Liquid Velocity in Commercial Steel Pipe Mobile Application

by

Nur Ezzati binti Amran
16256

Interim Report submitted in partial fulfillment of
the requirements for the
Bachelor of Technology (Hons)
(Information Communication Technology)

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Universiti Teknologi PETRONAS
Bandar Seri Iskandar
31750 Tronoh
Perak DarulRidzuan

CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Information Communication Technology Programme
Universiti Teknologi PETRONAS
In partial fulfilment of the requirements for the
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Approved by

_____

(Assoc. Prof. Dr. Wan Fatimah Wan Ahmad)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
May 2015

CERTIFICATION OF ORIGINALITY

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

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(NUR EZZATI AMRAN)

ABSTRACT

The study is to show how technology is being applied in the field of engineering. The liquid velocity in commercial steel pipe mobile application will effective and efficiently help the engineer in solving fluid mechanic calculation problem. Manual ways of calculating the velocity can still be used for the purpose of learning in the education system. Advance in technology help the engineer to improve their operational production. This new mobile application will try to improve on some of the features which previous did not being cover by other application. Instead of referring to the reference book to find on what the standard nominal size for the specific flow rate, Q, the user can just download this mobile application. The scope for this application will be more clear and unambiguous. Based on the result and discussion, the storyboard and the flow of the application is being design. All the design and development will be based on the user preferences. The future work will aim to further give improvement on the design and development phase of this mobile application.

ACKNOWLEDGEMENTS

Alhamdulillah. Thanks to Allah SWT, whom with His willing giving me the opportunity to complete this Final Year Project which is title Liquid Velocity in Commercial Steel Pipe Mobile Application. This final year project report was prepared for Department of Computer & Information Sciences (CIS), Universiti Teknologi PTERONAS (UTP) which basically for student in final year to complete the undergraduate program that leads to the degree of Bachelor of Information communication technology.

First, I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this project. A special thanks to my final year project supervisor, Assoc. Prof. Dr. Wan Fatimah Wan Ahmad whose help, stimulating suggestions and encouragement, helped me to supervise my project especially in writing this report.

Next, I also would like to give appreciation to my co-supervisor, Mr Mohd Zamri Abdullah, whose help, suggested some solutions and always be prepared the materials needed for the projects. He also let me be in his laboratory class to conduct my user testing on my project.

I would like to thank you all my batch mates. They were really helpful in term of spiritual and moral support in completing this final year project.

Last but not least my gratitude to my family who give me support in term of moral support to finish my study in UTP since I was in foundation.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

Nowadays, Engineers are required to have knowledge on the technology in order to help them to solve their daily mathematics and sciences they deal with. Field of engineering is extremely broad and each of the specialized field is more emphasis on the particular areas of applied technology, science and application. Technology is needed in order to help the engineer on solving their problem more effective and efficiently.

Fluid mechanic is defined as the material in which movement occur continuously under the application of a tangential shear stress. It is branch of applied mechanics concerned with the static and dynamic of fluids that is liquid and gases. Usually, the equilibrium and dynamics of fluids is described using the mathematical model. There are various properties of the fluid such as velocity, pressure, density and temperature. The current method used in calculating the liquid velocity in the commercial steel pipe is using manual way. The engineer needs to calculate manually and refer to reference book to get the best nominal pipe size and pipe schedule. It is time consuming.

In this 21st century, the education becomes more flexible, creative, challenging and complex this is due to technological revolution. Technology is simply a tool to assist education and learning system. According to (Libman and Huang, 2013) the chemistry related software or application is seeing dramatically growth and also increase adoption rates. So, it is importance to the engineering students to adapt with this new millennium era. Critical thinking on the students is future improve when technology is applied.

In addition, fluid dynamic is important to the oil and gas company simply because it help them to understand the performance and design of the petroleum

reservoir. The numerical experiment can be conducted easily. It is also reduce the cost and time involved in making the prototype design programs individually. Lastly, with technology make engineer operate in effectively and efficiently way.

1.2 Problem Statement

The current students or engineer are using manual way to calculate the liquid velocity of the commercial steel pipe. Manual way means student or engineer need to calculate manually by pressing the calculator one by one. Despite the software of the mobile application should be used for almost all of the fluid mechanic calculation, and yet the university, engineer or the researcher still use the manual way to do the calculation. It might not be the effective and efficient way of solving the calculation even the users get the same answers but it is time consuming.

Usually, the engineer needs to refer to reference book to refer on the nominal pipe size as the input is entered, books need to be carried every time it need to be used unless they already remember all the suitable nominal pipe size to used. It will just wasting energy and time.

Moreover, there is no existing mobile application have been developed on this specific scope. Therefore a study which will implement simple and interactive way implementing the calculation could remedy the current problem.

1.3 Objective

- To identify the variable used in calculating the liquid velocity in the commercial steel pipe.
- To develop mobile application on fluid mechanic for chemical engineering students.
- To conduct user testing

1.4 Scope of Study

Below is the scope of study used in this project:

1) Research on the chemical term used in this project
    - Study on chemical term used in order to create this application.

2) Fluid Mechanic
    - Understand on what and how the fluid mechanic operate
    - Study on formula used for calculating the liquid velocity

3) Research on the mobile application related to this project
    - Check on the availability of the mobile application on the fluid mechanic field.
    - Compare the existing application
    - Discuss on the improvement of the existing application

4) Research and workshop on the mobile application platform
    - Study on how to use app inventory to create the application
    - Find suitable database software to used

5) Target user for this mobile application
    - Study on the user of this mobile application
    - Set the target user for this mobile application

CHAPTER 2

LITERATURE REVIEW

2.1 Technology

There is variety of definition on technology term. The Merriam-Webster Dictionary defines technology as "the use of science in industry, engineering, to invent useful things or to solve problems" and "a machine, piece of equipment and method that is created by technology". To achieve or accomplish objective in producing goods and services, a techniques, methods and process had been gather which is known as technology (Liddell 1980). Therefore, everything that is implement in computers, machines and device which can help the working process is also known as technology. Independent machines that ease the life of human is known as technology.

Technology term is first used in 1958. All the computer, network and application used is involved. It is general term that covers broad area of study. Technology simply means anything that involves data, information and knowledge is included in the field of information technology (Hamdanet al., 2011). Technology is always involve in computing discipline rather than just strictly theoretical in nature.

There are number of things that are being affected by technology. The leisure class is keep increasing as the technology is involved. Technology involves in the society and helps to develop advance economic to the world. In order to fulfill the need of technology, many new issues such as ethical issue is arise. According to the ("IT Discipline", 2012) there are five components of the information technology as shown below:

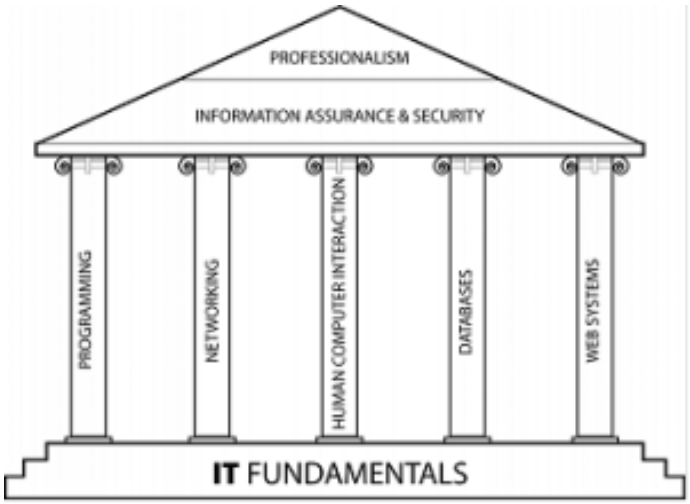


Figure 1 IT Discipline identity and name disguises (Sabin 2011)

Technology is defines as anything that fulfills the human purpose (Arthur 2009).Technology is really needed in order to solve problem to help the working to be done effective and efficient way. In every industry around the world is boosted with the help of the advance technology. It always eases the life of the user. With the technology nothing is impossible to achieve. Technology help the information to be available to reach even it is really far away. Not to mention the technology can arrive at the wide place just in few seconds.

In this new millennium era technology is really needed. Technology is needed to improve on the way of the learning process as the student is more interested to learn and try new things than stick with the old education technique. Teachers still needed in the education system, thus is to assist the student in technology. The collaboration of the technology with the engineering department is importance. Engineer can do their work in effective and efficient way by the help of technology. Most of the engineer work involves calculation, which is also including remembering all the formula. With technology everything can be done shortly. Technology cannot replace teacher. Imagine if there is only technology in this world, when the issues arise there is nothing can be solved. America and Europe had applied used of technology in education since the 60's (Ferbar&Markman, 2003)

The current culture of life especially in education has widely being influenced by the communication technology. Malaysia education should implement the technology education as the technology revolution is rising in the present era. Malaysia needs to increase their development in economy within the aspect of political, social spiritual and cultural. This is to ensure that the goal of 2020 is achieved (Mohamed, 1999)

Engineers always have clear specification in development, which is always being included in the software requirement specification. However, there is not much thinking and feeling being applied in the software. Engineer always have experience to be shared in the learning process. The developer has not yet built the learning environment for engineer to bring the experiences in the real world. Most of applications in the market can be access very easy and fast. Other than that most of the application in the mobile application market is less expensive or free. With the experience the mobile application can be create differently.

Engineer should be exposed to the software to ease their work. Engineer should explore the existing mobile application to have experience on the new things. Recently the mobile phone and computer table is growing in ecosystem include increasingly sophisticated in chemical software. The mobile application is more focusing on the specific range of the tasks. The goal of the developing mobile application for the engineer not to make them dependent on the application only but to help them implement all the formula in simple way of doing work. Goal of developing the mobile application to the engineer is not to build robot but to assist human in the learning environment. (Platzer, E., &Petrovich, O., 2010).

In decade, smartphone is being used as the medium of communication in sharing information. Besides that, the smartphone also have advanced computing and multiple capability on the communication. This is the standard device being used to transfer all the information easily beside the computer. Most of new young generation always demands in advance features. They always want to have their personal management tools, high resolution of the cameras, and high quality of the audio system or recording device. These generations always want to have specific operating system that offers them to download and application easy.

Smartphone make the most of task available on anywhere, anytime without bringing their laptop or computer around. In addition, smartphone price is cheaper than the personal computer and can easily carry. It is one-step forward compare to those days where people still need to have hardcopy of book and journals. Handheld devices such as smartphone and tables offer the standard facilities of communication to the user (Gomez et al., 2011).

