SQL command to show table created in database

4.4 System Evaluation

The purpose of the system is to check the functionalities of the application.

Table 12 : System Functional Testing for application

Component	Expected Function	Testing Frequency	Testing Results		Remark
			Success	Failure	
" Start " button	Navigate to Menu page	20	20	0	
Story Board	Display story	20	20	0	
SQL Command box	Display real SQL command or message from mySQL	20	20	0	

"What is database Schema" button	Dialog Pop out	20	20	0	
Admin Login	Message of "connection to mySQL open" displayed	20	19	1	Failure caused by wrong username and password
User login	Navigate to database management page	20	18	2	1st Failure caused by wrong username and password
					2nd Failure caused by slow server processing
"Documentation" button	Display content of Documentation	20	20	0	
"Help" button	Display SOS message	20	20	0	
Database list	Display existing database list	20	19	1	Failure caused by slow server processing
"Create database" button	To create database	20	18	2	1st Failure caused by database with same name exists in database
					2nd Failure caused by no filling database name

45

" Drop database" button	To drop an existing database	20	18	2	1st Failure caused by database with name provided is not exists in database
					2nd Failure caused by no filling database name
Table list	Display existing table list	20	19	1	Failure caused by slow server processing
"Create table" button	To create table	20	17	3	1st Failure caused by table with same name exists in database
					2nd Failure caused by no filling table name and number of attribute
					3rd Failure caused by clicking more than 1 primary key
Database Schema	To generate database schema	20	20	0	

4.5 User Acceptance Testing (UAT)

The user acceptance testing is done for the user-guided database schema generator application to ensure the effectiveness and efficiency.The main features that is being tested for the application is:

- Usefulness : the application is useful for database schema creation, good for learning and basic understanding
- User-friendliness : the application provide interesting and attractive user interface, wording and stories displayed at story board
- Usability : the application is usable in real life, including learning or workplace
- Navigation : the application provide good and clear guideline and easy to navigate from one page to the others
- Ease of time : the application save user's time to develop database schema
- Behavioral Intention : the application reduce the feeling of fear of developer and intend to store data by using database instead of excel, which is not appropriate
- User Satisfaction : the application meet the expectation of user and user is happy to use it

30 new database developers have been randomly to perform the testing, mainly the students and junior database developers. Targeted users are provided with the application setup on own laptop and required connect to connect to the local host server and database. After perform UAT, users are required to fill in the questionnaire and present their ratings as shown in **Appendix 7.3**. Testers's reponses are captured by **observation** and **questionnaires**. 10 out of the 30 testers are UTPian and they test the system in front of the research. **None help is requested from the 10 testers and they manage to create a database schema with just 1 time testing.** This proved that the system is ease of use.

Figure 33 shows the result analyzed from questionnaires answered by 30 testers. Based on the respondents' UAT results, it has shown high ratings of at least four of each testing criteria and this proves that the respondents have agreed and supported the implementation of application. Usefulness, user-friendliness and ease of time have the highest ratings. Thus, it is believed that the testers find the application very useful, easy to be operated, efficient and would definitely save time for database schema creation compared to the conventonal method.

Number of Respondents (30)	Usefulness	User-friendliness	Usability	Navigation	Ease of Time	Behavioral Intention	User Satisfaction
Strongly Agree (5)	26	26	18	17	26	18	22
Agree (4)	4	4	12	13	4	12	8
Neutral (3)							
Disagree (2)							
Strongly Disagree (1)							
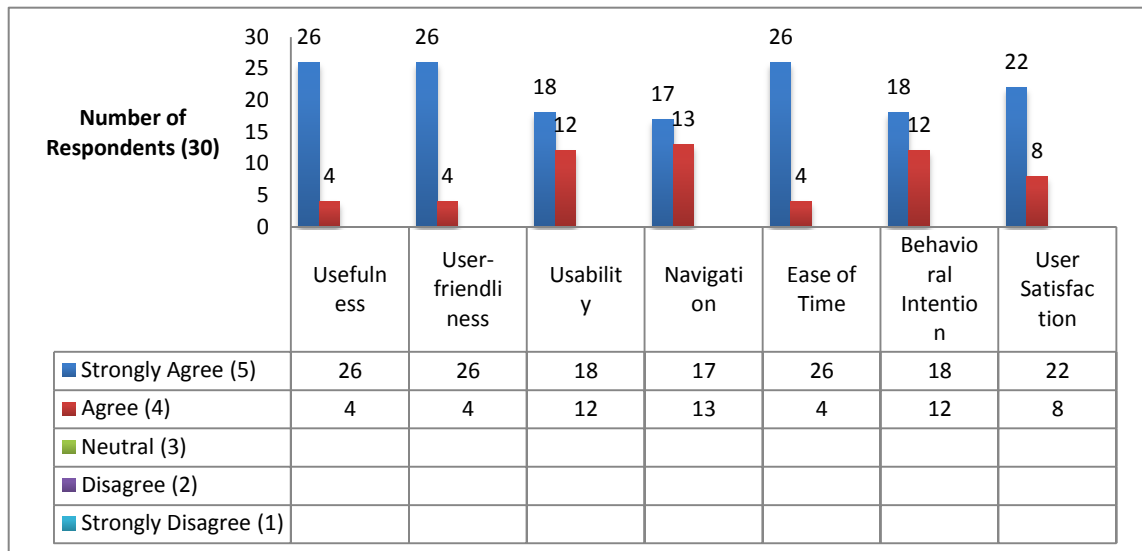
Figure 33 : The result of User Acceptance Testing (UAT)

Research also seek for overvall comment from 3 database developers who had tested the application. They agreed that the application is a very good learning platform for new or naive database developer. They also agree that this help to speed up and effectively improve the database schema creation process and this can reduce the feeling of fear of developers who is lack of technical knowledge and bring their intention and willingness to switch their option from Microsoft Excel to database. However, the expert commented that it will be good if more elements is added while create a table, to ensure optimization and full normalization. The current application meet the basic requirement of database schema.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.0 Conclusion and Recommendations

5.1Conclusion

Data is everywhere. It linked to the continued health and survival of an organization and creates value to an organization when it turned into useful information. Competitive advantages gained will help the organization to differenciate themselves from the competitor. Besides, an organization can also monitor and analysis the behavior of their customer based on daily activities. When ones understand the customers very much, they can always retain their customers with high loyalty. Hence, a tool to store and manage the huge amount of data us requires, almost every organization has employed a Database Management System (DBMS) from the market. However, having the software available alone is not enough to support users' data storage intention due to the concept of database design itself will need to be understood and mastered by the users before they can use the software effectively. This would require formal database design training which take times. So, most users tend to avoid using DBMS but rather opt to keep their data using more familiar software such as Excel spreadsheet or Word processor. This decision can be used for short-term but not appropriate for long-term plan.

The projects have provided a significant value especially to the less experiences database developers as it provide an easier and guided way to create own database schema, regardless the scarcity of technical knowledge and feeling of fear . The functionality of the application provides a very good and efficiency learning platform for the user. Besides that, it also helps the employer to be more easily to recruit fresh graduate from the workforce market for the role if the software application became more user friendly, ease to use and then fit to business need.

In the perspective of business and technology, it helps to improve the business process or "the way to get thing done". All research activities include literature research, quantitative survey, interview, designing new process and the development of prototype are related and strive to achieve the objectives of the research.

Last but not least, the output from this research can be beneficial to the society and the world at large since database is needed in all aspects of organizations and not all organization especially SMEs are capable of hiring a dedicated database developer. This is in line with the Digital Lifestyle Malaysia (DLM) initiative championed by the Malaysian Communications and Multimedia Commission (MCMC) which aims to promote to use of IT in the workplace (DL-Work).

5.2 Future Work and Recommendations

As for the recommendation to be made for this research, the elements included in table creating can be added as suggested by the database expert. This is to ensure the application achieve optimization and full normalization. If the time permit, researcher will try to modifies the system so that it can be best fit to user need. Besides, in future, researchers will include the features of activate or inactivate the story board and SQL Command box. The user who always use the system might find it annoying.

Other than that, researcher need to compare the current application to the benchmark of database structure in working industry, it might not achieve the level to enter SMEs yet. Researcher would like to further improve the application by providing more functionality such as drop table, create user and grant priviledge, to maximize the security of the application.

Furthermore, researcher also might consider in enabling the application connected to different type of database, not limit to mySQL only. That will provide more value to the organization who using different types of database. It will be good if it can be run with operating systen other than Windows.

Lastly, researcher also believe that this work can be extending to all industries and get grant from government for further studies.

CHAPTER 6

REFERENCES

6.0 Reference

[1] Ballve, M. (2013, Oct 2). *How Big Data Is Transforming The Mobile Industry.* [Online]. Available: http://www.businessinsider.com/local-mobile-makes-big-data-real-2013-10

[2] *Data* (2013, Oct 8). [Online]. Available: http://en.wikipedia.org/wiki/Data

[3] *Information* (2013, Oct 8). [Online]. Available: http://en.wikipedia.org/wiki/Information

[4] Hasanali, F. (2005, June 16). *Article: Knowledge Sharing In Call Centers*. [Online]. Available: http://www.contactcenterworld.com/view/contact-center-article/knowledge-sharing-in-call-centers.aspx?fhost=australia

[5] Quast, L. (2012, August 20). *Why Knowledge Management Is Important to the success of Your Company*. [Online]. Available: http://www.forbes.com/sites/lisaquast/2012/08/20/why-knowledge-management-is-important-to-the-success-of-your-company/

[6] *Development In the Downturn: PETRONAS Focuses On Knowledge and Information*. (2013). [Online]. Available: http://www.oilandgasiq.com/strategy-management-and-information/articles/development-in-the-downturn-petronas-focuses-on-kn/

[7] *DBMS* (2013, Oct 8). [Online]. Available: http://www.techterms.com/definition/dbms

[8] Allen, J. (2013). *Excel is Not a Database.* [Online]. Available: http://adminsecret.monster.com/benefits/articles/2599-excel-is-not-a-database

[9] *The 10 Most Common IT Challenges Faced by SMEs* (2013). [Online]. Available: http://www.cyberlogic.co.za/services/10-common-it-challenges/

[10] *CNN: Best Job in America* (2012). [Online]. Available: http://money.cnn.com/pf/best-jobs/2012/snapshots/5.html

[11] Hautle, R. (2013). *Data Collection and Record Keeping Made Simple, Quick and Safe*. [Online]. Available: http://excelworks.co.uk/default.aspx?page=20100&alias=Solution_Data_Collection_Record_Keeping_Intro

[12] *Datical Emerges from Stealth Mode; Unveils Database Change Management Solution that Delivers 50 Percent Increase in Application Release Throughout.* [Online]. Available: http://www.datical.com/news/datical-emerges-stealth-mode-unveils-database-change-management-solution-delivers-50-percent-increase-application-release-throughput/

[13] Graham,P. (2008, July). *Startup Ideas We'd Like To Fund*. [Online]. Available: http://ycombinator.com/ideas.html

[14] Everett,C. (2013). *DBAs and data warehouse architects in High Demand.* [Online]. Available: http://www.computerweekly.com/feature/DBAs-and-data-warehouse-architects-in-high-demand

[15] *Database Administration training Course.* (2013). [Online]. Available: http://www.computertrainingschools.com/database-administration-training/

[16] F.-J. Yang, "AVirtual Tour for Relational Schmea Normalization", *Inroads*, vol. 2, no. 3, 2011, pp. 38-42.

