Gateway to Student Knowledge using Smart Card Technology

by

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CERTIFICATION OF APPROVAL

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Approved by,

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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 acknowledgments, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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AL'LA MOHAMED ADAM

ABSTRACT

The advancement of Smart card technology today has exceed the idea of not only using the card as identification but to grant access rights and cover multiple transactions as well. This Gateway to student's knowledge using smart card technology Project is a Student MIS (Management Information System) that using smart card technology and addresses the need of university students of the 21rst century. The Functionality included in the system includes transactions that are automated and are done manually in UTP. This system will be useful for UTP student management and monitoring purposes, through the portal students can access their personalized web portals containing all relevant information to a particular student, allowing students to perform multiple transactions with only a click or swap away. The Author employs a fast methodology to develop the smart card application system, within the given timeframe. The given framework of this projects covers a research part for the smart card, and introduces a new design that isn't able to implement due to the limitation of time, and money in the. Smart card technology is a very advanced technology as it introduces ICT in student's daily lives, and it brings on multiple benefits to the university and students this therefore warranted further research.

ACKNOWLEDGEMENT

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Gateway to student knowledge using smart card technology is a system that will be recommended to be implemented in UTP. The system is a proposed student portal which uses smart card technology as its main feature.

As computer and technology are on a vast evolution, it's almost impossible to keep up to date with the revolution happening around us, and it's almost unfair to be an outsider and not participate in the almost perfect lifestyle being introduced to us. Thus the system is aimed to implement part of that technology is our daily lives.

The system is a gateway to student information and a gateway to a more sophisticated, intelligent and smart life style of students in the 21st century.

This gateway is introduced as a system which is encompassed with the latest technology and is being introduced in a form of a web portal which is accessed either using a stable internet connection or by simply inserting the smart card in designated mainframe computers located in the university.

The Portal being introduced is simply an information Portal where students can monitor there daily student activities, the Portal will be a semi-functional system as

some functions will be enabled and fully functional, and some will be briefly enabled but can be expanded and will be recommended . In this Portal, several features from the current UTP e-learning system will be imported, but will be distinguished from the current e-learning as it   will not need a stable internet connection to access it. It can be accessed by simply inserting the smart card in a mainframe.   In this portal students have there Profile, an email account, access to registered courses, e-learning, e-clinic, e-wallet, various features as bulletin boards, Digital drop box to submit forms such as clearance forms, internship forms, final year Project forms, Visa renewal forms and status check will also be included.

With the use of the smart card to access the system, students will also be able to purchase items, to gain access through library, labs, and class rooms, and by accessing this; the smart card automatically updates the database on the student's access and hence can confirm attendance to classes and labs. Due to the time limitations not all these features will be fully functional.

Systems using smart cards has grown to become one of the leading technologies underpinning a whole world of varied and complex transactions, as the multi-application smart card brings the only realistic option for managing multiple electronic transactions.

This smart card is simply a plastic card that has been embedded with a microchip that stores, manages and processes information which is stored and processed within the cards chip, it encompasses either a memory or microprocessor, the card can contains an embedded 8-bit microprocessor under a gold contact pad on one side of the card. This microprocessor replaces the usual magnetic stripe on a credit card. The microprocessor on the smart card is there for Security, the card reader and mainframe which reads the card communicate with the microprocessor which enforces assess to the data on the card.

The cards data is transacted via a reader but is part of a computing system. Smart cards vary is memory as technological advances provide Smart Cards with the capability to contain not only more data but multiple applications.

It has 8 bits of microprocessor running at 5 MHz; smart cards use a serial interface and receive its power from external sources like a card reader. .The embedded chip is

Pre-programmed with several files or pages of information and contents of the chip can be protected by security code(s).

Using open platform technology users have a range of services just a swap away.

Smart cards are widely used by various universities, but not all universities and to be specific UTP has realized the importance of smart cards, this Project will expand the technology and features adding more values and advantages to the university such as:

1. Linking Students to transactions and preventing refutation.
2. Providing authentication and/verifying access of students who are holding themselves out to be a particular student of to be hold a position of authority.
3. Preventing access to systems by unauthorized People and computer applications, hence reducing the chances of Hacking.
4. Preserving the privacy of personnel information and the security of university information.
5. Providing students with smart cards that are multi functional and students activates will be tracked easily by checking on there statuses and transactions.
6. Ensuring that the students carry there smart card with them and acknowledge the importance of it.

1.2 PROBLEM STATEMENTS

After carrying out a survey in the form of a questionnaire of 20 students, about how efficient Student Smart cards are, these following problems have been concluded and identified.