Previously, the mobile devices have big and low screen resolution. Even, the memory use for the page is most likely 2GB.It now, mobile device are not as the same like in the past. It is big improvement on the size and the quality of the mobile application. The screen becomes more standard which is not too big and not to small. The hardware of the system is also being improved. Now there external memory card is available up to 64GB. Mobile application is really importance in this new era. It is extremely popular in the past few years. They are widely being used in everyday life.

Mobile application used by the young and elderly generation. In addition, it is always made human life easier. Most of the mobile application in the Android play store is free and less expensive. Even someone with the background of Information Communication can develop mobile application. There are some open source applications that help to build the mobile application without using the coding. It just likes solving puzzle.

There are two most search and wanted mobile operating system in the market. It is Google Android and Apple iOS, They are attractive and growing in term of their platform. In education system mobile device will be the best tool to use in the learning process, as they are easy to use. Moreover, the student will be more interested to learning through their mobile device compare to the old technique. The innovative project in the development is the responsible of the developers to have the wider customer base (Maasalmi&Pitkanen 2011).

Statistics on how the use of mobile phones in Malaysia is the third highest in the Asia Pacific and beyond developed countries like the United States and Europe (“StatistikPengunaantelefonpintar di Malaysia”,2014). Malaysia recorded a smart phone penetration rate of 80 percent after Hong Kong and Singapore (87 percent),

followed by Australia (75 per cent) and China (71 percent). Mobile phones in Asia Pacific continued to record double-digit growth over the past few years. Smartphone in emerging markets also rose. Thailand posted a penetration rate of 49 percent, followed by Indonesia (23 percent), India (18 percent) and the Philippines (15 percent).

The numbers of users who have multiple handsets are also increasing in the Asia Pacific region, especially in Malaysia, where nearly half or 47 percent of users have more than one handset, followed by Hong Kong (31 percent) as well as Singapore and China (29 percent).

In addition to smartphone, tablet usage is also seen growing in this region compared to the market last year, with Singapore increased by almost 30 per cent to 47 per cent, Hong Kong (57 percent) and Malaysia (42 percent). The report also shows that the brand has become a major factor influencing the choice of smartphone users in Asia Pacific, and Samsung is the most preferred brand in Malaysia.

Consumers in Southeast Asia also spent an average of three hours per day using their smartphones, including applications for chat, social media and entertainment such as games and multimedia. Malaysia, Singapore, Hong Kong and Australia also saw the use of mobile trading higher, with rates between 25 percent and 31 percent, in which consumers use their smartphones to purchase goods or make payments.

Engineer always deal with the numerical problem solving which was introduced in early nineteen sixties. Previously they are using the mathematical software package such as MAPLE, MATHCAD, MATLAB, Mathematica and PolyMath for solving the numerical problem. The software is easy to use to solve the numerical problem. Besides that, it is the most efficient way to have the accurate solutions. Based on the trends, the general numerical problem can be solve using the computer and simple Android mobile application based (Cutlipet al., n.d.).

2.2 Comparison between the android platforms with IOS Platform.

Android is rich with platform for the development and the programming (Matos and Grasser 2010). Android application is more flexible compare to other operating system. Most of the application in the Apple is available in the Android play store. Besides, the Android application can be distribute without depend on the other application.

Android Platform	IOS Platform
Google provides free services and sells ads there, Android being one of the services.	Apple has the integrated model, where iOS (software) is integrated with the iPhone (hardware).
Apps handling: Anyone can develop and distribute An- droid apps. Although there is the official Google Play store, the apps can also be distributed from any other place.	Apps handling: iOS apps can only be developed by sub- scribers to the iOS Developer Program, and can only be distributed through the official App Store. As an exception, organizations that participate in the iOS Developer Enterprise Program can develop and distribute in-house apps solely to their employees.

Table 1 Shows the comparison between android with IOS platform

Fluid is liquid and gases and the most importance of difference between this two state is gases can be compressed more easily compare to liquid (Michaelmas, 2002). Velocity is one properties of fluid. Velocity means the speed over displacement. In calculating the velocity there are different type of the velocity and pipe involved.

Method use for calculating liquid velocity in pipe is using manual way. Manual way is where the student needs to calculate without using any tool and using formula (Abdullah, 2015). Other than that, student needs to refer to the thick book of the fluid mechanic to select the value of the nominal pipe size and pipe schedule.

2.3 Comparison between the Existing Applications

Below are the lists of the existing mobile application related to fluid mechanic field on Google Play Store:

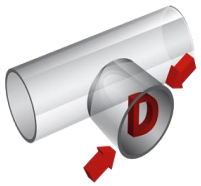
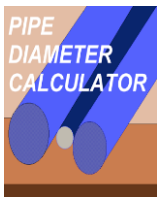
Mobile App Feature	1. Fluid Mechanics-Free 	2. Pipe Diameter Calculator 	3. Pipe diameter Calculator Free 
Type of Input	Insert/ Select	Select and Insert	Insert
Instruction/Manual/Help	-	-	-
SI unit/English (US) unit	SI unit	SI Unit	Both
Auto-Calculation	Yes	Yes	Yes
Nominal Pipe Size	-	-	-
Schedule Number(SCH)	-	-	-
Target User	Civil engineering for preliminary hydraulics analysis	Engineer	Engineer

Table 2 Shows the existing mobile application

Based on the above table, below are the explanations about the existing mobile application of this project:

1. Fluid mechanics free

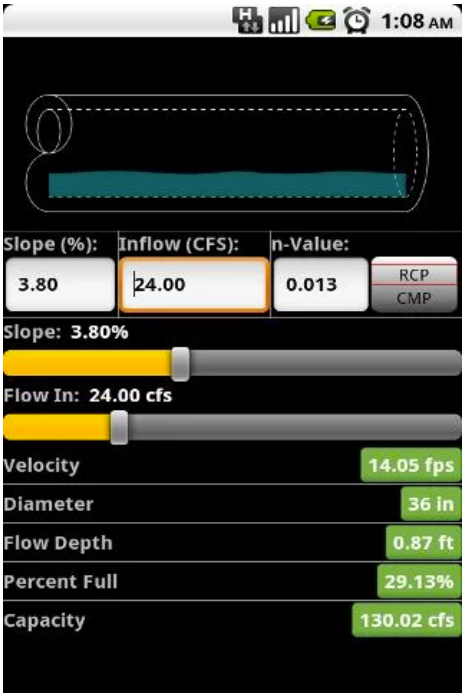


Figure 2 Main screen for fluid mechanics free

This application allows the user to input the slope and the fluid flow inside. The user can choose either to insert input or to play with the scrolled of the slope and fluid flow. This application also allow the user to insert type of pipe user the user want to use, Other than that, fluid mechanics free is displayed the status of the velocity, the diameter use, the flow depth, and percent full with the full flow capacity. Their target user is civil engineering for preliminary hydraulics analysis. The size for the application is 109k.

2. Pipe diameter calculator

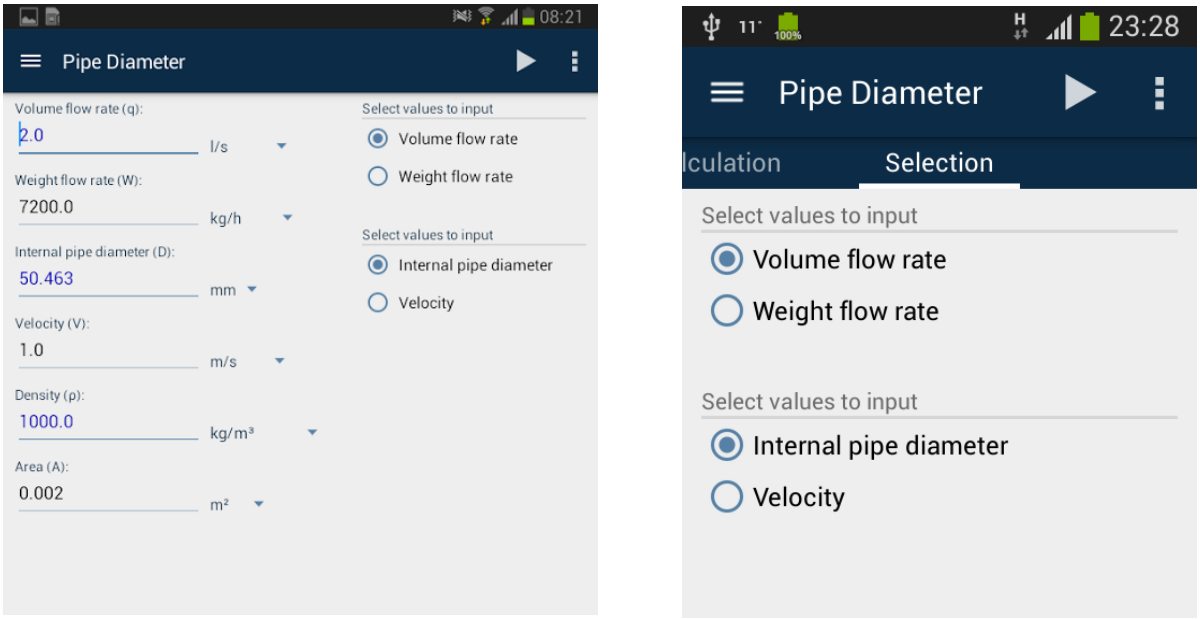


Figure 3 Main screen for the pipe diameter calculator

This application is using symbol as the label for each of the function. It allows the user to choose the input value the user wants to calculate. The user needs to insert the input based on the input value they choose earlier. For each of the variable the user able to select the SI unit on the dropdown list provided. When the users click button calculate the value for the output is calculated. The size for the application is 419k