[17]   C. Farre et al., "SVTe – A Tool to Validate Database Schemas giving Explanations", in Proc. 1st international workshop on Testing database systems (DBTest'08), 2008, pp. 1–6.

[18]   M.Z. Saringat et al., "On Database Normalization using User Interface Normal Form", in *D.-S. Huang et al. (Eds.): ICIC 2010, LNCS 6215*, 2010, pp. 571-578.

[19]   A. Alsaadi, "Checking Data Integrity via the UML class diagram", in *Proc. International Conference on Software Engineering Advances (ICSEA 2006),* 2006*,* pp. 37-46.

[20]   J. Ni et al., "ADAPT: Adaptive Database Schema Design for Muti-Tenant Applications", in *Proc. 21st ACM international conference on Information and knowledge management (CIKM'12),* 2012, pp. 2199-2203.

[21]   L. Qian, K. LeFevre and H.V. Jagadish, "CRIUS – User Friendly Database Design", in *Proc. VLDB Endowment*, vol. 4, no. 2, 2010, pp. 81 – 92.

[22]   A. A. Waseem, S.J. Hussain and Z.A. Shaikh, "An Extended Synthesis Algorithm for Relational Database Schema Design", in *Proc. 2013 International Conference on Information Systems and Design of Communication (ISDOC'13)*, 2013, pp. 94-100.

[23]   S. Hartmann, M. Kirchberg and S. Link, "Design by example for SQL table definitions with functional dependencies", *The International Journal on Very Large Data Bases,* vol. 21, no. 1, 2012, pp. 121–144.

[24]   *Trygit* (2013). [Online]. Available: http://try.github.io/levels/1/challenges/3

[25]   *Ragic!* (2013). [Online]. Available: http://www.ragic.com/

[26]   *Wufoo* (2013). [Online]. Available: http://www.wufoo.com/

[27]   43 Dreaming 5GW, Part III: Lessons from Software Development (2007). [Online]. Available: http://www.tdaxp.com/archive/2007/07/28/dreaming-5gw-part-iii-lessons-from-software-development.html

CHAPTER 7

APPENDIX

7.0 Appendix

7.1 Questionnaire for less experiences database developers

USER- GUIDED DATABASE SCHEMA GENERATION FOR NAIVE DATABASE DEVELOPERS

This is FYP project which intend to develop a system to naive/ less experiences database developer to create database schema.

* Required

Do you think database schema generation system with user-guided approach helpful? *

○ Yes

○ No

What method you prefer? *

○ Story-telling

○ Direct Question

○ Combination of Story-telling and Direct Question

Submit

Never submit passwords through Google Forms.

Powered by
Google Drive

This content is neither created nor endorsed by Google.
Report Abuse - Terms of Service - Additional Terms

7.2 Interview Transcript

Interview 1

Interviewee Name: Thiagarajan, Susila

Interviewee Professional Profile: Currently employed by Baker Hughes Inc, as IT Senior Manager, Eastern Hemisphere-Regions and Business Operations. 18 years of experience in IT management, Software development, Project management. Database experiences include Oracle, SQL, Ingres, IBM DB2.

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?

   Yes, it will be of assistance to naïve database developers because domain knowledge of the database is the important criteria. When a software developer or a DB developer talks to the user, he usually has to understand what is the reason or objective of the database. Subsequently, he will ask a series of question to find out in what ways the database will be searched to produce the required information.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.

   The Story telling option will make the process of creating the schema more interesting and educational.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)

   I would look at all the elements.

4. What element you look first, secord, third etc?

   1. Attributes of entity 2.Normalise 1NF 3. Unique Ids 4.Relationship 5. Normalise 2NF 6. Normalise 3F

5. How do you identify them (element above)?

If you remember your DB101, a database is a collection of structured info for a specific purpose. To identify the design goal, you will want to identify what kind of information you want to keep track off and understand what you want to do with that information. First, think of the entity as "things" that you want information about. Next, identify the attributes of those entities. So, A book will have the attributes Author, Title, Publisher, Genre, Price…..

Then you check 1st NF. Is the book entity 1NF? Multivalued attributes become new entity. In this case, you will have Book entity with attributes Title, Publisher, Genre, Price and Author entity with First name, Last name,

Next, check what in our Book and Author entities can act as unique identifier. So here we can create Book ID and Author ID. Now we can model the relationships. Usually, its One-to-Many or Many-to-Many. In our example, It's Many-to-Many. Carry on until your entities are 3NF. ☺
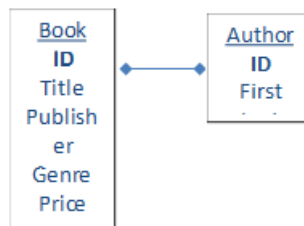
6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?
So far, we have not incorrectly designed a DB.

7. Any relevant comment that helps in this project.
I think that profiling the performance of the Entity Framework is as important as query profiling. You may want to check and include that as a prime capability.

Interview 2

Interviewee Name: Sevenpri Candra

Interviewee Professional Profile :

Faculty Member at BINUS University and eBusines Enthusiast. Please refer to my linkedin page -> http://id.linkedin.com/in/scandra/

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?
   In theoretical it will helps the developers, but in reality very a few developers that will read the user-guide. Perhaps, documentation that will make should more interesting and user friendly with current condition.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.
   I believe both story-telling and straight question more helpful for developers. Or you can make more interactively and more human by utilize the speed of processor nowadays. Let's say generate user guide by using Natural Language Processing, so developer can ask with their own language through key in sentence or speak. See SIRI from iPhone or Google NOW.

3. If you are given a database scenario, what are the elements that you will look for? (example:relationship, attribute ,entity, fuynctiona; dependency etc)
   First of all , Relationship !

4. What element you look first, secord, third etc?
   1. Relationship
   2. Attribute
   3. Entity
   4. Functional dependency

5. How do you identify them (element above)? By see the relationship

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning? -

7. Any relevant comment that helps in this project. the key point is point #4

Interview 3

Interviewee Name: Sunil Sharma

Interviewee Professional Profile:

I have over 7 yrs of experience in working with system applications and databases primarily SAP and Oracle. I am working as a SAP Solution Architect for Baker Hughes Incorporated.

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?
    It would certainly help, as success of an application relies on how strong the database schema is designed. It strengthens the security, performance of the application. Most important aspect of an application is to provide reliable and secure data.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.
    Both story-telling and straight question techniques are helpful. This can ensure database developers do not miss out any important element of database schema and this can be a good learning tool for the newbie.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)

    In any database scenario, it is very important to identify entity and segregate them from characteristics. Once the entities are identified with their characteristics or attributes, we should focus on relationship bet entity and its attribute, relationship between various entities. Sometimes seemingly independent entities can be tightly integrated based on the functional business case of the application, so it is very important that the identification of the entities is based on the functional business utility of the application.

4. What element you look first, secord, third etc?

    Design a working problem statement. List down the entities required to resolve this problem. Look out for smallest working entity first, their attributes, and their consolidations. Look out for relations between these entities. Work on validations on the attributes. Ensure that no overlapping entities eliminate redundant entities if they can be assigned as attributes to a parent entity.

5. How do you identify them (element above)?
    This is depends on the requirement of stakeholder.

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?
    So far no.

7. Any relevant comment that helps in this project.
    Work on the prototype that connected to the database first, important element that needed included can be changed from time to time based on the need of business. Make sure the system work with normalization and relationship, which is very important in database.

Interview 4

Interviewee Name: Ng Kok Jing

Interviewee Professional Profile :

Student in UTP. Major in E-business and software developer for 3 years. Frequently deal with database.

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the na ïve database developers? Why?
   Yes, it helps people to understand the benefit of DBMS rather than using common approach. It is believe it will provide a simple tool for DB development.

2. Story- telling and straight question - which technique more helpful for a na ïve database developers? Why? You may suggest better technique too.
   It depend on the developer itself. DB developers fell uncomfortable as some of them are not expert in SQL and may require certain requirement and time to develop the database. Usually the DB that have drag and drop method to develop the database will be preferred along with WML diagram.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)

   Besides all item stated in the bracket, an expert system that help to normalize the database to make database table more effective and efficient.

4. What element you look first, secord, third etc?
   First: Table name
   Second: Relationship attribute
   Third: Primary Key and Foreign Key

5. How do you identify them (element above)?
   Cannot answer in correct as it is depend.
   First: can see from the title of table

Second: See the attribute mark with FK

Third: The attribute mark with key sign or PK

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?
NO normalization done in the database. Everything crumple into one table. Make access of data very difficult. The solution is to re-design the database structure and re-done the coding for software. It will be good if design done properly prior to software development.

7. Any relevant comment that helps in this project. So far none.

Interview 5

Interviewee Name: Guilherme Dinis Jr.

Interviewee Professional Profile: ICT student in UTP.

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?

   I can't say. When I learned (relational) database design, there were two parts to it: the concept of relational databases and how to use a specific RDBMS system (Oracle). A user-guided schema-generation system might be helpful in assisting naïve users understand the relational concept, if it approaches it from a learning point of view. But there are other aspects to database design that users also take into consideration. For example, for an SME running a small operation, it might make more sense for them to use an MS Excel/Access sheet to keep records, instead of using and RDMBS system, because there is a learning curve, a need for a server, etc. This implies costs in terms of time, money, and the risk of losing control over operations. If the user doesn't have any knowledge of system development or management, it might be very difficult for them to get their hands on an RDBMS and start building a database. So, in a way, I think the approach taken for naïve users would really have to consider rather the user has some level of system development/management knowledge or not.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.

   I think that to answer this question, one would have to look at the content that is being delivered. Some content might be better delivered with one approach over another. What I would say is that, generally, whatever technique is used should clearly illustrate a path, let the user know where they are at point in time, where they're going, and where they have been, and what their goal is, if this is to be a learning tool.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)

This depends on what I am trying to do. If I'm in scenario where I'm trying to understand a system, and looking connections between entities, I'll probably look at the relationship and linkage between them. In certain cases, I might just be looking for certain data, and so I might just look at the attributes. Though, I think it would be valid to say that one would always look at entities first, and the attributes to understand what we're modelling in those entities. Of course, the relationship between entities is what ultimately leads us to understanding the functional purpose of the system, in way.