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1.2.1 Problem Identification

1.2.1.1 Students Smart Cards are Functionally Limited in UTP

Students carry around smart cards with them in UTP, but these cards are not multi functional, as to date its been believed that the only use of the smart card is in the E-library, these cards are also cheap in their design and have no intelligence whatsoever, they distinguish one another with Serial numbers, they have no memory, microprocessors, computer chips or any smart feature whatsoever

1.2.1.2 Students have no Personalized Portal to Monitor Their Activities

With the limited use of the card in UTP, students also have no means of personalized internet Portal where they can monitor there smart card activities or obtain any source of knowledge through their smart card. Students have no way in obtaining personalized information from either the university website of the E-learning.

So basically this card is to the designed to the benefit of the university directly and indirectly, as it is only enabled in the library, this reduces the time to manually key in the data in the database and hence reduces on the Human resource available in the check out counter.

1.2.1.3 Students have no Means to Check Pending Status, or Obtain any Form of Information

With our huge campus, students that need information from any department have to go all the way to the respective department for inquires, students can't monitor their statuses or obtain any updated information such as venue relocation, class cancellation and briefings only via the internet labs which are located around 500 Meters from Students residence. There's no single Portal that ties the Academic department, Finance department, Exam unit Department, Student support services, Bank, Library and Clinic, however these functionalities will not be integrated with

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their current systems, but will stand as an individual system that's has its own interface and database.

1.2.1.4 Students have no Reminder of Important Dates

Students have no reminder of important event on campus, such as meetings, briefings, deadlines, visa renewal, book overdue deadlines, scholarship deposits, club meetings and meetings with sponsors. This causes students to miss out on important events and deadlines causing an inconvenience to both the university and student.

1.2.1.5 Paper Wastage

The world is going paper less, that's one of the mottos of the 21st century

"HAVING A PAPER LESS ENVIRONMENT"

The university exhausts it paper resources by manually putting up notices on the boards and nearby students Residence whenever an announcement or notice is released, by doing this a lot of paper has been wasted and eventually the University walls are being tarnished and need to be painted regularly to maintain a sophisticated image of the campus.

A lot of paper is wasted on attendance lists, exam slips, registration forms, FYP forms; Internship forms any many other activities and transactions that can be eliminated with the use of the system.

1.2.1.6 No security Restrictions

Students can walk into any part of campus, and into any labs during working hours, there is no sort of security restrictions and authentication for students causing it difficult for the university to monitor any abuse of intentional destruction or theft of labs and equipment on campus.

1.2.1.7 Cash Handling

Students deal with cash on daily activities, such as Purchase of books, Meals, Groceries, stationeries, photocopying, summons and paying laundry. With two ATM machines which are located in an inconvenience location on campus and over 3000 students and staff using them, it's a time that an E-wallet has been introduced on campus, where students transfer money from their bank accounts to their smart cards On-line, or on any mainframe located on campus and just use their Smart cards to Purchase any desired items, with No interest whatsoever.

1.2.2   Significance Of the Project

If the Project is implemented in UTP, it will allow several transactions to be monitored systematically and will solve current Problems that students and staff encounter. This project will offer personalized student Portal which will ease many transactions, and will answer many questions arisen by students and will offer great benefit to both students and university and will cut down on resource such as paper resource, time resource, human resource and since time is money; hence it will cut down and many financial expenditures by the university.

With the implementation of this project it proposes and Offers a High Tech campus, which is fully encompassed with latest technology and security features, fulfilling the objective of being University Technology Petronas.

1.2.2.1 Access Rights and Authorization

The University will be able to monitor student's smart cards and their activities and be able to trace any abuse of equipment.

1.2.2.2 Multi Functionality

If Smart cards are to be implemented the use of them will expand to deliver a multi functional card that adds to the convenience of students.

1.2.2.3 Personalized Monitoring Portal

Students will have a customized web Portal where they can access through the internet or through inserting of their Smart cards on designated Mainframes on campus. This Portal allows students to monitor their activities, check statues, transfer money from bank accounts to smart cards and be reminded of important date and reminders.

1.2.2.4 Cutting Down on Resources

The University will be able to cut down on resources such as paper, Human resource, Time and eventually money. Since the transactions are now systematic and electronic.

1.2.2.5 Security

With the implementation of the Smart Card students and university will have an increase in Security levels, with the use of the smart card students will be able to access and enter appropriate areas where they have access rights to, such as labs, classes and departments. We can also expand the implementation of the card and locate the smart card reader by the university main gate, so only authorized people can enter the university, this will reduce time and money spent on Security guards hence, cut down of human resource.

1.2.2.6 Cash Handling

This Smart card which can act as E-wallet will ease the way in which students handle money on campus, adding to the convenience of students, and saving time be queuing up for the Use of the ATM machines.

1.3 OBJECTIVE AND SCOPE OF STUDY

1.3.1 Objectives

This Project covers the Introduction of a Gate way to student information using smart card technology. Which is a smart system designed to assists students of UTP or any other university to obtain information and to get an easy way around a High Tech campus.