3. Pipe Diameter Calculator Free

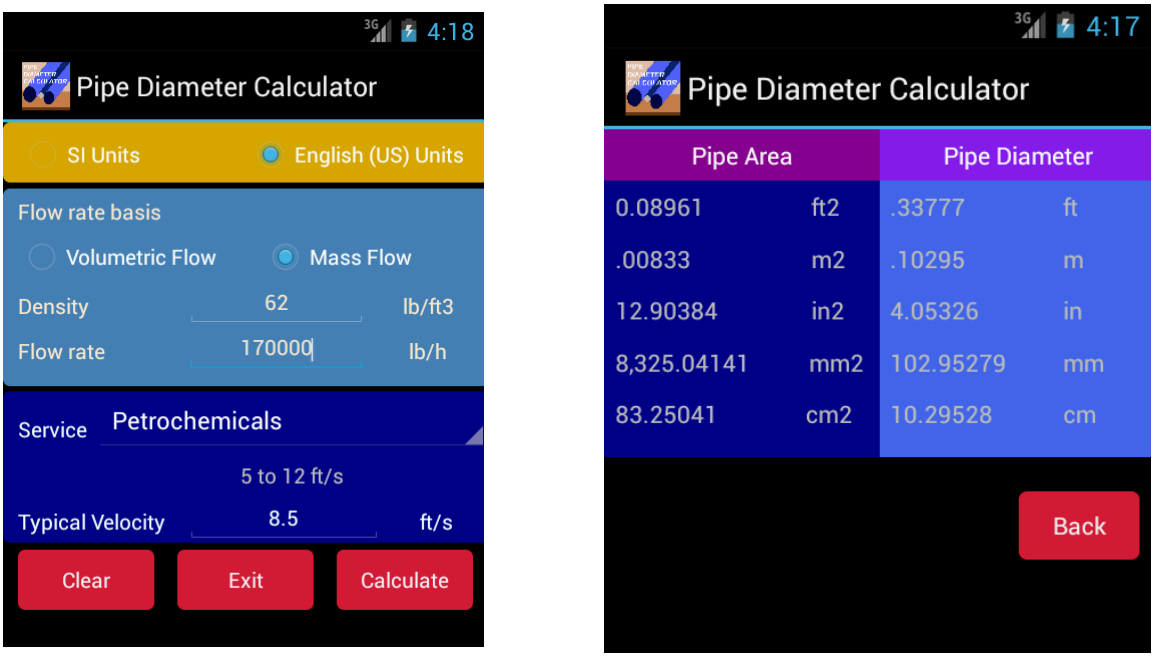


Figure 4 Main screen for pipe diameter calculator free

This application allows the user to select either the user want to use SI Units or English (US) Unit. Then the user can choose to select the flow rate basis. Based on the flow rate basis, the user needs to enter some input. Next, the user can choose the service. Service is the output result. User needs to enter the typical velocity. The user can choose whether to select the clear, exit or calculate button. If the user click calculate button, the output will be display on the other screen. Else if the user click clears, all the input and output will be reset. Else, the application will be closed. When the user clicks calculate without enter the input then the error message will be pop out. The size for this application is 1.6M

2.4 The gaps from existing application

All of this application does not have an instruction or guideline to help the new user using the application. Any of this application does specify the type of the fluid used. In addition, all of this application does not specify their scope to the type of pipe use. There a few function not provided for all of this application such as the nominal pipe size and pipe schedule. The button on the application can still press even when there is no input.

2.5 Improvement for fluid mechanic application

First, this liquid velocity will provide instruction or manual for the user on how to use the application. This manual will be provided on the homepage of the mobile application. This instruction is available to read on anytime offline. As the name imply, the liquid velocity in commercial steel pipe is specialize for calculating the liquid type of fluid and steel pipe only. Basically, the calculation of the output cannot be completed if the nominal pipe size and pipe schedule function.

These functions will be linked to the type of the calculation the user want to perform. Moreover, this application will suggest suitable or standard nominal pipe size and pipe schedule the user can choose. Next is, the calculate button can still be press by the user, but the error message will be display if one of the input or function is leave empty. The target user for this application is engineer, lecturer, students and researcher.

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

System development life cycle (SDLC) is defined as the process of developing system or software to meet certain requirement. In this project, Rapid Application Development (RAD) model is being used. It is the most suitable model for this project because it can be developed faster and has the higher quality compare to other model. It is incremental model and it helps the developer to gather their work into the prototype. With that, the model can show something to the end user to provide the feedback on their requirement. Prototype is sample of the implementation of the real system. It is not final product of the project. Usually, the prototype is not based on the strict planning.

As the time for this project is limit, the RAD is the most suitable method to be used. The dramatically changes can be made as the system requirement tend to expand. Besides that, this project will use the prototype-based methodology to perform the basis analysis and work immediately can begin on the system prototype. By using these methods, it will be very quick to act to the user interaction even when the mobile application is not done. It helps to refine the real requirements. As a result, it is possible to redo again from the beginning since there is a possibility to alter the initial design decision.

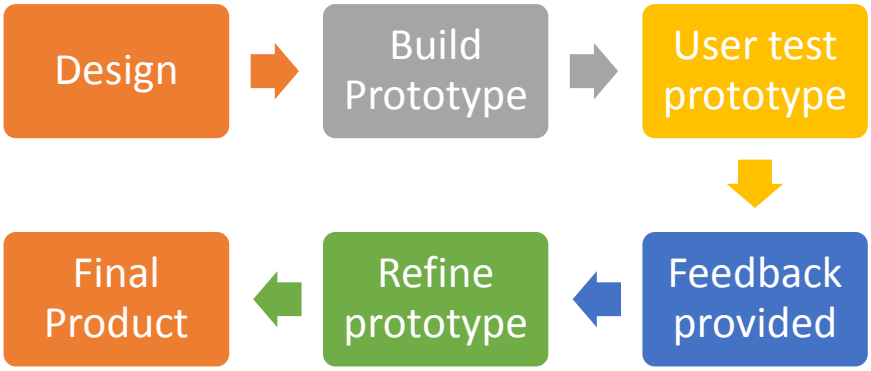


Figure 5 RAD prototype model

1. Design

The mobile application is design based on the requirement specification from the stakeholder. This is phase actually design storyboard for this project

2. Build Prototype

Next is building prototype of this project. The prototype includes the functions that the real project need, but the functions may not fully cover here.

3. User Test Prototype

The user test is conducted as the prototype on the first stage being built.

4. Feedback provided

Then, the feedback will be provided by the user in order improve the function or design of the prototype.

5. Refine prototype

The development will refine the prototype again as to add some functions or to improve the previous design.

6. Final Product

Lastly the final product is produced.

3.2 Project Development

Project Proposal

The project title liquid velocity in commercial steel pipe using mobile phone is idea from my supervisor. This project is requested from my co-supervisor from the chemical engineering department. The project initiation begins when the need for the project is identified.

Planning

In order to ensure all the project activities are cleared and can be done the time is allocated as shown in the Gantt chart, table 3.

Requirement analysis

This phase is all about collecting information related to the project. Meeting with co-supervisor to make sure the entire requirement is clear and unambiguous. When the scope of the requirement is clear then research on this topic is conducted. This is being translated to the suggested process flow diagram.

Design Development

Storyboard is being design in order to help the developer on how design each of the function in the mobile application works. The description is provided as well. Based on storyboard, use case diagram with the use case specification is being designed.

3.3 System Architecture

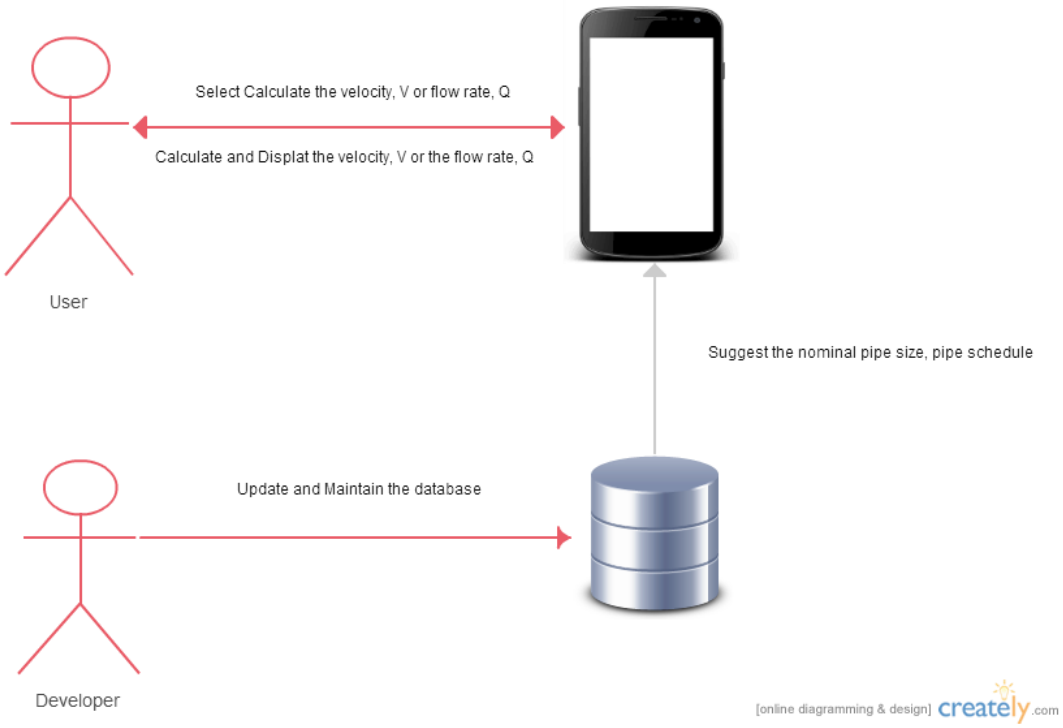


Figure 6 System architecture design

3.4 Key milestones

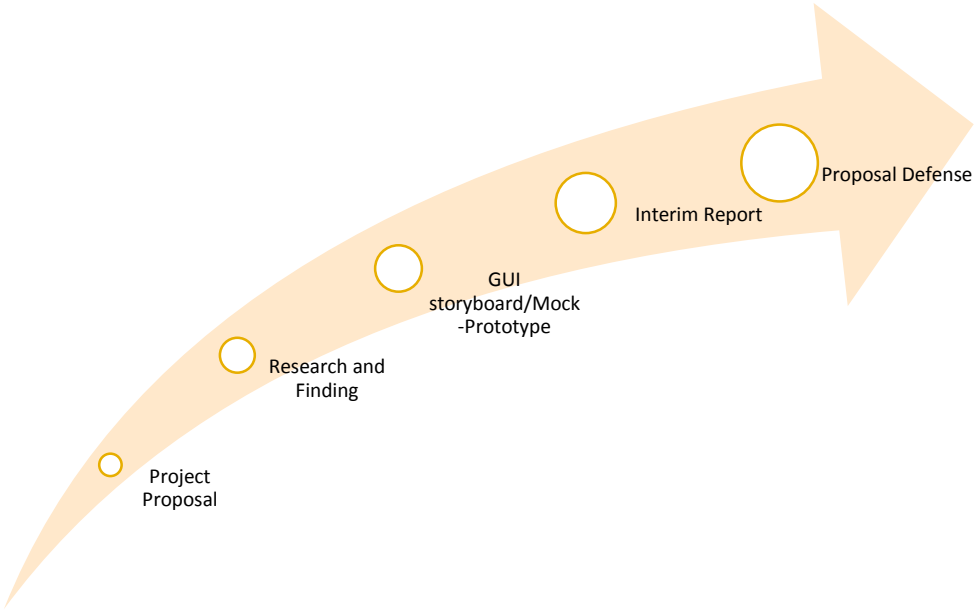


Figure 7 Key milestones

3.5 Gantt chart for FYP1

No	Details/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project Title														
2	Project Proposal submission														
3	Chapter 1: Introduction														
4	Chapter 2: Literature review														
5	Comparison between existence application														
6	Analysis of the finding research														
7	Chapter 3: Methodology use														
8	UML Diagram														
9	Overall functions of system														
10	Chapter 4: Results and Discussion														
11	Chapter 5: Conclusion														
12	Interim report submission														
13	Proposal Defense														

Table 3 Shows the Gantt chart for FYP1

3.6 Gantt chart for FYPII

No	Details/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Prototype development														
2	Developing User Interface														
3	Coding														
4	Testing														
5	Pre-sedex														
6	Implementation														
7	Submission technical paper														
8	Viva														
9	Project Submission														

Table 4 Shows the Gantt chart for FYPII

CHAPTER 4

RESULT AND DISCUSSION

4.1 Pre-survey result

A pre-survey was conducted in the chemical laboratory session under Mr. Zamri. The aims of this survey are to gather information about their knowledge on determining liquid velocity in commercial steel pipe, current methods used in determining liquid velocity and on their experience on using any technology, system or software related to this field. The total of participants is thirty students. These are the result of the questionnaire.