4. What element you look first, second, third etc? Q5

5. How do you identify them (element above)?

If the scenario you have in mind is of designing a database, I guess you have to get the story (by talking to clients, and/or observing the process), and derive the objects/nouns and transactions that take place. Even then, you would need to really understand the context to know what objects/entities and transactions are truly important, and also, how the information about such objects and processes are used by the organization. For example, a coffee shop has customers, and it sells coffee to these customers; some coffee shops may keep customer data for bonus programs, while eithers don't. In either case, it is likely that the business does not need to link any sale transaction directly to a customer. They might just give out bonus cards for every 100th customer, instead of tracking the purchases of each one.

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?
None.

7. Any relevant comment that helps in this project.

I am unclear on who the target users of the system are. Is it intended for an academic domain, or a practical domain? The implications of this would be quite relevant, I think. If one assumes the system is intended for an academic domain, then you could always assume the presence of an instructor, and the content of the system would be organized in the form of teaching curriculum. On the other hand, if it is for practical use (by individuals or organizations), then you would have to make the system as self-explanatory as possible. Most though, I think, is to define whether the system is targeted for IT or non-IT naïve users.

Interview 6

Interviewee Name: Khairul Shafee Kalid

Interviewee Professional Profile:

UTP lecturer who major in knowledge management and familiar with expert system.

Interview Setting : Interviewed is conducted at lab of UTP Academic Block 2 at 1PM, 2 December 2013.

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?
   Yes, definitely. I think that database schema generation expert system with user-guided approaches helps the junior database developer who is less experiences when they do some data modeling,

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.
   I will prefer straight question which is more helpful for the junior database developer. Story-telling is only for understanding of certain concept, which is more suitable for undergraduate student who is studying database. Straight question is more relevant and direct compared to straight question.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)
   The important element I look for are Entity and its relationship and Normalization of the database schema.

4. What element you look first, second, third etc?
   1 Entity 2 Attribute 3 Relationships

5. How do you identify them (element above)?
   I will interview the user and look at the form involved in the business process.

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?

Be honest, the best person to answer this question will be those who involves in database development in the real industry.

7. Any relevant comment that helps in this project.

User interface and user friendliness is very crucial. Besides, I worry this project not fit with the term of "expert system" because the expert system has different architectures. It is right that expert system start with questions but one of the main elements of expert system – influence engine is developed by specific tool such as Exsys Corvid® Expert System Development Tool. You may use VB to develop this, perhaps.

Interview 7

Interviewee Name: SAIPUNIDZAM MAHAMAD

Interviewee Professional Profile:

Working as lecturer for about 13 years, majoring in Computer System. Research are more on learning system targeted for early child

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?
   It is a great opportunity for the leaner which make learning process much easier.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.
   Both concept are new for me since DB is not my expertise. However, I would prefer straight forward kind of situation for easy digest.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)
   In defining the scenario, we should think of what kind of DB to be used, is it OO or just a normal DB since those going to have different way of interpreting it. I would say, entity, relationship and dependency should come first while the attribute will require to generate the schema.

4. What element you look first, secord, third etc?
   As an above, Entity would be the first that we should look into.

5. How do you identify them (element above)?
   Not really sure, based on the scenario, we should look for the key element that has been discussed

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?

Never involve in DB project for the past 10 years

7. Any relevant comment that helps in this project.

Interview should be focusing to the area expert, while questionnaire would be more appropriate for a general user (everyone)

Interview 8

Interviewee Name: Chew Jo Han

Interviewee Professional Profile:

Software Engineer at Monster Technologies Malaysia. Designed DB for website and mobile application. Proficient in SQL and SQLite

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?
   No, a database schema generation expert system with user-guided approaches will not help a DB developer; a DB developer should know what queries are needed to create a complete DB scheme, they will not learn by taking shortcut. It is however useful to non-DB developer who wants to develop a DB but have no knowledge of doing so.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.
   A combination of both is the best. Just story telling alone, user might miss some critical usecases, this is where question asking should come in and clarify the ambiguity.

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)
   All of them of course.

4. What element you look first, secord, third etc? Entity, relation, and attribute

5. How do you identify them (element above)?

   In term of natural language, Entities are usually a noun. A shop, a customer. Relations are usually a noun followed by a verb and another noun. A mall has many shops, a shop has many customers.

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?
   Plan before you start to write a single line of SQL. Draw out the entire DB with all its' elements if possible. Think of as many use case as possible that the schema can't handle.

7. Any relevant comment that helps in this project. -

Interview 9

Interviewee Name: Paul Clark

Interviewee Professional Profile:

Software developer in Java and more recently NodeJS. I have used SQL databases in the past, but recently have been using the unstructured MongoDB for fast data access for websites.

Interview Setting : Email

1. Do you think database schema generation expert system with user-guided approaches helps the naïve database developers? Why?

   Yes it sounds like a good idea. Database design can come down to a set of questions about the data to be stored. An expert system should help users to consider all the relevant factors without forgetting any, help them to question their assumptions, and finally make good and justifiable decisions.

2. Story- telling and straight question - which technique more helpful for a naïve database developers? Why? You may suggest better technique too.

   My initial answer thought that "story telling" meant giving prior examples from the databases of earlier applications, to explain the common concepts and reasons/uses for DB features:

   Story telling is useful to give real-world examples, to understand why one approach may be better than another.

   Straight questions are more useful when actually doing the design, to ensure all factors are considered.

   For a naïve user, I think straight questions could be too difficult. They may not be able to answer accurately, if they do now know the specific meaning of the terminology. So story-telling may be easier for them. But can it cover all the details needed? Perhaps a combination of approaches can be used. For example, straight questions but with an option to "see an example/story" that can explain what is being asked.

My second answer assumes that "story telling" means discussing application use cases:

Story telling is vital for naïve and non-naive developers. We cannot understand the necessary structure of our data without knowing how it will be used. Designing without use cases will often result in a database that solves the wrong problem!

I see it as a two-stage process. First use cases / user stories should be analyzed to collect the necessary data types and fields, and understand relationships between the data, forming an initial sketch of the database structure. Secondly we should go through each element of our proposed design, and ask all the detailed questions, to ensure the details are worked out, and nothing has been missed. At this point assumptions should be challenged, e.g. "could this data possibly be used differently in the future development of the app? If so, how can we make it flexible / future proof?"

That said, even a naïve developer will understand the need for user stories. To answer your question, it may be the case that direct questions about the data and its structure will be more useful to a naïve developer, to make him think about things he had not considered. (Of course, he also needs to know the features that are available in the DB system, and when and how they should be employed.)

3. If you are given a database scenario, what are the elements that you will look for? (example: entity attribute, relationship, functional dependency etc)

   The fundamental objects. Then relationships are important of course, although they do add complexity in the relational DB model, but that cannot be avoided! Where things can be unique or may be non-unique. Where things may be null (I assume by default that everything is non-null). Normalization to avoid redundancy - there is nothing worse than duplicate information in an SQL database! (That said, with MongoDB double-links / links back are recommended over relations, for speed, but then we must pay for that redundancy/duplication when doing updates or removals!)

4. What element you look first, secord, third etc?

    I cannot claim to have huge experience in this. Scalability/efficiency can be considered later, by revisiting the use-cases after the initial structure has begun to form. It may then guide restructuring. But I believe it is most important to get the entities and relationships correct first! I suspect it is preferable to create a clear and simple model first, and then refactor for efficiency using minimal migrations, than to create a very complex layout from the start that has focused on efficiency but has made some mistakes! Anyway there is nothing wrong with keeping efficiency in mind as we go along, if we can keep enough in our heads.

    Likewise security concerns (keeping sensitive data in separate tables from other data) should be kept in mind, but should not confuse the initial design. (Although I understand views can provide an alternative method to shield sensitive data from unauthorized access.) A common mistake for a new developer is to consider a relationship as a child object of a more fundamental entity, and create addition fields for it, rather than separating it out into its own table. Therefore I think separation of different entities / components should be considered and encouraged early on. (For example in our most recent project, we separated addresses from users early on. Even if our users will never share an address, and 1-to-1 is a reasonable relationship, it is still conceptually correct that people and addresses are different things, and so should live in different tables!)

5. How do you identify them (element above)?

    I wish I could formalize this for you, but I cannot. I can only recommend putting more than one critical mind into the design. Write down the use cases and make them available to the whole team. Whenever an assumption is made quickly, question it! Identify potential issues early. Sometimes it can take a week or two to think over problems. Trying to solve them on-the-spot may result in making the wrong decisions. (Of course, that is not true in all cases. Some problems are more complex than others. It may be useful to flag parts of the design as 'confirmed' or 'still under consideration'.)

6. Share your experience of wrong database schema and how you/ your team solve it? If you are given one more chance, what will you do in the beginning?

This is probably a fairly common example, and not the kind of interesting edge-case you are looking for. But we kept too much data in one table. We should have broken things up more, to where they conceptually belonged, even if it means adding the complexity of extra tables. I believe keeping more tables with fewer rows makes things easier to adapt in the long run. The following advice does not really apply until later, but I want to share it anyway!

Refactor early, refactor often. This assumes that we will make mistakes in our database design. Once they are identified, solve them sooner rather than later! Refactoring the structure will only get harder later. The longer it persists, the more code will be tied to the incorrect structure, and the larger the refactor will be later on. Not doing this may help you to reach short-term deadlines, but will more severely affect long-term deadlines. As a stop-gap, deprecate access to the poorly-structured data, and write an interface layer that presents the data in the structure it should have, even if it accesses the poorly-structured data below it. In conclusion: do not fear refactoring; consider it an essential part of workflow, and be prepared for it!

7. Any relevant comment that helps in this project.

The idea of an expert system that can ask all the challenging questions, and make designers second-guess their decisions, certainly sounds valuable! The challenge may be in limiting the number of questions, by hiding the simple ones which do not need to be over-thought.

I am interested in this approach, and would be more than happy to provide feedback on future sketches/designs.

7.3 Questionnaire for User Acceptance Testing (UAT)

Questionnaire for User Acceptance Testing (UAT)

Thank you for your participant in user testing for User-Guided Database Schema Generator application, hope you are enjoyed the experience. Please present your ratings to each question below for better system enhancement.

* Required

Usefulness : the application is useful for database schema creation, good for learning and basic understanding *

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly Agree (5)

User-friendliness : the application provide interesting and attractive user interface, wording and stories displayed at story board *

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly Agree (5)

Usability : the application is usable in real life, including learning or workplace *

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly Agree (5)

Navigation : the application provide good and clear guideline and easy to navigate from one page to the others *

- ○ Strongly Disagree (1)
- ○ Disagree (2)
- ○ Neutral (3)
- ○ Agree (4)
- ○ Strongly Agree (5)

Ease of time : the application save user's time to develop database schema *

○ Strongly Disagree (1)

○ Disagree (2)

○ Neutral (3)

○ Agree (4)

○ Strongly Agree (5)

Behavioral Intention : the application reduce the feeling of fear of developer and intend to store data by using database instead of excel, which is not appriopriate *

○ Strongly Disagree (1)

○ Disagree (2)

○ Neutral (3)

○ Agree (4)

○ Strongly Agree (5)

User Satisfaction : the application meet the expectation of user and user is happy to use it *

○ Strongly Disagree (1)

○ Disagree (2)

○ Neutral (3)

○ Agree (4)

○ Strongly Agree (5)

Submit

Never submit passwords through Google Forms.