The main objective of this project is to implement an enhanced smart card system, which offers a variety of transactions and services (Tracking important dates, monitoring activities, E-wallet, E-mail etc...) to both students and the university. This smart card system also incorporates a Personalized web portal which is customized for every student to access there services, and keep up to date with important activities that they encounter in there every day lives. With the implementation of Proper hardware and software, this system integrates all the departments and gives students a gateway to all essential information with only a swap away.

1.3.2 Scope of Study

The scope of this proposed gateway offers students, with multiple functionalities, and automated process that exist manually.

The outcome of this project is a dissertation on a Gateway to Student Knowledge using Smart Card Technology. This dissertation contains the proposed hardware and software design of the smart system, a security plan and a Prototype of the system (consisting of several Interfaces) that appears to the student once they have inserted their Smart card into the Card reader. This Prototype is in the Form of a web Portal and data base that have many features enabled and functioning, many areas such as (E-wallet, E-clinic, E-library) will be support in the area of the research, but will not be as intelligent and as smart as they can be and not fully functional due to the time constraints, hence the scope of these areas are minimized.

The testing of the system will be done prior to the delivery of the prototype to determine the functionality.

1.3.3 Feasibility of the Project Within the Scope and Time Frame

The three constraints (triple constraints) that may face any project are TIME, SCOPE and COST.

In this Project I will face all there constraints, as Cost is not available, hence presenting a fully functional smart card is not possible. When it comes to time, Time is also very limited as I will introduce the system, but several features will be recommenced and not fully functional. The Scope of the projects is limited as well due to the time constraints as only five month are given to complete this project.

Hence if time, scope and cost where not limited a more promising output would have been developed.

CHAPTER 2

LITERATURE REVIEW

2.1 OVERVIEW OF A SMART CARD

Figure 2.1 Smart Card

The first smart card was developed in 1974, by independent inventor Roland Moreno. Smart card use in Europe and Asia is outpacing North America, but smart card growth is expected to continue at a brisk pace.

By way of comparison, there are over 900 million credit cards in circulation today. Major uses will include providing enhanced financial services, increasing the security and flexibility of cellular phones, and securing satellite and cable transmissions in TV set-top boxes[1].

A smart card is a card that is embedded with either a microprocessor and a memory chip (IC card like ACS AC0S1) or only a memory chip with non-programmable logic

(memory card like <u>SLE smart cards</u>). The IC card can add, delete, and otherwise manipulate information on the card, while a memory-chip card (for example, pre-paid phone cards) can only undertake a pre-defined operation.

Magnetic stripe technology remains in wide use in the U.S. However, the data on the stripe can easily be read, written, deleted or changed with off-the-shelf equipment. Therefore, the stripe is really not the best place to store sensitive information. To protect the consumer, businesses in the U.S. have invested in extensive online mainframe-based computer networks for verification and processing. In Europe, such an infrastructure did not develop and instead the card carries the intelligence. There are advantages and disadvantages to both systems.

The microprocessor on the smart card is there for security. The host computer and card reader actually "talk" to the microprocessor. The microprocessor enforces access to the data on the card. If the host computer read and wrote the smart card's random access memory (RAM), it would be no different than a diskette.

A smart card resembles a credit card in size and shape, but inside it is completely different. First of all it HAS an inside -- a normal credit card is a simple piece of plastic. The inside of a smart card usually contains an **embedded 8-bit microprocessor**. The microprocessor is under a gold contact pad on one side of the card. Think of the microprocessor as *replacing* the usual magnetic stripe on a credit card or debit card [1].
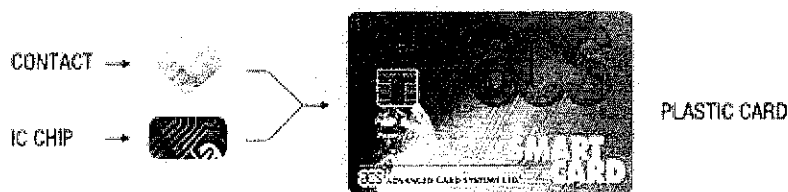
Figure 2.2 Design of a Smart card

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2.2 STANDARDIZATION OF THE SMART CARD

The subtle point about the physical characteristics and the 8 contacts layout of the Java smart card is that it is compatible to ISO 7816 (part 1 & 2) – International Standardization Organization. This allows Java smart card interoperates with the other smart cards and also enables applications from different industries to coexist in the same card [2]. For example, it can combine the personal identification data for GSM phone with the credit card.