Most of respondents' are male and their ages are between 21-25 years old and all of them are chemical engineering students.

Gender

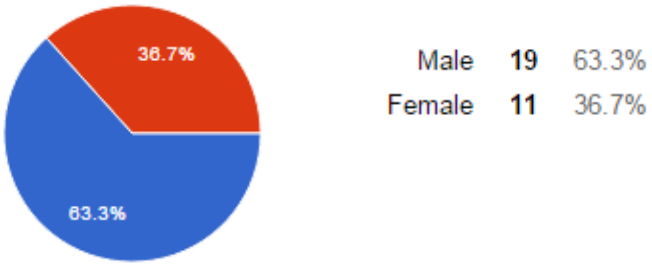


Figure 8 Gender for respondents

The age of the respondents is divided into five parts. Because the survey is conducted during class session, all of them age between 21-25 years old.

Age

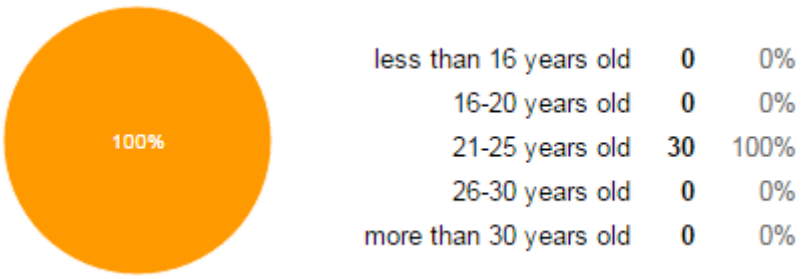


Figure 9 Age of respondents

Due to the same lab class, most of them are undergraduate students. Only of the student is foundation student.

Academic Qualification

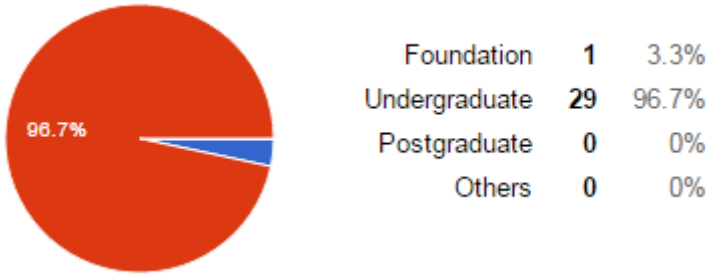


Figure 10 Academic Qualification of respondents

All of the respondents are chemical engineering student as I am conducted the survey in their class.

Programme

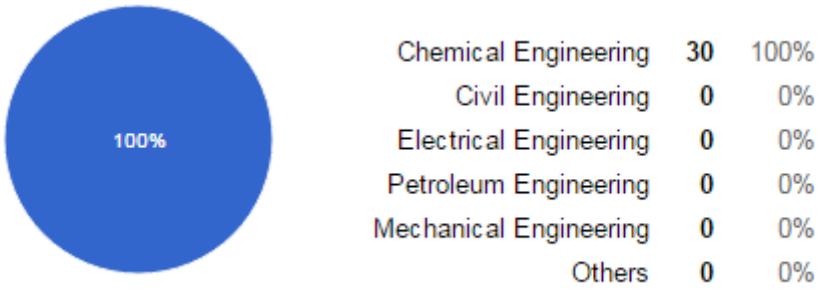


Figure 11 Programme of respondents

Most of the respondents know how to calculate liquid velocity in commercial steel pipe. Only one of the student answered no.

Do you know how to calculate liquid velocity in commercial steel pipe?

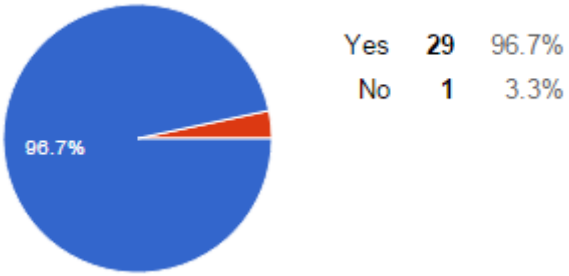


Figure 12 Do you know how to calculate liquid velocity in commercial steel pipe

Most of the student said that the current way of determining the liquid velocity in commercial steel pipe is using manual way. Manual way means they need to refer to the reference book to know the standard nominal pipe size and pipe schedule.

What is the current method you are using to determine the liquid velocity in commercial steel pipe?

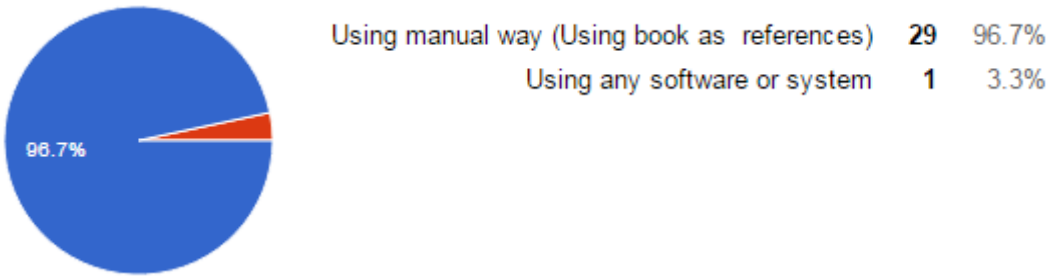


Figure 13 What is the current method you are using to determine the liquid velocity in commercial steel pipe

Engineers need some time to solve the problem related to liquid velocity in commercial steel pipe. Based on this survey, most of the respondents take three minutes to solve the problem. Three of them take less than three minute, six of them take five minutes and only one of them takes more than five minutes to solve the problem

How long you need to solve the problem related to liquid velocity in commercial steel pipe?

Figure 14 How long you need to solve the problem related to liquid velocity in commercial steel pipe

Most of the respondents did not have any experience using any technology, system or application in determining the liquid velocity in commercial steel pipe.

Have you experience using any technology, system or application in determining the liquid velocity in commercial steel pipe?

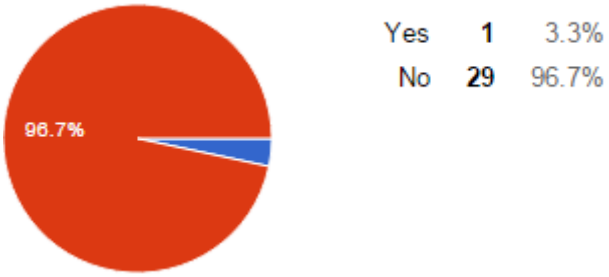


Figure 15 Have you experience using any technology, system or application in determining the liquid velocity in commercial steel pipe

All of the respondents never using any of the system or application that provide them with the standard nominal pipe size and pipe schedule in commercial steel pipe.

Have you experience using any of the system or application that provide you with the standard nominal pipe size and pipe schedule for commercial steel pipe?

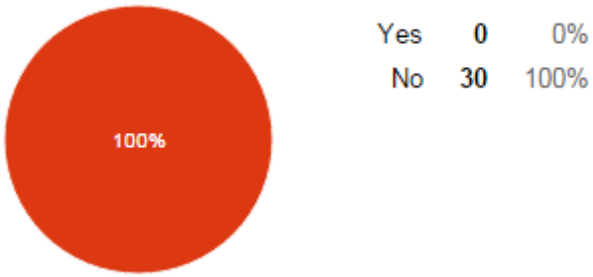


Figure 16 Have you experience using any of the system or application that provide you with the standard nominal pipe size and pipe schedule for commercial steel pipe

There are 83.3% of the respondents agreed that the current method used to determine the liquid velocity in commercial steel pipe is not effective and efficient to used.

Do you think the current method used for determining the liquid velocity in commercial steel pipe used is effective and efficient?

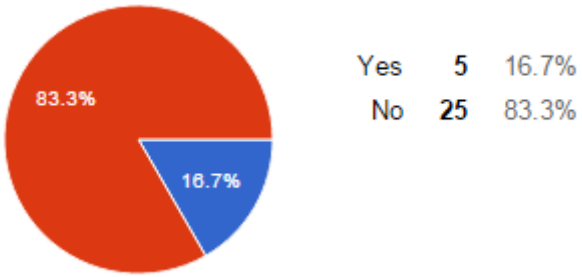


Figure 17 Do you think the current method used for determining the liquid velocity in commercial steel pipe used is effective and efficient

Most of the respondents will use the mobile application when they are provided with the suitable nominal pipe size and pipe schedule.

If there is mobile application that provide you with the suitable nominal pipe size and pipe schedule to determine the liquid velocity in commercial steel pipe, will you used it?