Question to database expert:

1. Does this system meet the basic need of a database schema? If no, how it can be improve?

2. Does this system makes value?

7.4 Coding of the application

Welcome.vb

```vb
Public Class Welcome

    Private Sub ToolStripContainer1_LeftToolStripPanel_Click(sender As Object, e As
EventArgs)

    End Sub

    Private Sub Label1_Click(sender As Object, e As EventArgs)

    End Sub

    Private Sub Label3_Click(sender As Object, e As EventArgs)

    End Sub

    Private Sub Label2_Click(sender As Object, e As EventArgs) Handles Label2.Click

    End Sub

    Private Sub Welcome_Load(sender As Object, e As EventArgs) Handles MyBase.Load

    End Sub

    Private Sub ProgressBar1_Click(sender As Object, e As EventArgs)

    End Sub

    Private Sub SplitContainer1_Panel2_Paint(sender As Object, e As PaintEventArgs)

    End Sub


    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        Me.Hide()
        MainForm.Show()
        MainForm.Storytext.Text = "Hello! Welcome to User-Guided database schema generator!
First, Click what is database schema to have big picture of database."
    End Sub

    Private Sub LinkLabel1_LinkClicked(sender As Object, e As LinkLabelLinkClickedEventArgs)
Handles LinkLabel1.LinkClicked
        System.Diagnostics.Process.Start("IExplore",
"http://dev.mysql.com/downloads/connector/net/")

    End Sub

    Private Sub LinkLabel2_LinkClicked(sender As Object, e As LinkLabelLinkClickedEventArgs)
Handles LinkLabel2.LinkClicked
        System.Diagnostics.Process.Start("IExplore",
"https://www.apachefriends.org/index.html")
    End Sub

    Private Sub GroupBox2_Enter(sender As Object, e As EventArgs) Handles GroupBox2.Enter

    End Sub

    Private Sub Label4_Click(sender As Object, e As EventArgs) Handles Label4.Click

    End Sub

    Private Sub Label7_Click(sender As Object, e As EventArgs)

    End Sub

    Private Sub Label10_Click(sender As Object, e As EventArgs) Handles Label10.Click

    End Sub
```

```vb
        Private Sub Label13_Click(sender As Object, e As EventArgs) Handles Label13.Click

        End Sub

End Class
```

MainForm.vb

```vb
Imports MySql.Data.MySqlClient


Public Class MainForm


    Dim MysqlConn As New MySqlConnection()
    Dim adminName As String
    Dim adminPass As String
    Dim userName As String
    Dim userPass As String
    Private dbCredentials As New databaseCredentials

    Public Shared commandsStr As String = ""

    Private Sub MainForm_Load(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles MyBase.Load

    End Sub

    Private Sub MainForm_Close(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles MyBase.FormClosing
        'MsgBox(commandsStr)
        Dim fileDate As String = System.DateTime.Now.ToString("yyyyMMddHHmmss") & ".SQL"
        Dim objWriter As New System.IO.StreamWriter("C:\Users\admin\Desktop\" & fileDate,
False)
        objWriter.WriteLine(commandsStr)
        objWriter.Close()
        'MsgBox("" & fileDate)
    End Sub


    Private Sub disablePanels()
        adminLogPnl.Visible = False
        userLogPnl.Visible = False
        dbManagementPnl.Visible = False
        dbCreateBtnPnl.Visible = False
        dbExecPanel.Visible = False
        dbCreationPnl.Visible = False
        dbDropPnl.Visible = False
        tableManagementPanel.Visible = False
        dbCreateFeebackPnl.Visible = False

    End Sub

    Private Sub Panel1_Paint(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.PaintEventArgs) Handles mainPanel.Paint

    End Sub

    Private Sub adminLogBtn_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles adminLogBtn.Click
        disablePanels()
        pagePnl.Controls.Add(adminLogPnl)
        adminLogPnl.Visible = True
        Storytext.Text = "The default installation of MySQL come with username root and empty
password. However, this has the high potential vulnerability to buffer overflow attacks and
makes the database an easy target to attacks. To strengthen the security, database developer
```

80

```vbnet
may create a new user and grant the privileges.  Have a try now for administrator login! Root
user can do everything."

    End Sub

    Private Sub menuLbl_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles menuLbl.Click

    End Sub

    Private Sub Label1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles adminNameLbl.Click

    End Sub

    Private Sub adminSigninBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles adminSigninBtn.Click
        adminName = adminLogNameTxt.Text
        adminPass = adminLogPassTxt.Text
        'MessageBox.Show("name: " & adminName & "    pass:" & adminPass)

        'MysqlConn = New MySqlConnection()
        MysqlConn.ConnectionString = "server=localhost;" & "user id=" & adminName & ";" &
"password=" & adminPass & ";" & "database=mysql"
        Try
            MysqlConn.Open()
            MessageBox.Show("Connection to Database has been opened.")
            MysqlConn.Close()
        Catch myerror As MySqlException
            MessageBox.Show("Cannot connect to database: " & myerror.Message)
        Finally
            MysqlConn.Dispose()
        End Try
    End Sub

    Private Sub adminLogPassTxt_TextChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles adminLogPassTxt.TextChanged
        adminLogPassTxt.PasswordChar = "*"c
    End Sub

    Private Sub userLogBtn_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles userLogBtn.Click
        disablePanels()
        pagePnl.Controls.Add(userLogPnl)
        userLogPnl.Visible = True
        Storytext.Text = "One database can have more than one user but everyone is with
different privileges, such as only view, create etc. First time user, please login with root
and empty password. This application do not have function of create user"

    End Sub

    Private Sub userLogPnl_Paint(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.PaintEventArgs) Handles userLogPnl.Paint

    End Sub

    Private Sub userSigninBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles userSigninBtn.Click
        Storytext.Text = "Database is a structured set of data held in a computer, especially
one that is accessible in various ways.Before create a new table, a database must be selected
and used first! With default installaton, there is a default database named mySQL. You are
advised to create new database with a name. This application give option to drop database
too. Bottom of center show real SQL Command, happy learning!"
        userName = userNameTxt.Text
        userPass = userPassTxt.Text

        MysqlConn.ConnectionString = "server=localhost;" & "user id=" & userName & ";" &
"password=" & userPass & ";" & "database=dummy"

        Try
            loggedUserLbl.Text = "Welcome to the apps, " & userName & "!"
            lauchDBManagementPanel()
            'MysqlConn.Close()
        Catch myerror As MySqlException
```

```vb
            MessageBox.Show("Cannot connect to database: " & myerror.Message)
        Finally
            MysqlConn.Dispose()
        End Try
    End Sub


    Private Sub populateDBListCombobox()
        'Populate the list of databases combobox
        MysqlConn.Open()
        Dim stm As String = "SHOW DATABASES"
        Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
        Dim reader As MySqlDataReader = cmd.ExecuteReader()
        dbListCmbx.Items.Clear()
        dbListCmbx.Items.Add("Database List")
        dbListCmbx.SelectedIndex = 0
        While reader.Read()
            dbListCmbx.Items.Add(reader.GetString(0))
        End While
        MysqlConn.Close()
    End Sub


    Private Sub lauchDBManagementPanel()
        disablePanels()
        pagePnl.Controls.Add(dbManagementPnl)
        dbManagementPnl.Visible = True
        'Populate the list of databases combobox
        populateDBListCombobox()
        'show the database creation button
        dbCreationFunction()
    End Sub


    Private Sub dbCreationFunction()
        'check if the user is root
        Dim rootUser As String
        rootUser = "root"
        If String.Compare(userName, rootUser) = 0 Then
            dbCreateBtnPnl.Visible = True

        Else
            dbCreateBtnPnl.Visible = False
        End If
    End Sub


    Private Sub userPassTxt_TextChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles userPassTxt.TextChanged
        userPassTxt.PasswordChar = "*"c
    End Sub


    Private Sub dbManagementPnl_Paint(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.PaintEventArgs) Handles dbManagementPnl.Paint

    End Sub


    Private Sub dbCreateBtn_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles dbCreateBtn.Click
        dbExecPanel.Visible = True
        dbDropPnl.Visible = False
        dbExecPanel.Controls.Add(dbCreationPnl)
        dbCreationPnl.Visible = True
    End Sub


    Public Shared Sub updateCommandsString(ByVal cmdStr)
        commandsStr = commandsStr & "\r\n" & cmdStr
    End Sub


    Private Sub dbCreationBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles dbCreationBtn.Click
        dbCreateFeebackPnl.Visible = True
        Storytext.Text = "Click drop down list again, new database is in system now!"
        If String.IsNullOrEmpty(dbCreateNameTxt.Text) Then
            dbCreateFeedBackTxt.Text = "Please Enter a database name in the database text
box!"
        Else
```

```vb
            Dim myConStr As String = "Data Source=localhost;User Id=" & userName & ";Pwd=" &
userPass & ";"
            Dim myConnection As New MySqlConnection(myConStr)
            Dim myNewDB As String = "CREATE DATABASE " & dbCreateNameTxt.Text & ";"
            'The following will DROP the database
            'Dim mynewdb As String = "DROP DATABASE menagerie;"
            Dim myComm As New MySqlCommand(myNewDB)
            myComm.Connection = myConnection
            Try
                myConnection.Open()
                myComm.ExecuteNonQuery()
                myConnection.Close()
                'Populate the list of databases combobox
                populateDBListCombobox()
                dbCreateFeedBackTxt.Text = myNewDB
                commandsStr = commandsStr & myNewDB & "\r\n"
            Catch ex As Exception
                'MessageBox.Show(ex.Message)
                dbCreateFeedBackTxt.Text = ex.Message
            End Try
        End If

    End Sub

    Private Sub dbDropBtn_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles dbDropBtn.Click
        dbExecPanel.Visible = True
        dbCreationPnl.Visible = False
        dbExecPanel.Controls.Add(dbDropPnl)
        dbDropPnl.Visible = True
    End Sub

    Private Sub dbDropBtn2_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles dbDropBtn2.Click
        Storytext.Text = "Click drop down list again, database is removed from system now!"
        dbCreateFeebackPnl.Visible = True

        If String.IsNullOrEmpty(dbDropNameTxt.Text) Then
            dbCreateFeedBackTxt.Text = "Please Enter a database name in the database text
box!"
        Else
            Dim myConStr As String = "Data Source=localhost;User Id=" & userName & ";Pwd=" &
userPass & ";"
            Dim myConnection As New MySqlConnection(myConStr)
            Dim myNewDB As String = "DROP DATABASE " & dbDropNameTxt.Text & ";"
            Dim myComm As New MySqlCommand(myNewDB)
            myComm.Connection = myConnection
            Try
                myConnection.Open()
                myComm.ExecuteNonQuery()
                myConnection.Close()
                'Populate the list of databases combobox
                populateDBListCombobox()
                dbCreateFeedBackTxt.Text = myNewDB
                commandsStr = commandsStr & myNewDB & "\r\n"
            Catch ex As Exception
                dbCreateFeedBackTxt.Text = ex.Message
            End Try
        End If
    End Sub

    Private Sub launchTableManagementPanel()
        'disable the database create/drop pannel
        dbCreateBtnPnl.Visible = False
        dbCreationPnl.Visible = False
        dbExecPanel.Visible = True
        dbExecPanel.Controls.Add(tableManagementPanel)
        tableManagementPanel.Visible = True
        dbCreateFeebackPnl.Visible = True
    End Sub

    Private Sub dbListCmbx_SelectedIndexChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles dbListCmbx.SelectedIndexChanged
        Dim selectedItemValue As String = dbListCmbx.Items(dbListCmbx.SelectedIndex)
```

```vb
        If Not (selectedItemValue.Equals("Database List")) Then
            dbCredentials.hostName = "localhost"
            dbCredentials.userName = userName
            dbCredentials.userPass = userPass
            dbCredentials.database = selectedItemValue
            dbCredentials.commands = "USE " & selectedItemValue
            Dim tblManagementForm As New TableManagementForm
            tblManagementForm.setDatabaseCredentials(dbCredentials)
            'tblManagementForm.setCommandsString(commandsStr)
            tblManagementForm.Show()
            'MsgBox(selectedItemValue)
            'launchTableManagementPanel()
            'Dim myConStr As String = "Data Source=localhost;User Id=" & userName & ";Pwd=" &
userPass & ";"
            'Dim myConnection As New MySqlConnection(myConStr)
            'Dim myNewDB As String = "USE " & selectedItemValue & ";"
            'Dim myComm As New MySqlCommand(myNewDB)
            'myComm.Connection = myConnection
            'Try
            'myConnection.Open()
            'myComm.ExecuteNonQuery()
            'myConnection.Close()
            'dbCreateFeedBackTxt.Text = myNewDB
            'Catch ex As Exception
            'dbCreateFeedBackTxt.Text = ex.Message
            'End Try
        End If

    End Sub
    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        Documentation.Show()
    End Sub


    Private Sub Button2_Click(sender As Object, e As EventArgs) Handles Button2.Click
        MessageBox.Show("Do you need help? Please contact system admin at alisonwac@gmail.com
or +60133092312")
    End Sub

    Private Sub Button3_Click(sender As Object, e As EventArgs) Handles Button3.Click
        What_is_database_schema.Show()
    End Sub


End Class
```