ISO 7816 consists of:

- Physical characteristics (part 1)
- Dimensions and location of the contacts (part 2)
- Electronic signals and Transmission protocols (part 3)
- Inter-industry commands for interchange (part 4)
- Application identifiers (part 5)
- Inter-industry data elements (part 6)
- Inter-industry command for SCQL (part 7)

2.3 APPLICATIONS OF SMART CARDS

Smart cards are entering a dramatically growing number of service applications to take the place of money, tickets, documents and files. Credit card, cash-less pay phones, road toll systems, logical access control devices, health care files and pay TV are just a few of the current examples. All these applications need more and more intelligence inside the card to ensure an ever increasing level of security [3]

The practical applications of a smart card can be broadly classified into 3 main categories as shown in Figure 2.3

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Figure 2.3 Some of the Many Applications for smart Cards

Data carrier: The card is used as a convenient, portable and secure means of storing information (e.g. medical record).

- Identification: The card provides a secure means of identifying the holder so as to allow access (e.g. PC access authorization).

- Financial: The card can be used for transactions as a replacement for cheques, for example.
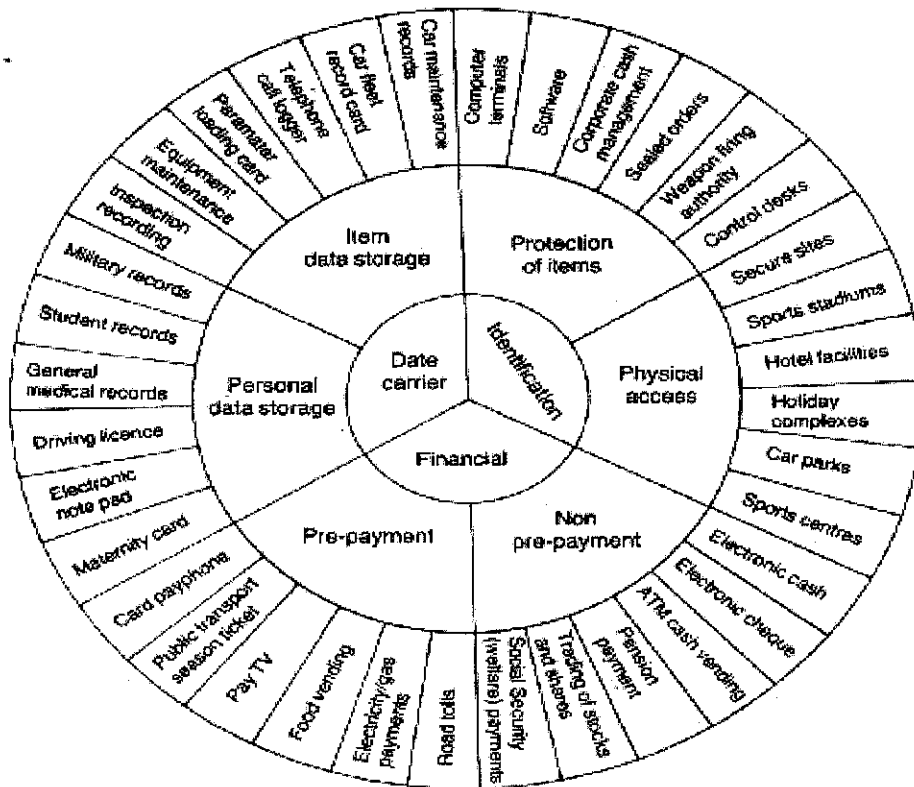
2.3.1 Multi-Applications Smart Card

Most of the smart card systems in use today serve one purpose and are related to just one process. For example, the smart telephone card which makes public telephones convenient, the medical card which stores medical history and insurance information. All of these applications are stored in different smart card systems separately, and lead to the same situation and problem as with the traditional magnetic stripe card system which require users to carry multiple cards for multiple applications [4].

In fact, smart card has the capability to integrate those applications together to form a multiple application card by utilizing its embedded microprocessor and memory storage spaces. However, this kind of integration is always limited by some of the external logical elements rather than technical issues. For instance, in single application card system, data stored in the card or even the card itself always belongs to the card issuer. In the case of more than one application residing in a single card, this becomes impractical.

At the present time, the 7816 standard is incomplete at all levels. At the card level we do not have a fully specified operating system interface, we do not have a properly specified directory structure, application naming standards are incomplete and card level data structures are not fully specified. At the application level, application level standards are incomplete, and in some cases, not even started.