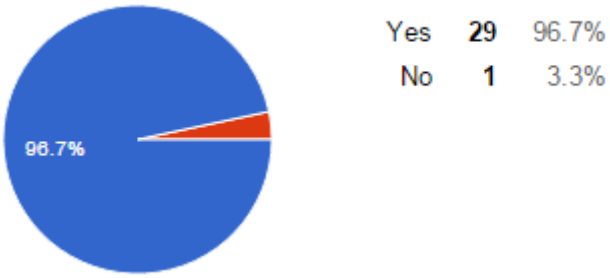


Figure 18 If there is mobile application that provide you with the suitable nominal pipe size and pipe schedule to determine the liquid velocity in commercial steel pipe, will you used it

4.2 Storyboard

Below is the storyboard for liquid velocity in commercial steel pipe mobile application:

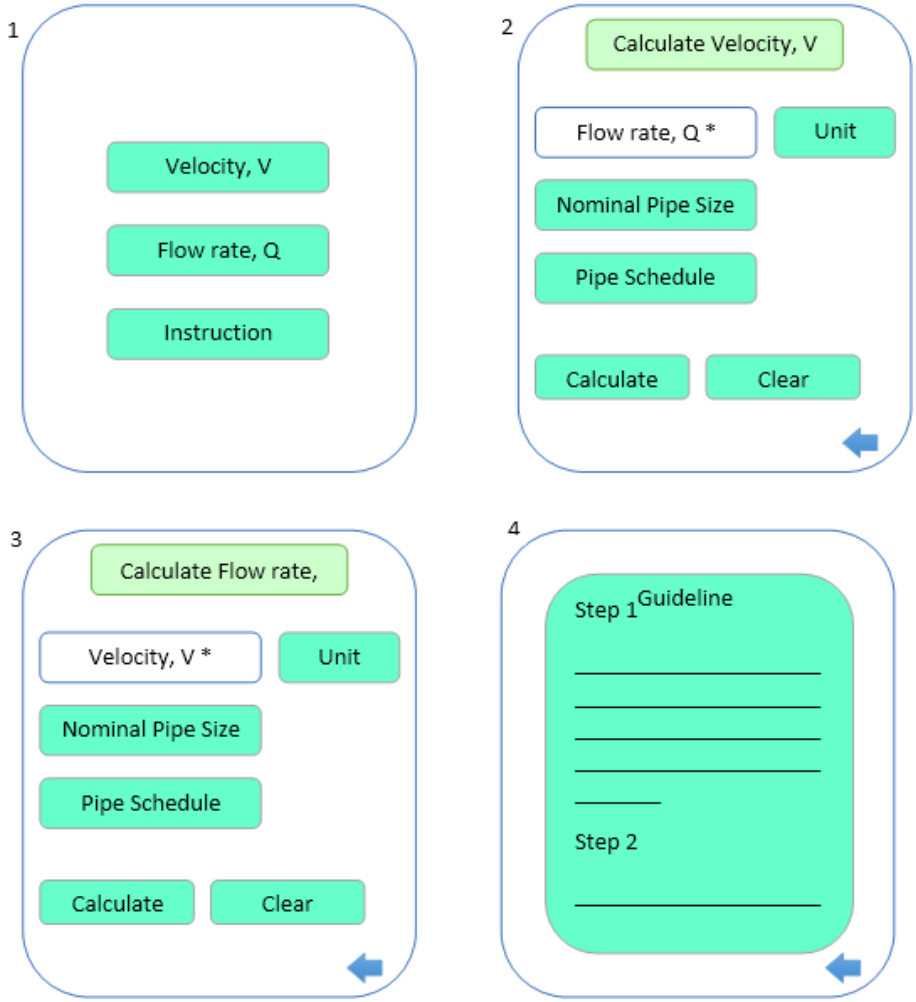


Figure 19 Storyboard for liquid velocity in commercial steel pipe

1. **Homepage:** This is the homepage for the liquid velocity. It display with velocity, flow rate, Q and instruction button. The user needs to select one button to process to next screen.

2. **Calculate Velocity:** This interface is being designed with one textbox, four spinners/dropdown lists and two buttons. Textbox (Input flow rate, Q) is compulsory to insert before selecting the other functions. If not, the system will display error message until the user insert or enter the input. The user can select SI unit the end user wants to use. This system will display the default SI unit when the user did not select one of the units on the dropdown list.

Then the system will recommend or provide standard nominal pipe size based on the Q input. It is the same goes to pipe schedule and V SI unit. The user can choose either to calculate or to clear. If the user click calculates then the system will display the calculated V (output), else the system reset.

3. **Calculate Flow rate:** This interface is being designed with one textbox, four spinners/dropdown lists and two buttons. Textbox (Input velocity, V) is compulsory to insert before selecting the other functions. If not, the system will display error message until the user insert or enter the input. The user can select SI unit the end user wants to use. This system will display the default SI unit when the user did not select one of the units on the dropdown list. Then the system will recommend or provide standard nominal pipe size based on the V input. It is the same goes to pipe schedule and V SI unit. The user can choose either to calculate or to clear. If the user click calculates then the system will display the calculated Q (output), else the system reset.

4.3 Use Case

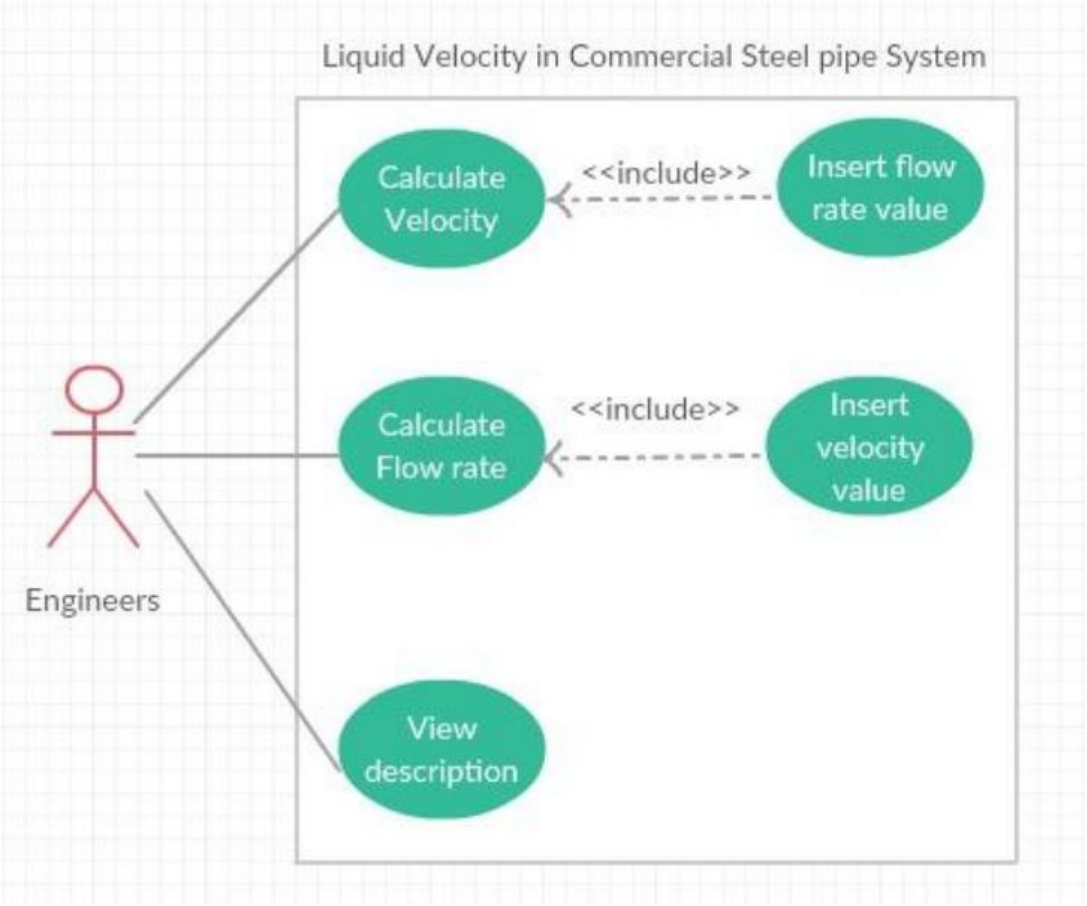


Figure 20 Shows the use case Diagram

4.3.1 Use Case Specification

Use Case: Calculate Velocity
ID: UC1
Actor: End- user, Database System, Calculate System
Pre-Conditions: The user must select calculate velocity on the homepage
Main Flow: 1. User needs to insert flow rate, Q value (input) and select the SI Unit for the input 1.1 **If** the Q or SI unit is empty then 1.2 The system display error message 2. **Else** the system suggest the pipe nominal size 3. The system suggests the pipe schedule value

4. The user selects one value of pipe schedule from the display selection 5. The user selects SI unit for the Velocity, V 5.1 **If** the user did not select the SI unit of V, then the system will display the default SI unit for the V 6. The user clicks calculate V.
Post Condition: The system should display correct calculated value of the V.

Table 5 Shows the use case Specification for liquid velocity

Use Case: Calculate Flow rate, Q
ID: UC2
Actor: End- user, Database System, Calculator System
Pre-Conditions: The user must select calculate flow rate, Q on the homepage
Main Flow: 1. User needs to insert velocity, V value (input) and select the SI Unit for the input 1.1 **If** the V or SI unit is empty then 1.2 The system display error message 2. **Else** the system suggest the pipe nominal size 3. The system suggests the pipe schedule value 4. The user selects one value of pipe schedule from the display selection 5. The user selects SI unit for the flow rate, Q 5.1 **If** the user did not select the SI unit of Q, then the system will display the default SI unit for the Q 6. The user clicks calculate Q.
Post Condition: The system should display correct calculated value of the Q.

Table 6 Shows the use case Specification for flow rate

4.4 Activity Diagram

Activity diagram is a flow chart that represents the flow of the activity from one flow to another. The activity diagram is draw based on the function on the use case. One use case has one activity diagram.

1. Calculate Velocity, V

   The first activity diagram is basically to calculate the liquid velocity in commercial steel pipe. First the user need to select calculate velocity in the homepage of this application. Then the user needs to need the input for the flow rate, Q. If the Q is empty then the system will display error message else user can select the nominal pipe size. Then user selects the pipe schedule. Then select the V SI unit. IF the SI unit is selected then system display calculated liquid velocity value (answer) else the answer is using default SI unit.

2. Calculate Flow rate, Q

   The second activity diagram is basically to calculate the flow rate in commercial steel pipe. First the user need to select calculate flow rate, Q in the homepage of this application. Then user needs to need the input for the Velocity, V. If the V is empty then the system will display error message else user can select the nominal pipe size. User selects the pipe schedule. Then select the V SI unit. IF the SI unit is selected then system display calculated flow rate, Q value (answer) else the answer is using default SI Unit.