databaseCredentials.vb

```vb
Public Class databaseCredentials
    Public userName As String
    Public userPass As String
    Public hostName As String
    Public database As String
    Public commands As String
End Class
```

Documentation.vb

```vb
Public Class Documentation


    Private Sub Label3_Click(sender As Object, e As EventArgs) Handles Label3.Click

    End Sub

    Private Sub Documentation_Load(sender As Object, e As EventArgs) Handles MyBase.Load

    End Sub
```

```vbnet
End Class
```

LOGOFYP1pngV2.ico
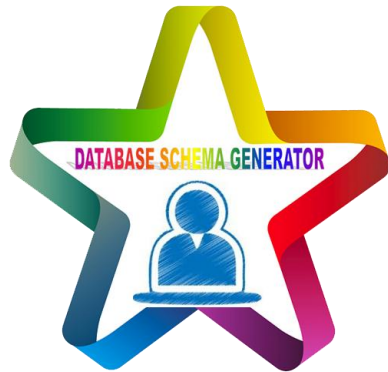
TableAttribtesPanel.vb

```vbnet
Public Class TableAttribtesPanel

    'The panel of header titles
    Private headerPnl As New Panel

    'The number of attributes characteristics in the header panel
    Private numOfAttr As Integer = 9

    'The panel containing all the attributes (rows) panels
    Private aPanel As New Panel

    'An Arraylist of panels of individual attributes
    Dim panelArray As New ArrayList()

    'the current database in use
    Private dbCredentials As New databaseCredentials

    'Panels spacifications
    Dim xLocation As Integer = 0
    Dim yLocation As Integer = 0
    Dim spacing As Integer = 3
    Dim height As Integer = 20
    Private horizontalControlSpacing As Integer = 3

    Public Sub dimensions(ByVal w As Integer, ByVal h As Integer)
        aPanel.Width = w
        aPanel.Height = h
    End Sub

    Public Sub location(ByVal x As Integer, ByVal y As Integer)
        aPanel.Location = New System.Drawing.Point(x, y)
    End Sub

    Public Sub createHeaderPanel()
        Dim attrlXLocation As Integer = 0
        Dim attrlYLocation As Integer = 0
        Dim myfont As New Font("Sans Serif", 9, FontStyle.Bold)
        headerPnl.Name = "headerPnl"
        headerPnl.BackColor = Color.Green
        headerPnl.Width = aPanel.Width
        headerPnl.Height = height
        headerPnl.Location = New System.Drawing.Point(xLocation, yLocation)
        headerPnl.Visible = True
        headerPnl.Show()
        headerPnl.Enabled = True
        'Populate the header panel with the titles
```

```vbnet
'Define and add the attribute name label
Dim attrNameLbl As New Label
attrNameLbl.Width = headerPnl.Width() / numOfAttr
attrNameLbl.Height = headerPnl.Height()
attrNameLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
attrNameLbl.Name = "attrNameLbl"
attrNameLbl.Visible = True
attrNameLbl.Show()
attrNameLbl.Enabled = True
attrNameLbl.Text = "Name"
attrNameLbl.Font = myfont
attrNameLbl.BorderStyle = BorderStyle.FixedSingle
headerPnl.Controls.Add(attrNameLbl)
'Update the locations
attrlXLocation += attrNameLbl.Width
attrlXLocation += horizontalControlSpacing

'Define and add the attribute datatype
Dim attrDataTypeLbl As New Label
attrDataTypeLbl.Width = headerPnl.Width() / numOfAttr
attrDataTypeLbl.Height = headerPnl.Height()
attrDataTypeLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
attrDataTypeLbl.Name = "attrDataTypeLbl"
attrDataTypeLbl.Visible = True
attrDataTypeLbl.Show()
attrDataTypeLbl.Enabled = True
attrDataTypeLbl.Text = "Type"
attrDataTypeLbl.Font = myfont
attrDataTypeLbl.BorderStyle = BorderStyle.FixedSingle
headerPnl.Controls.Add(attrDataTypeLbl)
'Update the locations
attrlXLocation += attrDataTypeLbl.Width
attrlXLocation += horizontalControlSpacing

'Define and add the attribute primaryKey label
Dim attrPrimaryKeyLbl As New Label
attrPrimaryKeyLbl.Width = headerPnl.Width() / numOfAttr
attrPrimaryKeyLbl.Height = headerPnl.Height()
attrPrimaryKeyLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
attrPrimaryKeyLbl.Name = "attrPrimaryKeyLbl"
attrPrimaryKeyLbl.Visible = True
attrPrimaryKeyLbl.Show()
attrPrimaryKeyLbl.Enabled = True
attrPrimaryKeyLbl.Text = "PK"
attrPrimaryKeyLbl.Font = myfont
attrPrimaryKeyLbl.BorderStyle = BorderStyle.FixedSingle
headerPnl.Controls.Add(attrPrimaryKeyLbl)
'Update the locations
attrlXLocation += attrPrimaryKeyLbl.Width
attrlXLocation += horizontalControlSpacing

'Define and add the attribute foreign Key label
Dim foreignKeyLbl As New Label
foreignKeyLbl.Width = headerPnl.Width() / numOfAttr
foreignKeyLbl.Height = headerPnl.Height()
foreignKeyLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
foreignKeyLbl.Name = "foreignKeyLbl"
foreignKeyLbl.Visible = True
foreignKeyLbl.Show()
foreignKeyLbl.Enabled = True
foreignKeyLbl.Text = "FK"
foreignKeyLbl.Font = myfont
foreignKeyLbl.BorderStyle = BorderStyle.FixedSingle
headerPnl.Controls.Add(foreignKeyLbl)
'Update the locations
attrlXLocation += foreignKeyLbl.Width
attrlXLocation += horizontalControlSpacing

'Define and add the attribute not null characteristic label
Dim notNullLbl As New Label
notNullLbl.Width = headerPnl.Width() / numOfAttr
notNullLbl.Height = headerPnl.Height()
notNullLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
notNullLbl.Name = "notNullLbl"
```

```vbnet
        notNullLbl.Visible = True
        notNullLbl.Show()
        notNullLbl.Enabled = True
        notNullLbl.Text = "NN"
        notNullLbl.Font = myfont
        notNullLbl.BorderStyle = BorderStyle.FixedSingle
        headerPnl.Controls.Add(notNullLbl)
        'Update the locations
        attrlXLocation += notNullLbl.Width
        attrlXLocation += horizontalControlSpacing

        'Define and add the attribute unique characteristic label
        Dim uniqueLbl As New Label
        uniqueLbl.Width = headerPnl.Width() / numOfAttr
        uniqueLbl.Height = headerPnl.Height()
        uniqueLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
        uniqueLbl.Name = "uniqueLbl"
        uniqueLbl.Visible = True
        uniqueLbl.Show()
        uniqueLbl.Enabled = True
        uniqueLbl.Text = "U"
        uniqueLbl.Font = myfont
        uniqueLbl.BorderStyle = BorderStyle.FixedSingle
        headerPnl.Controls.Add(uniqueLbl)
        'Update the locations
        attrlXLocation += uniqueLbl.Width
        attrlXLocation += horizontalControlSpacing

        'Define and add the attribute reference table label
        Dim refTableLbl As New Label
        refTableLbl.Width = headerPnl.Width() / numOfAttr
        refTableLbl.Height = headerPnl.Height()
        refTableLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
        refTableLbl.Name = "refTableLbl"
        refTableLbl.Visible = True
        refTableLbl.Show()
        refTableLbl.Enabled = True
        refTableLbl.Text = "RT"
        refTableLbl.Font = myfont
        refTableLbl.BorderStyle = BorderStyle.FixedSingle
        headerPnl.Controls.Add(refTableLbl)
        'Update the locations
        attrlXLocation += refTableLbl.Width
        attrlXLocation += horizontalControlSpacing

        'Define and add the attribute reference data label
        Dim refdataLbl As New Label
        refdataLbl.Width = headerPnl.Width() / numOfAttr
        refdataLbl.Height = headerPnl.Height()
        refdataLbl.Location = New System.Drawing.Point(attrlXLocation, attrlYLocation)
        refdataLbl.Name = "refdataLbl"
        refdataLbl.Visible = True
        refdataLbl.Show()
        refdataLbl.Enabled = True
        refdataLbl.Text = "RD"
        refdataLbl.Font = myfont
        refdataLbl.BorderStyle = BorderStyle.FixedSingle
        headerPnl.Controls.Add(refdataLbl)
        'Update the locations
        attrlXLocation += refTableLbl.Width
        attrlXLocation += horizontalControlSpacing

        'Add the header panel to the attributes panel
        aPanel.Controls.Add(headerPnl)
        'Update the location for the next row
        yLocation += height
        yLocation += spacing
    End Sub

    Public Sub createAttributes(ByVal num As Integer)
        aPanel.Name = "aPanel"
        aPanel.BackColor = Color.Red
        aPanel.Visible = True
        aPanel.Show()
```

```vb
            aPanel.Enabled = True
            aPanel.AutoScroll = True
            createHeaderPanel()
            For index As Integer = 0 To num - 1 Step 1
                panelArray.Add(New TableSingleAttributePanel)
                CType(panelArray.Item(index),
TableSingleAttributePanel).setDatabaseCredentials(dbCredentials)
                CType(panelArray.Item(index), TableSingleAttributePanel).dimensions(aPanel.Width,
height)
                CType(panelArray.Item(index), TableSingleAttributePanel).location(xLocation,
yLocation)
                CType(panelArray.Item(index), TableSingleAttributePanel).backColor(Color.Blue)
                CType(panelArray.Item(index), TableSingleAttributePanel).display()
                aPanel.Controls.Add(CType(panelArray.Item(index),
TableSingleAttributePanel).getPanel)
                yLocation += height
                yLocation += spacing
            Next
        End Sub


    Public Function getPanel() As Panel
        Return aPanel
    End Function


    Public Function getAttributePanelArrayList() As ArrayList
        Return panelArray
    End Function


    Public Sub setDatabaseCredentials(ByRef dbInfo As databaseCredentials)
        dbCredentials = dbInfo
    End Sub


End Class
```