Hence, it still needs to take some time for the standard to be finalized before the concept of a multi-application smart card can be implemented.
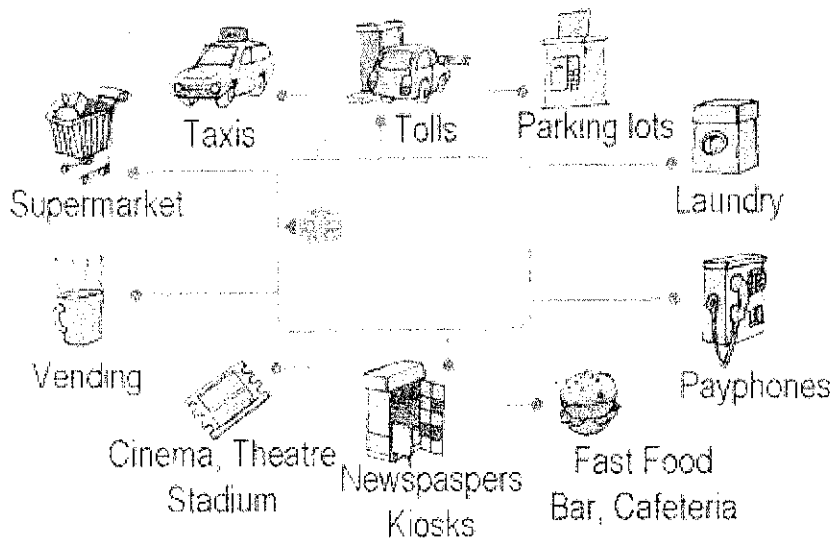
Figure 2.4 Multi-Application of Smart Card

2.3.2 Applications in Universities

This university smart card could be used to access university records, check test scores, tally customer loyalty points at stores and restaurants, store medical information and make travel arrangements -- not to mention accessing the Internet and online shopping.

"The only constraint is the amount of memory on the chip and that seems to be growing every year" [5].

The MMU (Multimedia University) Smart Card is the first multi-purpose card of its kind in South East Asia. Smart Card holds various type of information in electronic form with sophisticated security mechanisms in it. It combines financial and non-financial applications in one card. There are three technologies embedded into a single smart card such as contact chip, contact less chip and magnetic strip. Some of the financial applications are electronic purse, ATM Card, Touch N Go and Debit Card system. Non-financial applications are such as access control system, library

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applications, time attendance system, voting system, medical applications, examination results, information kiosk, booking facilities and parking management system. Smart Card can be easily integrated with any existing system for user authorization. The Smart Card offers paperless and cashless environment. The use of smart card technology will benefit the individuals and increase the quality of life [6].
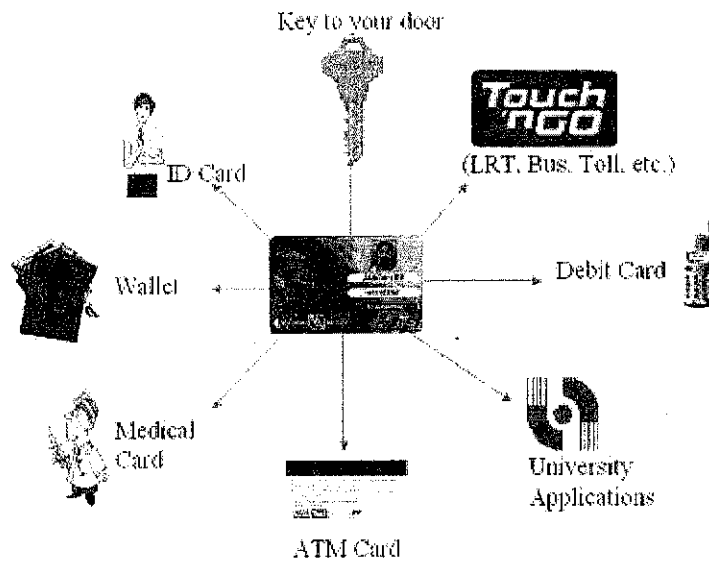
Figure 2.5 Applications in MMU

Smartcard can be used for a wide range of applications, such as access control, e-cash, library system, ATM applications, medical information, and voting system. The system incorporates three technologies, i.e. a microchip to support contact-based card readers, a second microchip with antenna to support contact less card readers and the magnetic strip to cater for the older ATM-based readers.

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2.4 SECURITY OF SMART CARDS

Smart cards our first line of defense against fraud, theft, espionage, violence, sabotage, terrorism and other identity-related threats. If the smart cards are not secure, neither is the organization.

Main security advantages of smart cards are for access control [7].

- Smart cards can offer advantages for controlling both physical access (to buildings and other facilities) and logical access (to electronic information).
- Smart Cards can replace or augment systems that currently control physical access. Smart cards can also support fast, easy, and secure logical access. Like physical access, logical access should be implemented by executing a cryptographic authentication transaction between the card and the reader, as well as controlled role-based access to data.
- Audit trail generation and transaction accountability.

2.5 BENEFITS OF SMART CARDS

Smart cards can offer enhance security, convenience, economical benefits, customization and multi-functionality. Many other advantages of smart cards are listed below [8].