Below are the activity diagrams for both functions in the use case:

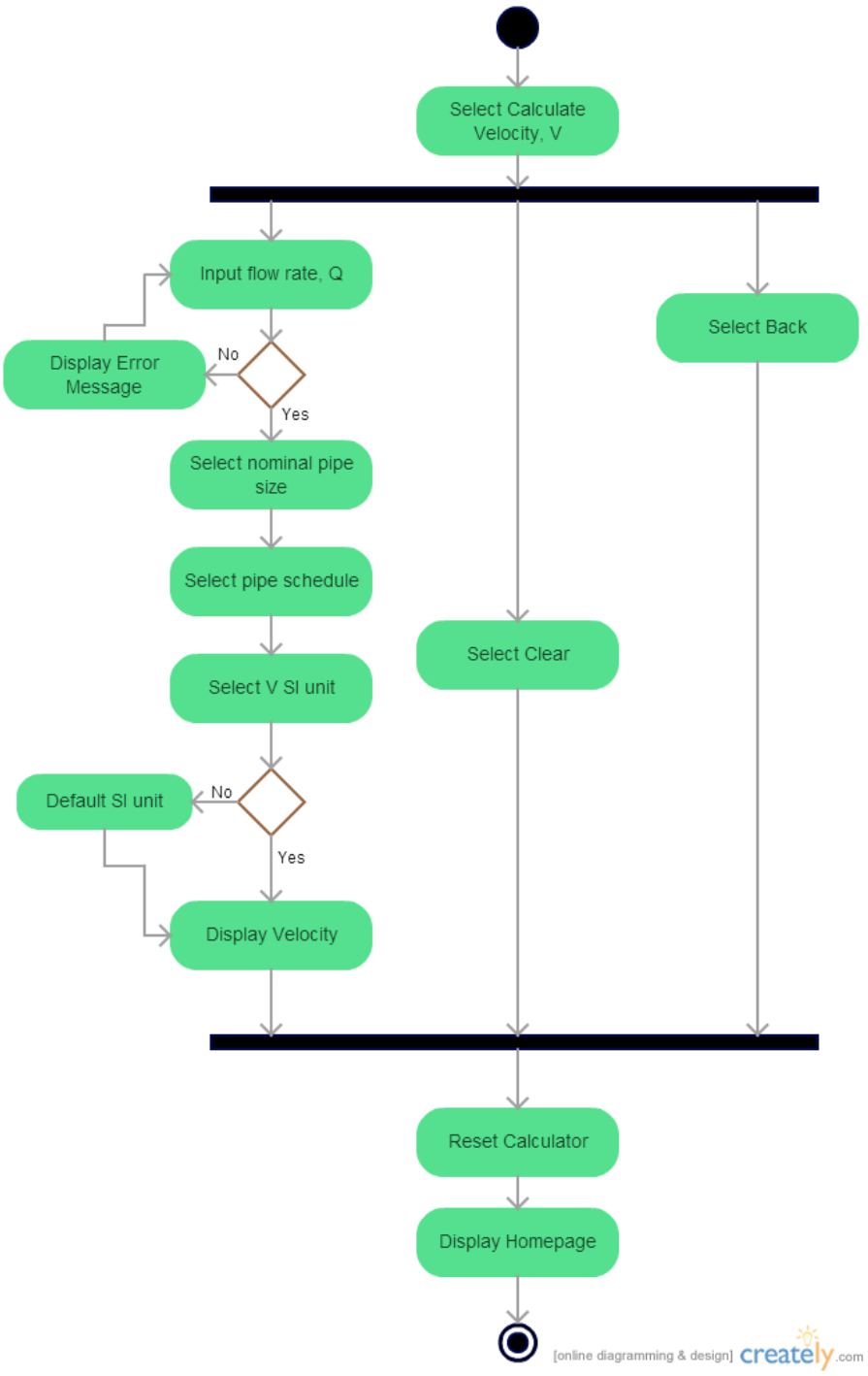


Figure 21 Activity diagram for calculate velocity, V

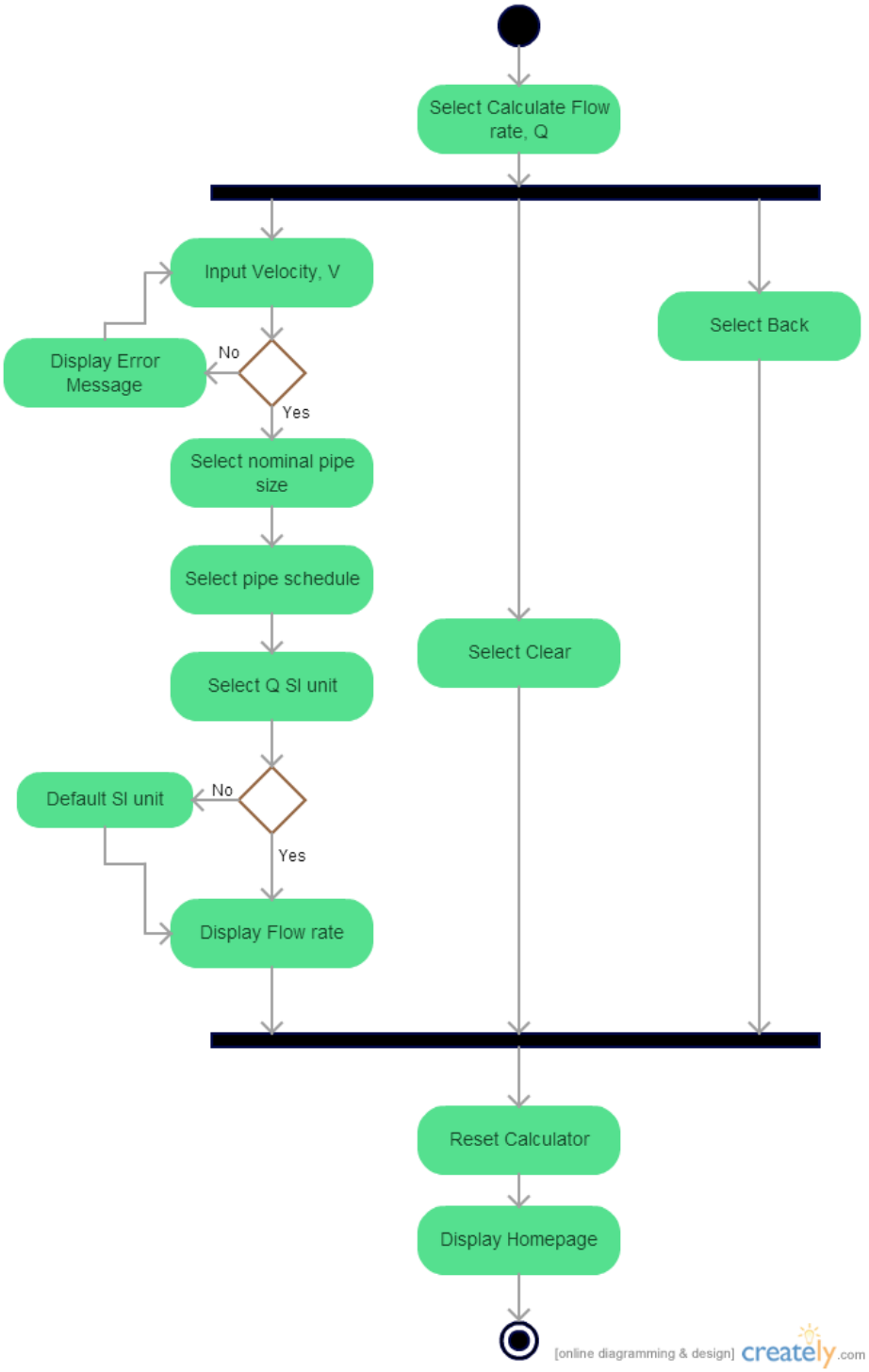


Figure 22 Activity diagram for calculate flow rate, Q

4.5 Flowchart Diagram

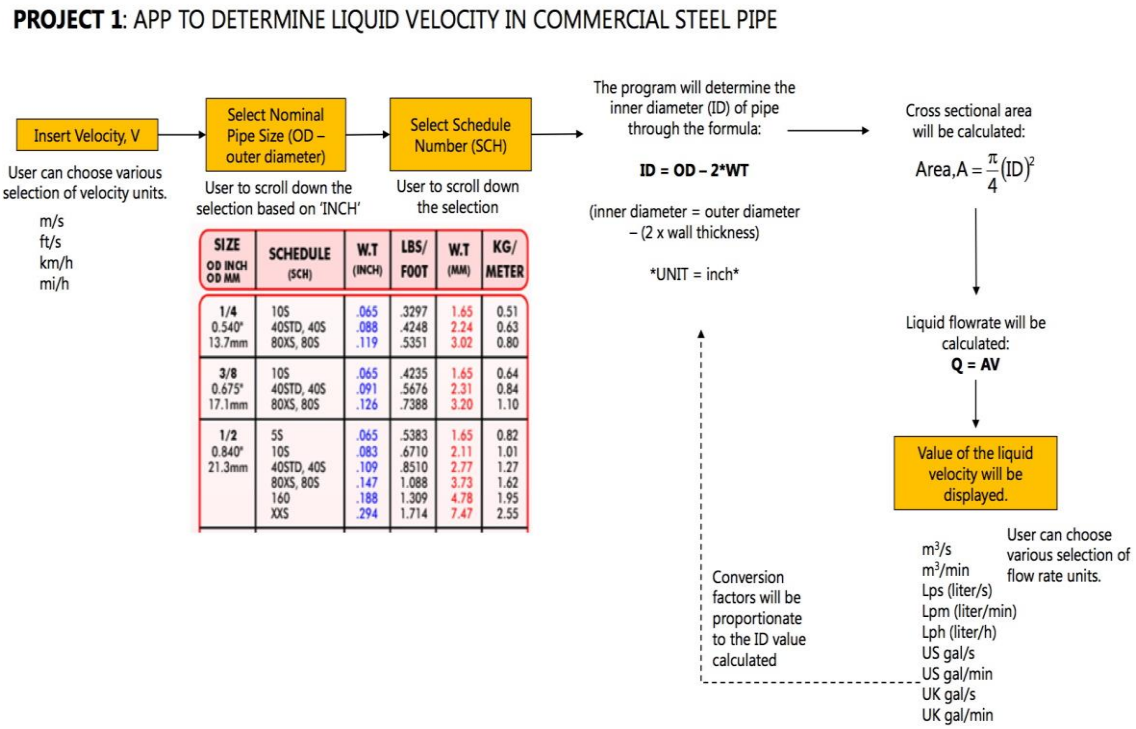


Figure 23 Flow rate for calculating velocity

Basically the figure above shows the flowchart of this liquid velocity mobile application. First, user needs to inset the flow rate as their input. The user also can select several of selection of velocity unit either in English unit or SI unit. Next the system will display the suitable or standard nominal pipe size for the input user entered. Then, the system will display the pipe schedule number based on the nominal pipe size the user chosen. All the formulas related to this application will be stored in the database system of the application. Lastly, the application will display the calculated value of velocity. If the user does not chose the SI unit for the output will be set as default unit.