TableManagementForm.vb

```vb
Imports MySql.Data.MySqlClient

Public Class TableManagementForm

    Dim MysqlConn As New MySqlConnection()
    Dim adminName As String
    Dim adminPass As String
    Dim userName As String
    Dim userPass As String

    Dim panelArray As New ArrayList()
    'the current database in use
    Private dbCredentials As New databaseCredentials
    Private tableCreationPnl As New Panel
    Private operationGbx As New GroupBox

    'Table Creation variables
    WithEvents tableCreateBtn As New Button
    WithEvents attributeCreateBtn As New Button
    Private tableNamePnl As New Panel
    Private tableNamePnlWidth As Integer = 0
    Private tableNamePnlHeigth As Integer = 0
    Private numberOfAttributes As Integer = 0
    Private tableName As String
    Dim tableNameTxt As New TextBox
    Dim nameLbl As New Label
    Dim attrNumbTxt As New TextBox
    Dim attrLbl As New Label
    Private tableCreateButtonPnl As New Panel
    Private attrPnl As New TableAttribtesPanel


    Private Sub TableManagementForm_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        'Edit the database Label
```

```vbnet
        Dim myfont As New Font("Sans Serif", 15, FontStyle.Bold)
        Storytext2.Text = "Table drop down list show tables exists in system, description of
system will show in the box of the right hand side.In relational databases and flat file
databases, a table is an organized set of data elements (values) using a model of vertical
columns (which are identified by their name) and horizontal rows, the cell being the unit
where a row and column intersect.[1] A table has a specified number of columns, but can have
any number of rows.[2] Each row is identified by the values appearing in a particular column
subset which has been identified as a unique key index.(wikipedia,2014)"
        databaseNameLbl.Text = "Using '" & dbCredentials.database & "' Database"
        databaseNameLbl.Font = myfont
        codeTxt.Text = dbCredentials.commands
        MainForm.commandsStr = MainForm.commandsStr & dbCredentials.commands & "\r\n"
        populateTableList()
    End Sub

    Public Sub populateTableList()
        MysqlConn.ConnectionString = "server=" & dbCredentials.hostName & ";user id=" &
dbCredentials.userName & ";" & "password=" & dbCredentials.userPass & ";" & "database=" &
dbCredentials.database
        Try
            MysqlConn.Open()
            Dim stm As String = "SHOW TABLES"
            Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
            Dim reader As MySqlDataReader = cmd.ExecuteReader()
            tableListCmbx.Items.Clear()
            tableListCmbx.Items.Add("Table List")
            tableListCmbx.SelectedIndex = 0
            While reader.Read()
                tableListCmbx.Items.Add(reader.GetString(0))
            End While
            MysqlConn.Close()
        Catch myerror As MySqlException
            codeTxt.Text = "Cannot connect to database: " & myerror.Message
        Finally
            MysqlConn.Dispose()
        End Try

    End Sub


    Public Sub setDatabaseCredentials(ByRef dbInfo As databaseCredentials)
        dbCredentials = dbInfo
    End Sub


    Public Sub tableDescript(ByVal tableName As String)

        'Empty all the controls in the operation panel
        While operationPnl.Controls.Count > 0
            operationPnl.Controls.RemoveAt(0)
        End While

        'Empty all the controls in the operation panel
        While operationGbx.Controls.Count > 0
            operationGbx.Controls.RemoveAt(0)
        End While

        'Define operation group box
        operationGbx.Width = operationPnl.Width
        operationGbx.Height = operationPnl.Height
        operationGbx.Location = New System.Drawing.Point(0, 0)
        operationGbx.Enabled = True
        operationGbx.Visible = True
        operationGbx.Name = "description"
        operationGbx.Text = "description of " & tableName
        operationGbx.Show()

        'Create a description text box
        Dim descriptionTxt As New TextBox
        descriptionTxt.WordWrap = False
        descriptionTxt.Multiline = True
        descriptionTxt.WordWrap = True
        descriptionTxt.Width = operationGbx.Width
        descriptionTxt.Height = operationGbx.Height
```

```vb
            descriptionTxt.Location = New System.Drawing.Point(0, 0)
            descriptionTxt.Name = "descriptionTxt"
            descriptionTxt.Visible = True
            descriptionTxt.Show()
            descriptionTxt.Enabled = True

            'Perform the mysql query
            MysqlConn.ConnectionString = "server=" & dbCredentials.hostName & ";user id=" &
dbCredentials.userName & ";" & "password=" & dbCredentials.userPass & ";" & "database=" &
dbCredentials.database
            Try
                MysqlConn.Open()
                Dim stm As String = "DESC " & tableName
                Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
                Dim reader As MySqlDataReader = cmd.ExecuteReader()
                Dim description As String = ""
                If reader.HasRows Then
                    While reader.Read
                        For i As Integer = 0 To 1
                            description = description & " " & reader(i).ToString
                        Next
                    End While
                End If
                MysqlConn.Close()
                descriptionTxt.Text = description
                codeTxt.Text = stm
                MainForm.commandsStr = MainForm.commandsStr & stm & "\r\n"
            Catch myerror As MySqlException
                codeTxt.Text = "Cannot connect to database: " & myerror.Message
            Finally
                MysqlConn.Dispose()
            End Try

            'Add the description text box to the operation panel
            'operationPnl.Controls.Add(descriptionTxt)
            operationGbx.Controls.Add(descriptionTxt)
            operationPnl.Controls.Add(operationGbx)
        End Sub

    Private Sub tableListCmbx_SelectedIndexChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles tableListCmbx.SelectedIndexChanged
            Dim selectedItemValue As String = tableListCmbx.Items(tableListCmbx.SelectedIndex)
            If Not (selectedItemValue.Equals("Table List")) Then
                tableDescript(selectedItemValue)
            End If
        End Sub

    Public Sub tableCreation()
            'Empty all the controls in the operation panel
            While operationPnl.Controls.Count > 0
                operationPnl.Controls.RemoveAt(0)
            End While
            'Load the table name panel
            loadTableNamePanel()

        End Sub

    Private Sub attributeCreateBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles attributeCreateBtn.Click
            'Validate the entries
            If String.IsNullOrEmpty(tableNameTxt.Text) Or String.IsNullOrEmpty(attrNumbTxt.Text)
Then
                MsgBox("Please, make sure to fill in the info")
            Else
                tableName = tableNameTxt.Text
                Try
                    numberOfAttributes = Convert.ToInt32(attrNumbTxt.Text)
                    'MsgBox("tableName: " & tableName & "     No.= " & numberOfAttributes)
                    loadAttributeFields(numberOfAttributes, 0, tableNamePnl.Height)
                    attributeCreateBtn.Enabled = False
                Catch myerror As Exception
                    MsgBox(myerror.Message)
                End Try
```

```vbnet
            End If
        End Sub

    Private Sub tblCreateBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles tblCreateBtn.Click
            tableCreation()
            tblCreateBtn.Enabled = False
            Storytext2.Text = "Please key in table and number of attribute in a table. One form
only for one table, you may create 2nd table after close the first form"
        End Sub

    Public Sub loadTableNamePanel()

            'Empty all the controls in the table name panel
            While tableNamePnl.Controls.Count > 0
                tableNamePnl.Controls.RemoveAt(0)
            End While
            'Create the table name panel
            tableNamePnl.Width = operationPnl.Width
            tableNamePnl.Height = 80
            tableNamePnl.BackColor = Color.Beige
            tableNamePnl.Location = New System.Drawing.Point(0, 0)
            tableNamePnl.Visible = True
            tableNamePnl.Enabled = True
            tableNamePnl.BorderStyle = BorderStyle.FixedSingle
            'Create the name label
            nameLbl.Text = "Table Name"
            nameLbl.Location = New System.Drawing.Point(10, 10)
            nameLbl.Visible = True
            nameLbl.Enabled = True
            tableNamePnl.Controls.Add(nameLbl)
            'Craete the name textBox
            tableNameTxt.Location = New System.Drawing.Point(150, 10)
            tableNameTxt.Visible = True
            tableNameTxt.Enabled = True
            tableNamePnl.Controls.Add(tableNameTxt)
            'Create the label for the number of attributes
            attrLbl.Text = "No. of attributes"
            attrLbl.Location = New System.Drawing.Point(10, 40)
            attrLbl.Visible = True
            attrLbl.Enabled = True
            tableNamePnl.Controls.Add(attrLbl)
            'Create the textbox for the number of attributes
            attrNumbTxt.Location = New System.Drawing.Point(150, 40)
            attrNumbTxt.Visible = True
            attrNumbTxt.Enabled = True
            tableNamePnl.Controls.Add(attrNumbTxt)
            'Define the button to load the rows for the attributes
            attributeCreateBtn.Location = New System.Drawing.Point(300, 40)
            attributeCreateBtn.Text = "Load Fields"
            attributeCreateBtn.Visible = True
            attributeCreateBtn.Enabled = True
            tableNamePnl.Controls.Add(attributeCreateBtn)

            operationPnl.Controls.Add(tableNamePnl)
        End Sub

    Public Sub loadAttributeFields(ByVal num As Integer, ByVal xLoc As Integer, ByVal yLoc As
Integer)
            'Make sure to clear the panel
            Storytext2.Text = "attribute:describe a component of the database, such as a table or
a field. The primary key of a relational table uniquely identifies each record in the table.
a foreign key is a field (or collection of fields) in one table that uniquely identifies a
row of another table.  "
            While attrPnl.getPanel.Controls.Count > 0
                attrPnl.getPanel.Controls.RemoveAt(0)
            End While
            attrPnl.setDatabaseCredentials(dbCredentials)
            attrPnl.dimensions(operationPnl.Width, operationPnl.Height - tableNamePnl.Height -
50)
            attrPnl.location(xLoc, yLoc)
            attrPnl.createAttributes(num)
            operationPnl.AutoScroll = True
            attrPnl.getPanel.BorderStyle = BorderStyle.FixedSingle
```