1. Reducing handling costs
2. Improve ease of use
3. Lowered costs in infrastructural support.
4. provide multi transactions through 1 card
5. Lower transaction cost and,
6. Ability to carry out offline, online and peer-to-peer communication.

Smart cards can hold up to 100 times more information then stripped cards. Smart cards are tougher to tamper with and can store than magnetic strip cards. They can

also handle multiple applications [9]. Thus that's why smart cards with embedded computer chips have managed to replace traditional, magnetic strip cards.

2.6 FUTURE OF SMART CARDS

Apart from the variety of applications currently in use, smart cards are entering a dramatically growing number of service applications to take the place of money, credit card and many other financial applications. For instance, both VISA and MasterCard have announce an extensive commitment to include a micro-processing smart card chip on all credit and debit cards distributed worldwide by the year 2000 [10].

All these (financial) applications require a higher intelligence inside the card to ensure an ever increasing level of security. Today, a simple PIN code verification to access the secret guarded inside the silicon is no long sufficient even with cryptography as it is intrinsically weak. New verification technique, known as biometrics is used.

The introduction of biometry provides a level of security previously unattainable, with inviolable protection against fraud. For security and private reasons, the biometrics recognition must be handled locally by the smart card. Implementing biometrics verification inside a smart card is notoriously difficult since template (the biometrics reference pattern) tend to occupy a large part of the card memory while biometrics verification algorithms are beyond the processing power of a standard 8-bit processor.

Constraints of memory space and processing power which prevent more sophisticated applications to be implemented, have lead Gemplus to introduce the first 32-bit RISC processor embedded in its smart card in November 1997 (GEMENOS, France). The core processor is an ARM7TDM processor from ARM.

2.7 DESIGNING THE WEB PORTAL

This gateway to students knowledge is in the form of a digital web based information system, its important to realize the importance of information systems and the role they play in managing and organizing information and the advantages they bring to the corporation using them.

An understanding of what an information system is; is crucial before starting the design of this portal, an **information** system is a social artifact serving the different interests of many stakeholders. Thus, inevitably, the design of an **information** system is a social activity, which involves understanding the social, organizational context of the system-to-be and making design decisions according to the limitations of environment and technology. As more and more software and **information systems** adopt Internet technologies and protocols for greater openness and interoperability, many new requirements appear. Unlike the closed computing environments for which most of the traditional **information systems** development methods were designed, the open, dynamic and almost unbounded nature of the Internet presents many new challenges and complexities. The design of new **information systems**, particularly Internet applications and web-based **systems**, are increasingly based on reusable components and flexible combination of existing patterns, which are hard to deal with without effective models and decision support tools [11].

Information systems design is a knowledge-intensive process. It involves domain-specific design knowledge, generic software design knowledge and knowledge about the specific situations of the current design.

When approaching the construction and design of an Information system, information should be gathered through analyzing the existing system, studying the literature review gathered and the user's requirements must be analyzed and studied, requirement engineering which is a goal-oriented modeling approach will be adapted in this project.

Goals describe the objectives that the system should achieve through the cooperation of actors in the software-to-be and in the environment. It captures "why" the data and functions are there, and whether they are sufficient for achieving the high-level objectives that arise naturally in the requirements **engineering** process. The incorporation of explicit goal representations in requirement models provides a criterion for requirements completeness, i.e., the requirements can be judged as complete if they are sufficient to establish the goals that they are refining.

Scenario-oriented models present possible ways in which a system can be used to accomplish some desired functions or implicit purpose. Typically, it is a temporal sequence of interaction events between the intended software and its environment (composed of other **systems** and humans). A scenario could be expressed in various forms including narrative text, structured text, images, animation or simulations, charts, maps, etc. The content of a scenario could describe system-environment interactions or events inside a system. Scenarios have been used for various purposes- as means to elicit or validate system requirements, as concretization of use-oriented system descriptions, or as bases for test cases. Scenarios have also become popular in other fields, notably human-computer interaction and strategic planning.

While goal modeling and scenario modeling each offers important capabilities, neither is adequate on its own for fully support requirements and design processes.

Goals are sometimes abstract and implicit and can be complemented by concrete and explicit scenarios. Scenarios are usually partial and incomplete. Their inadequacies in coverage can be revealed through goal modeling and means-ends reasoning. Scenarios provide the snapshots of possible design solutions or fragments of solutions. Their concreteness facilitates the communication process between stakeholders and implementers of the system. On the other hand, goal modeling supports the explicit identification of alternatives and design tradeoffs. The proposed combined approach therefore draws on the complementary strengths of goals and scenarios to facilitate decision-making at all stages from early requirements to fairly detailed design. At the same time, it makes all the decision making process traceable [12].

2.7.1 Service design and delivery

We need to begin by establishing that everyone agrees that service delivery is a design problem: services ought not to happen by chance, or be put together in a haphazard fashion, they ought to be planned and, specifically, they ought to be designed around the needs of the information user and his/her information-seeking behavior.