4.6 Class Diagram

Basically, class diagram is overview of the target system based on the relationship between the objects and the class. The class diagram is importance in helping the actors to responsible for their own responsibilities.

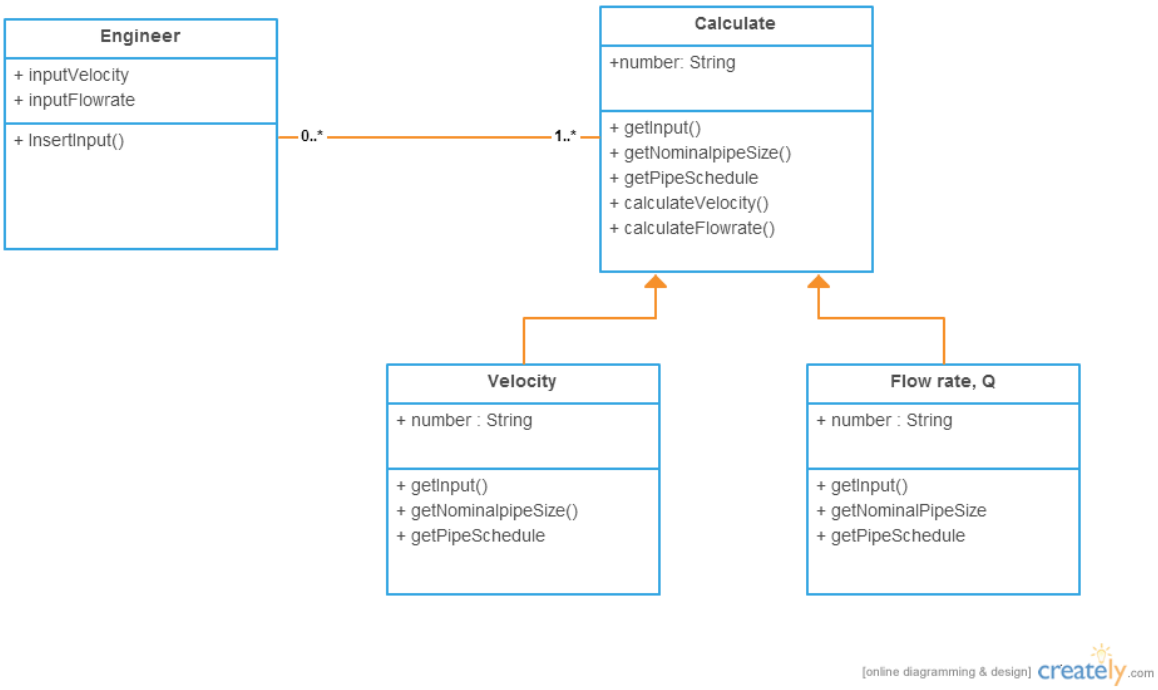


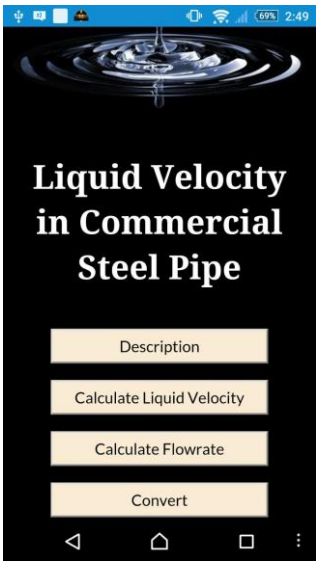
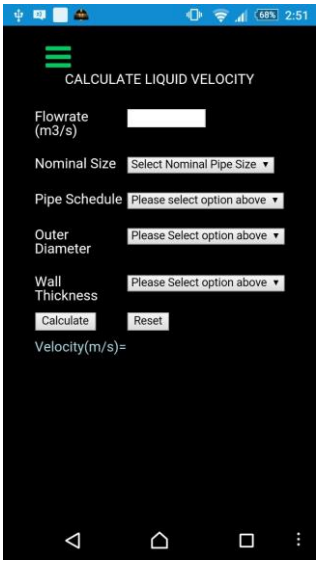
Figure 24 Class Diagram

4.7 Development of Prototype

4.7.1 Prototype

After gathered the user requirement, the next phase in this project was to develop a prototype that can ease the engineers while selecting the nominal pipe size and pipe schedule. The developed prototype is in mobile application concept. This prototype developed by using PhoneGap using html language. The content of this mobile application designed as the propose window navigation in design phase. But as the project ongoing from one phase to another, there were some changes applied to suit the user requirement.

The following is the screenshots taken from the prototype.

	Homepage of the liquid velocity mobile application
	Calculate Liquid Velocity page 1. User enters flow rate value (input) 2. User selects nominal pipe size 3. This application suggested the standard pipe schedule, outer diameter and wall thickness based on user selection on the nominal pipe size. 4. User clicks calculate to calculate the velocity (output). 5. This application displays the velocity value in default unit. 6. User clicks on reset to enter new value of flow rate.

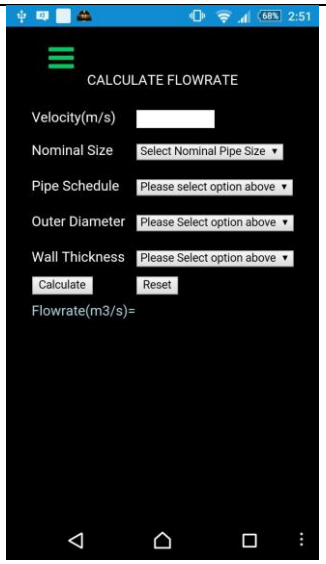
	Calculate Flow rate page 1. User enters the velocity value (input) 2. User selects nominal pipe size 3. This application suggested the standard pipe schedule, outer diameter and wall thickness based on user selection on the nominal pipe size. 4. User clicks calculate to calculate the velocity (output). 5. This application displays the velocity value in default unit. 6. User clicks on reset to enter new value of flow rate.

Figure 25 Screenshot of the prototype

4.7.2 User Testing Result

A testing was conducted to test the user ability to understand the function of the prototype for liquid velocity in commercial steel pipe. There were thirty people who involved in this application testing. The method of testing used is black box testing. This testing is conducted to test on the function of this mobile application. Users were testing this application using their own phone and just connect to the same server of mine.

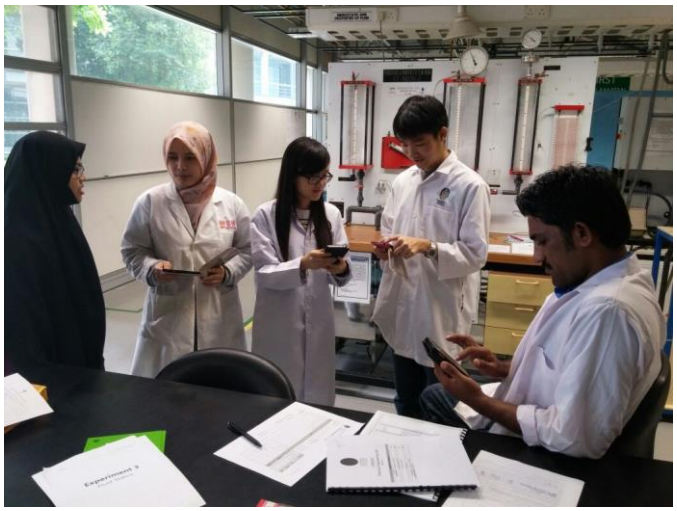


Figure 26 Users testing

The procedures of the testing are as below:

1. Users need connect their mobile phone to the same Wi-Fi provided.

2. Users need to download PhoneGap Developer on their phone to connect the application
3. Users need to connect to the same server as mine. (Server number is provided during the testing session).
4. Connected to the application and user can start testing on liquid velocity mobile application.

(Reminder: This procedure is being used for the testing purpose only).

From the testing, user able to give feedback about this application in order to improve the application by just click on the side transition bar of the application and click survey and will directly go to the online feedback form. The feedback was transferred to a chart for simple understanding.

Based on the user testing, most of the users strongly agreed that Liquid Velocity in Commercial Steel Pipe Mobile Application for chemical engineer provided simple navigation menu to the user.

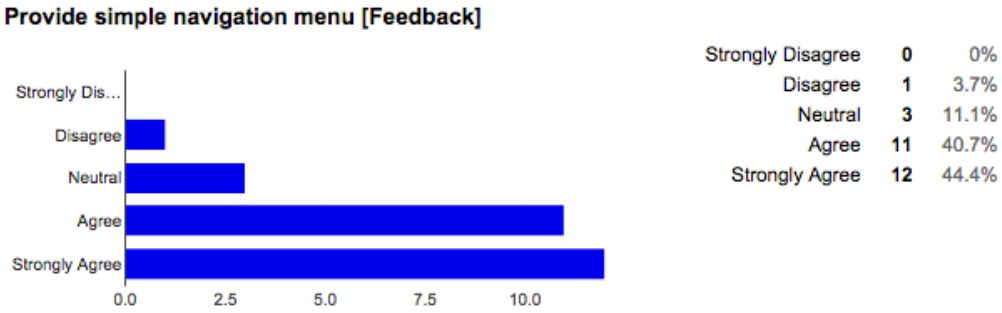


Figure 27 Responds for provide simple navigation menu question

In term of the application design, the user strongly agreed that this mobile application provide simple design and easy application to be used by chemical engineer.

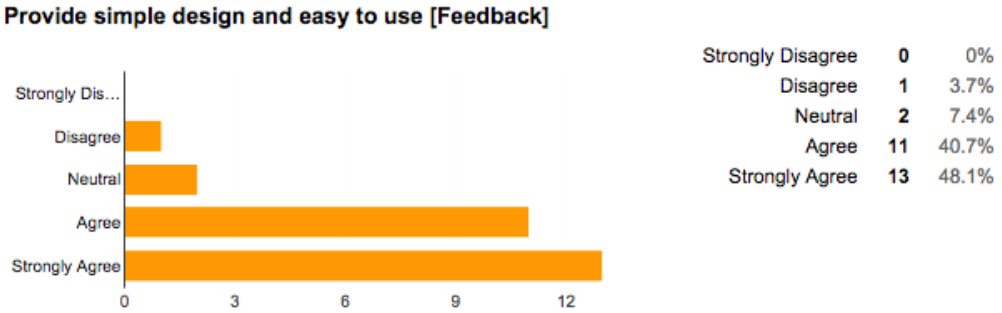


Figure 28 Responds for Provide simple design and easy to use question

Next, most of the users agreed that the content of this mobile application meet their requirement and need in order to calculate the liquid velocity in commercial steel pipe.