91

```vb
        attrPnl.getPanel().AutoScroll = True
        Me.operationPnl.Controls.Add(attrPnl.getPanel)
        'Define a panel to contain the button to create a table
        tableCreateButtonPnl.Width = operationPnl.Width
        tableCreateButtonPnl.Height = 50
        tableCreateButtonPnl.Location = New System.Drawing.Point(0, tableNamePnl.Height +
attrPnl.getPanel.Height)
        tableCreateButtonPnl.Visible = True
        tableCreateButtonPnl.Enabled = True
        tableCreateButtonPnl.BorderStyle = BorderStyle.FixedSingle
        'Define a button to finally create the table
        tableCreateBtn.Text = "Create Table"
        tableCreateBtn.Visible = True
        tableCreateBtn.Enabled = True
        tableCreateButtonPnl.Controls.Add(tableCreateBtn)
        Me.operationPnl.Controls.Add(tableCreateButtonPnl)

    End Sub

    Private Sub tableCreateBtn_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles tableCreateBtn.Click
        Storytext2.Text = "Table is now created in system! You need to know that, we cant
drop table which referenced by other tables, unless the foreign key has been removed"
        'Retrieve the array of attributes panels
        Dim attrPanelArray As ArrayList = attrPnl.getAttributePanelArrayList()
        'Retrieve the indices of the primary keys
        Dim primaryKeysArray As New ArrayList
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isPrimaryKey =
True Then
                primaryKeysArray.Add(index)
            End If
        Next
        'Retrieve the indices of the foreign keys
        Dim foreignKeysArray As New ArrayList
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isForeignKey =
True Then
                foreignKeysArray.Add(index)
            End If
        Next
        'Retrieve the indices of the not null attributes
        Dim notNullArray As New ArrayList
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isNotNull = True
Then
                notNullArray.Add(index)
            End If
        Next
        'Retrieve the indices of the not null attributes
        Dim uniqueArray As New ArrayList
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isUnique = True
Then
                uniqueArray.Add(index)
            End If
        Next

        Dim PKstr As String = ""
        For index As Integer = 0 To primaryKeysArray.Count - 1 Step 1
            PKstr = PKstr & " " & CType(primaryKeysArray.Item(index), Integer).ToString
        Next

        Dim FKstr As String = ""
        For index As Integer = 0 To foreignKeysArray.Count - 1 Step 1
            FKstr = FKstr & " " & CType(foreignKeysArray.Item(index), Integer).ToString
        Next

        Dim NNstr As String = ""
        For index As Integer = 0 To notNullArray.Count - 1 Step 1
            NNstr = NNstr & " " & CType(notNullArray.Item(index), Integer).ToString
        Next

        Dim Ustr As String = ""
```

```vbnet
        For index As Integer = 0 To uniqueArray.Count - 1 Step 1
            Ustr = Ustr & " " & CType(uniqueArray.Item(index), Integer).ToString
        Next

        'Define the mysql statement
        Dim stm As String = "CREATE TABLE " & tableNameTxt.Text & "("
        If (attrPanelArray.Count > 1) Then
            For index As Integer = 0 To attrPanelArray.Count - 2 Step 1
                stm = stm & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getAttributeName & " "
                stm = stm & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getDataType & " "
                If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isNotNull =
True Then
                    stm = stm & " NOT NULL"
                End If
                stm = stm & ", "
            Next
        End If
        stm = stm & CType(attrPanelArray.Item(attrPanelArray.Count - 1),
TableSingleAttributePanel).getAttributeName & " "
        stm = stm & CType(attrPanelArray.Item(attrPanelArray.Count - 1),
TableSingleAttributePanel).getDataType & " "
        'Add primary keys
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isPrimaryKey Then
                stm = stm & ", PRIMARY KEY (" & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getAttributeName & ") "
            End If
        Next
        'Add unique key
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isUnique = True
Then
                stm = stm & ", UNIQUE (" & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getAttributeName & ") "
            End If
        Next
        'Add foreign key constraints
        For index As Integer = 0 To attrPanelArray.Count - 1 Step 1
            If CType(attrPanelArray.Item(index), TableSingleAttributePanel).isForeignKey Then
                stm = stm & ", FOREIGN KEY (" & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getAttributeName & ") "
                stm = stm & "REFERENCES " & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getReferenceTable & "("
                stm = stm & CType(attrPanelArray.Item(index),
TableSingleAttributePanel).getforeignFieldName & ")"
            End If
        Next
        stm = stm & ");"
        codeTxt.Text = stm

        'Perform the mysql query
        MysqlConn.ConnectionString = "server=" & dbCredentials.hostName & ";user id=" &
dbCredentials.userName & ";" & "password=" & dbCredentials.userPass & ";" & "database=" &
dbCredentials.database
        Try
            MysqlConn.Open()
            Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
            cmd.ExecuteNonQuery()
            MysqlConn.Close()
            codeTxt.Text = stm
            MainForm.commandsStr = MainForm.commandsStr & stm & "\r\n"
        Catch myerror As MySqlException
            codeTxt.Text = "Cannot connect to database: " & myerror.Message & stm
        Finally
            MysqlConn.Dispose()
        End Try
        populateTableList()

    End Sub


    Private Sub actionGbx_Enter(sender As Object, e As EventArgs) Handles actionGbx.Enter
```

```vb
        End Sub



End Class
```