We also need to be aware that re-design is necessary from time to time (or, perhaps, given the pace of technological change, continuously), since the organization, its members and its functions change over time [13].

When designing and developing the system preliminary studies are carried out before the actual design is carried out.

It begins by looking at the information systems process, what people are involved in it, and how they might undertake the process. This includes consideration of both waterfall and spiral approaches to systems development, how user requirements may be investigated and recorded and includes prototyping and facilitated workshops in the techniques considered. Considering how user requirements may be documented and modeled. There is no prescription to which models should be used. The examination questions on these subjects will provide a narrative and candidates will be invited to diagram the narrative using a model they feel is appropriate and with which they are familiar.

The external design of systems; the inputs, the outputs and the interfaces must be planned. This is the part of a system that the user sees and so the designer can play an important part in assessing this aspect of design. The internal design of the systems, such as databases and file technologies are planned

Designers must have the capability to evaluate the existing information systems, providing them with an insight into how systems are implemented and assessed. It covers non-functional requirements such as archiving, audit trails and interfaces with other systems [14].

Information systems are nowadays developed and implemented in organizations flavored by changes in their environment and work practices. For information

systems (IS) developers this is reflected in terms of changes in the information needs of users during the development phase, increased requests for adaptive maintenance and sometimes in abandonment of a system as "useless for the current situation". These issues are often not considered to be the responsibility of IS developers, or simply seen as unfortunate facts of life. On the other hand, If the analyst is able to provoke discussion concerning changes in the user organization, s/he may not only be able to avoid the aforementioned difficulties, but may also be able to bring added value to the organization by supporting desired changes through IS design[15].

2.7.2 System Design

System analysis describes what a system should do to meet the information needs of users. System design specifies how the system will accomplish this objective. Systems design consists of design activities which produce systems specifications satisfying the functional requirements developed in the systems analysis stage. These specifications are used as the basis for:

1. Software development

2. Hardware acquisition

3. System testing

4. Other activities of the implementation stage.

• User Interface, Data, and Process Design

System design focuses on three major products or *deliverables* that should result from the design stage. System design consists of three activities:

1. User Interface Design

2. Data Design

3. Process Design

- **User Interface Design**

User interface design focuses on designing the interactions between end users and computer systems.

Designers concentrate on:

1. Input-output methods

2. Conversion of data and information between human-readable and machine-readable forms.

Interface design is frequently *a prototyping* process, where working models *or prototypes* of user interface methods are designed and modified with feedback from end users.

User interface design produces detailed specifications for information products such as:

1. Display screens

2. Interactive user/computer dialogues

3. Audio responses

4. Forms

5. Documents

6. Reports

- **Data Design**

The data design activity focuses on the design of the structure of databases and files to be used by a proposed information system. Data design frequently produces a **data dictionary,** which catalogues detailed descriptions of the:

1. Attributes or characteristics of the entities (objects, people, places, events) about which the proposed information system needs to maintain information.

2. Relationships these entities have to each other.

3. Specific data elements (databases, files, records, etc.) that need to be maintained for each entity tracked by the information system

4. Integrity rules that govern how each data element is specified and used in the information system.

- **Process Design**

The process design activity focuses on the design of software resources, that is, computer programs and of procedures needed by the proposed information system. It concentrates on developing detailed specifications for the program modules that will have to be purchased as software packages or developed by custom programming.

Process design produces:

1. Detailed program specifications and procedures needed to meet the user interface and data design specifications that are developed.

2. Produces specifications that meet the functional control and performance requirements developed in the analysis stage.

CHAPTER 3

METHODOLOGY AND SYSTEM DESIGN

3.1 METHODOLOGY

The methodology of completing this project subdivides the project into several stages and components.

The stages of this system are discrete and are done one after another. When engineering this project the methodology used consists of 5 stages, each has its own activities and deliverables. The phases are: Project Planning and Research, Analysis, Design, Construction, and testing and Debugging.

This Methodology used for the development of the system goes through the following steps:

1. Plan the Project and perform relevant research.
2. Identify System Requirements and Analyze Them
3. Break the System into Pieces (Architectural Design)
4. Design Each Piece (Detailed Design)
5. Code the System Components and Test Them Individually (Coding, Debugging, and Unit Testing)
6. Integrate the Pieces and Test the System (System Testing)
7. Deploy the System and Operate It

The system is divided into stages which are referred to system development life cycle (SDLC).

System Development Life Cycle (SDLC) is the overall process of developing information systems through a multi step process from investigation of initial requirements through analysis, design, implementation and maintenance.

This methodology was chosen since it provides a systematic and technical approach to design software based system and hence, solves and Technical encountered problem.