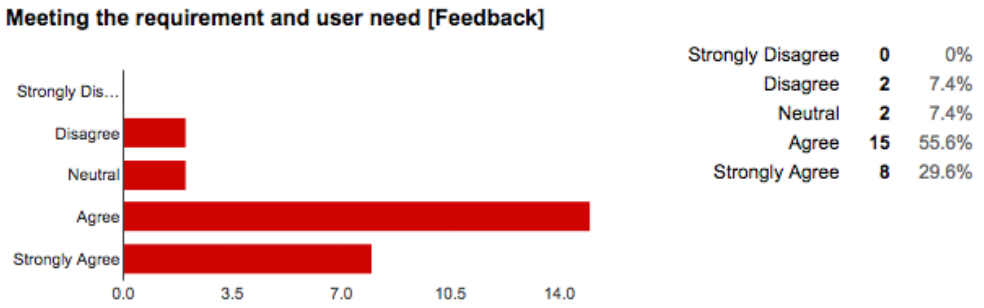


Figure 29 Responds for meeting the requirement and user need question

Most of the user strongly agreed that this mobile application reduce the time taken for the user to calculate the liquid velocity and flow rate in commercial steel pipe.

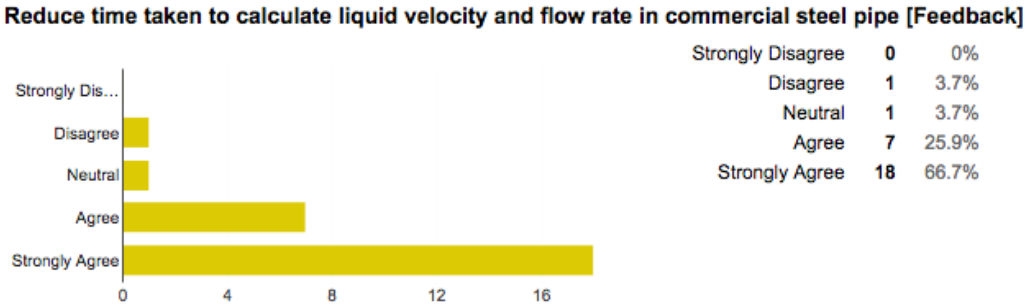


Figure 30 Responds for reduce time taken to calculate liquid velocity and flow rate in commercial steel pipe question

Next, most users of this application strongly agreed that this application provide accurate calculation for this liquid velocity and flow rate in commercial steel pipe.

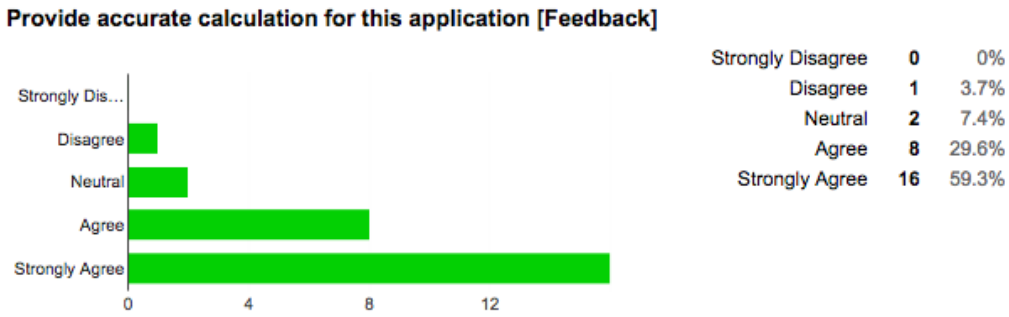


Figure 31 Responds for Provide accurate calculation for this application question

When the user are being ask directly on whether they need extra information for using this application, most of them answered that they do not need extra information because this application very simple and easy to use. However, based on this feedback form one of the user are disagree to the statement.

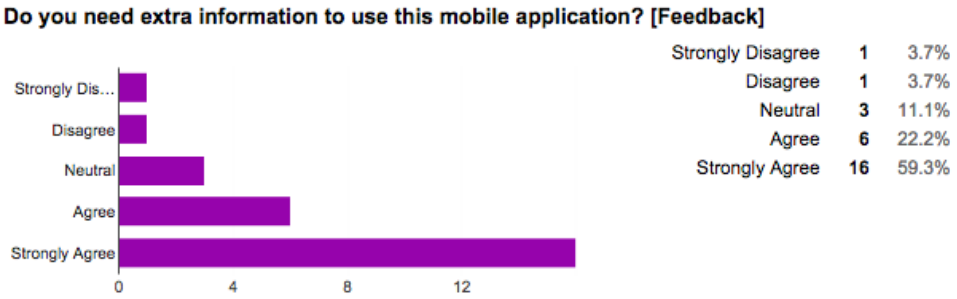


Figure 32 Responds for extra information need to use this mobile application question

This result of feedback form from the question of is this application is one of the attractive chemical engineering application are agreed and strongly agreed.

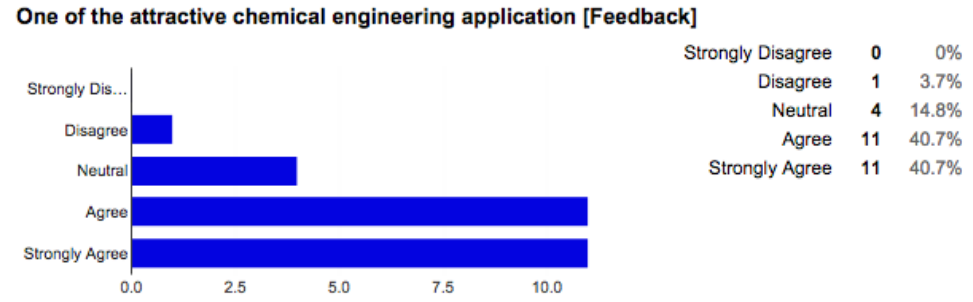


Figure 33 Responds for one of the attractive chemical engineering application question

Next, the users are strongly agreed that implementation of this mobile application is the best idea.

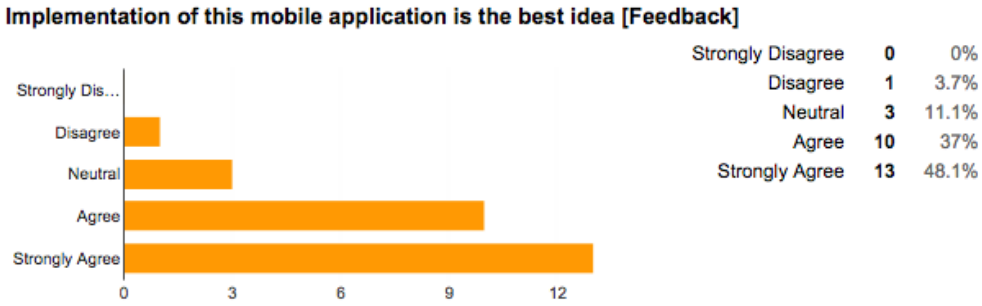


Figure 34 Responds for implementation of this mobile application is the best idea question

Users are agreed that this mobile application is suitable application to be used for learning tools for chemical engineer students.

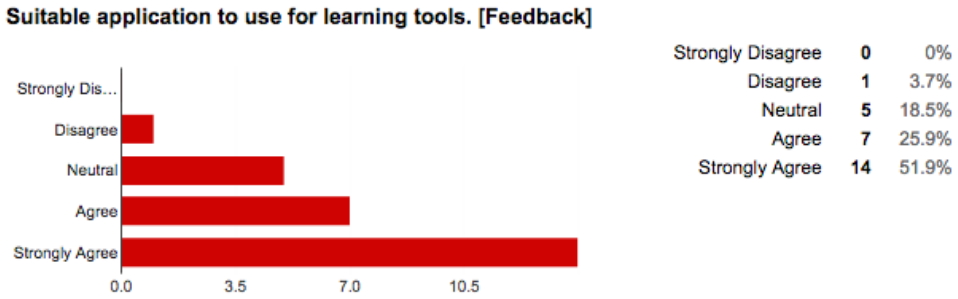


Figure 35 Responds for suitable application to use for learning tools question

The most important feedback needed from the user is how would you like to rate this mobile application. Most of them are strongly agreed to rate this application on the high rate.

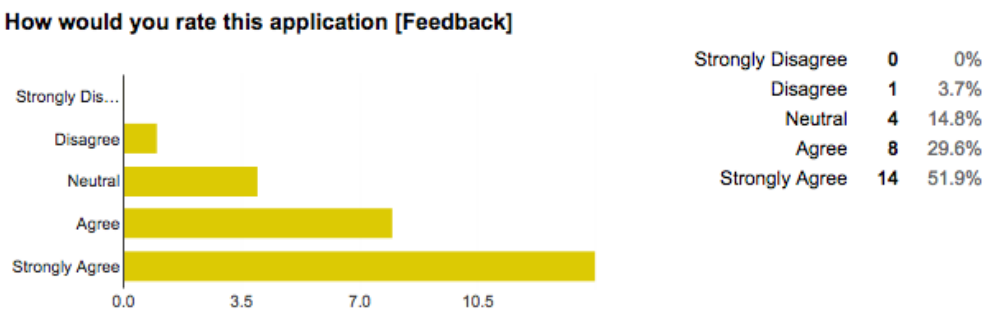


Figure 36 Responds for how would you rate this application question

CHAPTER 5

CONCLUSION

As conclusion, the mobile application being design based on the result and discussion from this project. The interface design of this liquid velocity mobile application in commercial steel became simple and easy to use. Thus, mobile application the objectives discuss earlier can be achieved. The nominal pipe size and the pipe schedule database will be the extra function for this mobile application. Usually when the nominal pipe size and schedule table provided, the engineers will automatically know that this application is related to the steel type of pipe. Besides, the oil and gas company performance can be increased as the advance technology is being used. It is also reduce the cost and time involved in making the prototype design programs individually. This mobile application also help the engineers to calculate the liquid velocity and flow rate in the commercial steel pipe in more effective and efficient way. Just few clicks on the button in the mobile application all the related output will be displayed. The manual way of solving problem still be used for the purpose of learning and understanding. The main things in this project are all about the relation between the engineers and mobile application. By using the mobile application tools engineer operation will make become more simple and easy.

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