TableSingleAttributePanel.vb

```vb
Imports MySql.Data.MySqlClient

Public Class TableSingleAttributePanel

    Private aPanel As New Panel
    Private attrNameTxt As New TextBox
    Private controlXLocation As Integer = 0
    Private controlYLocation As Integer = 0
    Private horizontalControlSpacing As Integer = 3
    'Special Keys attributes
    Private primaryKeyBool As Boolean = False
    Private foreignKeyBool As Boolean = False
    Private notNullBool As Boolean = False
    Private uniqueBool As Boolean = False
    Private dataTypeStr As String
    'Foreign Key remote table
    WithEvents foreignTableNameCmbx As New ComboBox
    Private foreignTableNameStr As String
    WithEvents foreignDataNameCmbx As New ComboBox
    Private foreignDataNameStr As String
    'CheckBoxes
    Private numberOfControls As Integer = 9
    WithEvents dataTypecmBox As New ComboBox
    WithEvents primaryKeyCheckBox As New CheckBox
    WithEvents foreignKeyCheckBox As New CheckBox
    WithEvents notNullCheckBox As New CheckBox
    WithEvents uniqueCheckBox As New CheckBox

    'An array of attribute along with its contraints
    Private attributeStr(6) As String

    'the current database in use
    Private dbCredentials As New databaseCredentials


    Public Sub location(ByVal x As Integer, ByVal y As Integer)
        aPanel.Location = New System.Drawing.Point(x, y)
    End Sub

    Public Function location() As System.Drawing.Point
        Return aPanel.Location
    End Function

    Public Sub dimensions(ByVal w As Integer, ByVal h As Integer)
        aPanel.Width = w
        aPanel.Height = h
    End Sub

    Public Sub backColor(ByVal col As Color)
        aPanel.BackColor = col
    End Sub

    Sub display()
        aPanel.Name = "aPanel" & panelCount()
        aPanel.Visible = True
        aPanel.Show()
        aPanel.Enabled = True
        'Add the controls to the current panel
        addAttributeNameTextBox()
        addDataTypeComboBox()
        addPrimaryKeyCheckBox()
        addForeignKeyCheckBox()
```

```vbnet
        addNotNullCheckBox()
        addUniqueCheckBox()
        addForeignTableNameComboBox()
        addForeignDataNameComboBox()
    End Sub

    Function panelCount() As Decimal
        Static totalSales As Decimal = 0
        totalSales += 1
        Return totalSales
    End Function

    Public Function getPanel() As Panel
        Return aPanel
    End Function

    Public Sub addAttributeNameTextBox()
        attrNameTxt.Width = aPanel.Width() / numberOfControls
        attrNameTxt.Height = aPanel.Height()
        attrNameTxt.Location = New System.Drawing.Point(controlXLocation, controlYLocation)
        attrNameTxt.Name = "attrNameTxt"
        attrNameTxt.Visible = True
        attrNameTxt.Show()
        attrNameTxt.Enabled = True
        aPanel.Controls.Add(attrNameTxt)
        'Update the locations
        controlXLocation += attrNameTxt.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addDataTypeComboBox()
        dataTypecmBox.Width = aPanel.Width() / numberOfControls
        dataTypecmBox.Height = aPanel.Height()
        dataTypecmBox.Location = New System.Drawing.Point(controlXLocation, controlYLocation)
        dataTypecmBox.Name = "dataTypecmBox"
        dataTypecmBox.Visible = True
        dataTypecmBox.Show()
        dataTypecmBox.Enabled = True
        'Populate the datatype combobox
        dataTypecmBox.Items.Add("Data Type")
        dataTypecmBox.SelectedIndex = 0
        dataTypecmBox.Items.Add("INT(11)")
        dataTypecmBox.Items.Add("VARCHAR(255)")
        dataTypecmBox.Items.Add("DECIMAL(12)")
        dataTypecmBox.Items.Add("DOUBLE")
        dataTypecmBox.Items.Add("TEXT")
        'Add the datatype combobox to the attribute panel
        aPanel.Controls.Add(dataTypecmBox)
        'Update the locations
        controlXLocation += dataTypecmBox.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addPrimaryKeyCheckBox()
        primaryKeyCheckBox.Width = aPanel.Width() / numberOfControls
        primaryKeyCheckBox.Height = aPanel.Height()
        primaryKeyCheckBox.Location = New System.Drawing.Point(controlXLocation,
controlYLocation)
        primaryKeyCheckBox.Name = "primaryKeyCheckBox"
        primaryKeyCheckBox.Visible = True
        primaryKeyCheckBox.Show()
        primaryKeyCheckBox.Enabled = True
        'primaryKeyCheckBox.BackColor = Color.White
        'Add the radio to the panel
        aPanel.Controls.Add(primaryKeyCheckBox)
        'Update the locations
        controlXLocation += primaryKeyCheckBox.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addForeignKeyCheckBox()
        foreignKeyCheckBox.Width = aPanel.Width() / numberOfControls
        foreignKeyCheckBox.Height = aPanel.Height()
```

```vbnet
        foreignKeyCheckBox.Location = New System.Drawing.Point(controlXLocation, 
controlYLocation)
        foreignKeyCheckBox.Name = "foreignKeyCheckBox"
        foreignKeyCheckBox.Visible = True
        foreignKeyCheckBox.Show()
        foreignKeyCheckBox.Enabled = True
        'Add the radio to the panel
        aPanel.Controls.Add(foreignKeyCheckBox)
        'Update the locations
        controlXLocation += foreignKeyCheckBox.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addNotNullCheckBox()
        notNullCheckBox.Width = aPanel.Width() / numberOfControls
        notNullCheckBox.Height = aPanel.Height()
        notNullCheckBox.Location = New System.Drawing.Point(controlXLocation, 
controlYLocation)
        notNullCheckBox.Name = "notNullCheckBox"
        notNullCheckBox.Visible = True
        notNullCheckBox.Show()
        notNullCheckBox.Enabled = True
        'primaryKeyCheckBox.BackColor = Color.White
        'Add the radio to the panel
        aPanel.Controls.Add(notNullCheckBox)
        'Update the locations
        controlXLocation += notNullCheckBox.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addUniqueCheckBox()
        uniqueCheckBox.Width = aPanel.Width() / numberOfControls
        uniqueCheckBox.Height = aPanel.Height()
        uniqueCheckBox.Location = New System.Drawing.Point(controlXLocation, 
controlYLocation)
        uniqueCheckBox.Name = "uniqueCheckBox"
        uniqueCheckBox.Visible = True
        uniqueCheckBox.Show()
        uniqueCheckBox.Enabled = True
        'primaryKeyCheckBox.BackColor = Color.White
        'Add the radio to the panel
        aPanel.Controls.Add(uniqueCheckBox)
        'Update the locations
        controlXLocation += uniqueCheckBox.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addForeignTableNameComboBox()
        foreignTableNameCmbx.Width = aPanel.Width() / numberOfControls
        foreignTableNameCmbx.Height = aPanel.Height()
        foreignTableNameCmbx.Location = New System.Drawing.Point(controlXLocation, 
controlYLocation)
        foreignTableNameCmbx.Name = "foreignTableNameCmbx"
        foreignTableNameCmbx.Visible = False
        foreignTableNameCmbx.Hide()
        foreignTableNameCmbx.Enabled = False
        aPanel.Controls.Add(foreignTableNameCmbx)
        'Update the locations
        controlXLocation += foreignTableNameCmbx.Width
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Sub addForeignDataNameComboBox()
        foreignDataNameCmbx.Width = aPanel.Width() / numberOfControls
        foreignDataNameCmbx.Height = aPanel.Height()
        foreignDataNameCmbx.Location = New System.Drawing.Point(controlXLocation, 
controlYLocation)
        foreignDataNameCmbx.Name = "foreignDataNameCmbx"
        foreignDataNameCmbx.Visible = False
        foreignDataNameCmbx.Hide()
        foreignDataNameCmbx.Enabled = False
        aPanel.Controls.Add(foreignDataNameCmbx)
        'Update the locations
        controlXLocation += foreignDataNameCmbx.Width
```

```vb
        controlXLocation += horizontalControlSpacing
    End Sub

    Public Function getForeignKeyCheckBox() As CheckBox
        Return foreignKeyCheckBox
    End Function

    Public Function getPrimaryKeyCheckBox() As CheckBox
        Return primaryKeyCheckBox
    End Function

    Private Sub primaryKeyCheckBox_CheckedChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles primaryKeyCheckBox.CheckedChanged
        If primaryKeyCheckBox.Checked = True Then
            primaryKeyBool = True
        Else
            primaryKeyBool = False
        End If
    End Sub

    Private Sub foreignKeyCheckBox_CheckedChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles foreignKeyCheckBox.CheckedChanged
        If foreignKeyCheckBox.Checked = True Then
            foreignKeyBool = True
            foreignTableNameCmbx.Visible = True
            foreignTableNameCmbx.Enabled = True
            foreignTableNameCmbx.Show()
            foreignDataNameCmbx.Visible = True
            foreignDataNameCmbx.Show()
            foreignDataNameCmbx.Enabled = True
            'Add the first Item
            foreignTableNameCmbx.Items.Clear()
            foreignTableNameCmbx.Items.Add("Table List")
            foreignTableNameCmbx.SelectedIndex = 0
            populateForeignTableNameComboBox()
        Else
            foreignKeyBool = False
            foreignTableNameCmbx.Visible = False
            foreignTableNameCmbx.Enabled = False
            foreignTableNameCmbx.Hide()
            foreignDataNameCmbx.Visible = False
            foreignDataNameCmbx.Hide()
            foreignDataNameCmbx.Enabled = False
        End If
    End Sub

    Private Sub notNullCheckBox_CheckedChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles notNullCheckBox.CheckedChanged
        If notNullCheckBox.Checked = True Then
            notNullBool = True
        Else
            notNullBool = False
        End If
    End Sub

    Private Sub uniqueCheckBox_CheckedChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles uniqueCheckBox.CheckedChanged
        If uniqueCheckBox.Checked = True Then
            uniqueBool = True
        Else
            uniqueBool = False
        End If
    End Sub

    Public Function isPrimaryKey() As Boolean
        Return primaryKeyBool
    End Function

    Public Function isForeignKey() As Boolean
        Return foreignKeyBool
    End Function

    Private Sub dataTypecmBx_SelectedIndexChanged(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles dataTypecmBox.SelectedIndexChanged
```

97

```vbnet
            Dim selectedItemValue As String = dataTypecmBox.Items(dataTypecmBox.SelectedIndex)
            If Not (selectedItemValue.Equals("Data Type")) Then
                dataTypeStr = selectedItemValue
            End If
        End Sub

    Public Function getAttributeDetails() As String()
            attributeStr(0) = attrNameTxt.Text
            attributeStr(1) = dataTypeStr
            If primaryKeyBool = True Then
                attributeStr(2) = "PRIMARY KEY"
            Else
                attributeStr(2) = ""
            End If
            If foreignKeyBool = True Then
                attributeStr(3) = "FOREIGN KEY"
            Else
                attributeStr(3) = ""
            End If
            If notNullBool = True Then
                attributeStr(4) = "NOT NULL"
            Else
                attributeStr(4) = ""
            End If
            If uniqueBool = True Then
                attributeStr(5) = "UNIQUE"
            Else
                attributeStr(5) = ""
            End If
            Dim refTable As String =
foreignTableNameCmbx.Items(foreignTableNameCmbx.SelectedIndex)
            If Not (refTable.Equals("Table List")) Then
                attributeStr(6) = refTable
            Else
                attributeStr(6) = ""
            End If

            Return attributeStr
        End Function

    Public Function getAttributeName() As String
            Return attrNameTxt.Text
        End Function

    Public Function getReferenceTable() As String
            Return foreignTableNameStr
        End Function

    Public Function isNotNull() As Boolean
            Return notNullBool
        End Function

    Public Function isUnique() As Boolean
            Return uniqueBool
        End Function

    Public Function getDataType() As String
            Return dataTypeStr
        End Function

    Public Function getforeignFieldName() As String
            Return foreignDataNameStr
        End Function

    Public Sub setDatabaseCredentials(ByRef dbInfo As databaseCredentials)
            dbCredentials = dbInfo
        End Sub

    Public Sub populateForeignTableNameComboBox()
            Dim MysqlConn As New MySqlConnection()
            MysqlConn.ConnectionString = "server=" & dbCredentials.hostName & ";user id=" &
dbCredentials.userName & ";" & "password=" & dbCredentials.userPass & ";" & "database=" &
dbCredentials.database
            Try
```

98

```vb
        MysqlConn.Open()
        Dim stm As String = "SHOW TABLES"
        Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
        Dim reader As MySqlDataReader = cmd.ExecuteReader()
        foreignTableNameCmbx.Items.Clear()
        foreignTableNameCmbx.Items.Add("Table List")
        foreignTableNameCmbx.SelectedIndex = 0
        While reader.Read()
            foreignTableNameCmbx.Items.Add(reader.GetString(0))
        End While
        MysqlConn.Close()
    Catch myerror As MySqlException
        MsgBox("Cannot connect to database: " & myerror.Message)
    Finally
        MysqlConn.Dispose()
    End Try
End Sub

Private Sub foreignTableNameCmbx_SelectedIndexChanged(ByVal sender As System.Object, _
ByVal e As System.EventArgs) Handles foreignTableNameCmbx.SelectedIndexChanged
    Dim selectedItemValue As String = _
foreignTableNameCmbx.Items(foreignTableNameCmbx.SelectedIndex)
    If Not (selectedItemValue.Equals("Table List")) Then
        foreignTableNameStr = selectedItemValue
        populateForeignDataNameComboBox(foreignTableNameStr)
    Else
        foreignTableNameStr = ""
        foreignDataNameCmbx.Items.Clear()
    End If
End Sub

Private Sub populateForeignDataNameComboBox(ByVal tblName As String)
    Dim MysqlConn As New MySqlConnection()
    MysqlConn.ConnectionString = "server=" & dbCredentials.hostName & ";user id=" & _
dbCredentials.userName & ";" & "password=" & dbCredentials.userPass & ";" & "database=" & _
dbCredentials.database
    Try
        MysqlConn.Open()
        Dim stm As String = "DESC " & tblName
        Dim cmd As MySqlCommand = New MySqlCommand(stm, MysqlConn)
        Dim reader As MySqlDataReader = cmd.ExecuteReader()
        foreignDataNameCmbx.Items.Clear()
        foreignDataNameCmbx.Items.Add("Attr List")
        foreignDataNameCmbx.SelectedIndex = 0
        While reader.Read()
            foreignDataNameCmbx.Items.Add(reader.GetString(0))
        End While
        MysqlConn.Close()
    Catch myerror As MySqlException
        MsgBox("Cannot connect to database: " & myerror.Message)
    Finally
        MysqlConn.Dispose()
    End Try
End Sub

Private Sub foreignDataNameCmbx_SelectedIndexChanged(ByVal sender As System.Object, ByVal _
e As System.EventArgs) Handles foreignDataNameCmbx.SelectedIndexChanged
    Dim selectedItemValue As String = _
foreignDataNameCmbx.Items(foreignDataNameCmbx.SelectedIndex)
    If Not (selectedItemValue.Equals("Attr List")) Then
        foreignDataNameStr = selectedItemValue
    Else
        foreignDataNameStr = ""
    End If
End Sub

End Class
```

What is database schema.vb

```vb
Imports System.Windows.Forms

Public Class What_is_database_schema

    Private Sub OK_Button_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles OK_Button.Click
        Me.DialogResult = System.Windows.Forms.DialogResult.OK
        Me.Close()
        MainForm.Storytext.Text = "It is very time and cost consuming for any database schema
changes.Any error during the process of manually writing SQL script to make database schema
changes can cause downtime, delays in implementation, raise unnecessary cost or critical data
loss (Datical.com, 2013)."

    End Sub

    Private Sub Cancel_Button_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs)
        Me.DialogResult = System.Windows.Forms.DialogResult.Cancel
        Me.Close()
    End Sub

End Class
```