The cycles or stages in the SDLC are technical cycles for the system to cycle through activities which are illustrated in Figure 3.1
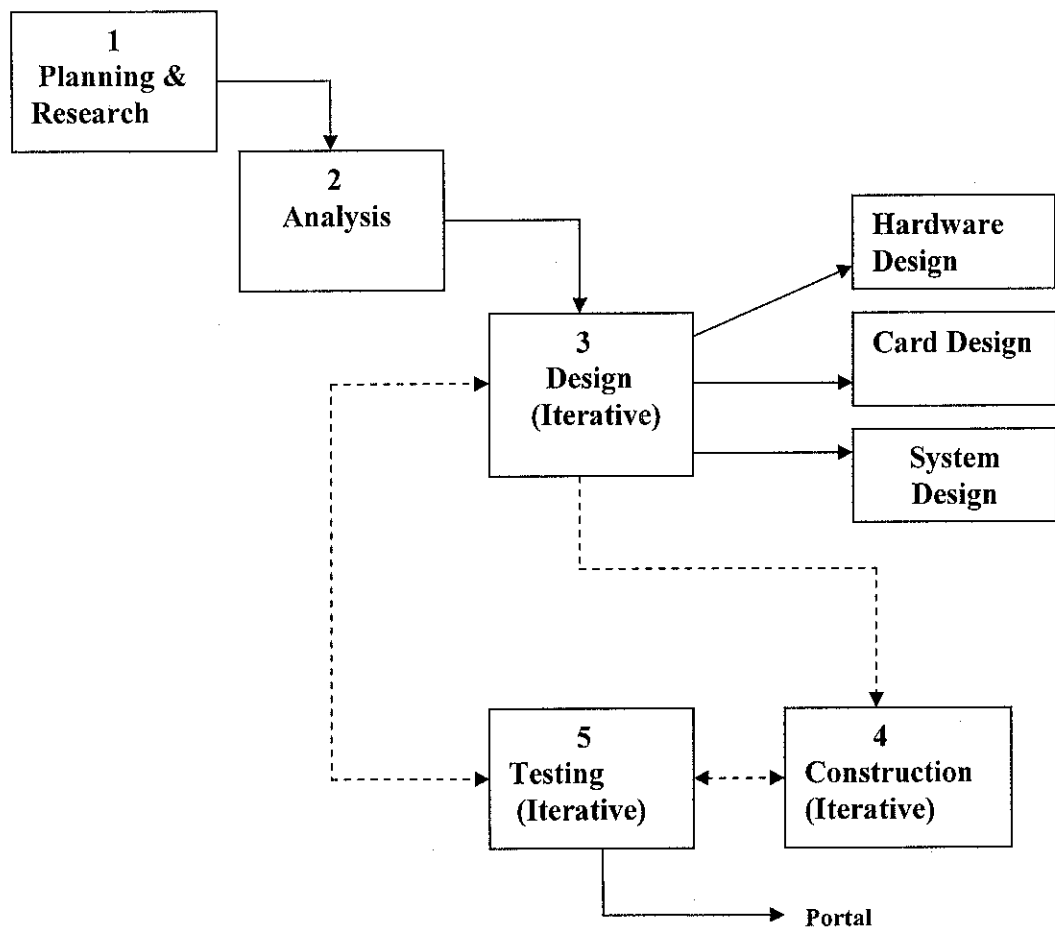

Figure 3.1 Student information System Portal model of the SDLC

3.2 LIFE CYCLE OF THE PROJECT

3.2.1 Project Planning and Research Phase

This phase is the starting point for this project. It addresses the key issues before the project can begin formally. These include: scope, approach to be adopted, gaining approval (from the supervisor), insuring that the necessary resources are available and finally planning and preparation of the project. The deliverables for this phase is a Gantt chart that spans over the period of fourteen weeks. The Gantt chart depicts the project tasks against the calendar and can be viewed in Appendix A.

The other component of this phase is the project research. Research is actually as ongoing activity throughout the project in order to constantly gain better understanding of the problems and therefore continuously improve the proposed solution.

3.2.2 Analysis Phase

Analysis is the phase of study of the problem, cause and affects that concern the project. The problem analysis phase provides us with a more through understanding of the problems and opportunities that trigger the problem. This phase answers the question, "Are the problems really worth solving?" and "Is this system really worth building?"

This is followed by a problem identification which leads to a list of requirements which it generates providing to the solution. In order to establish the requirements, an information gathering process is carried out Two important elements in this phase are the data gathering/collection and smart card Architecture.

- **Data gathering/collection**

Data gathering will be carried out in the Analysis stage. Questionnaires and researches through the internet and literature reviews are mainly the sources to gather relevant information.

Case study of a University implementing the smart card was also an important source of collecting data and getting an overview and glimpse of what standard procedures and expectations does this project need to fulfill.

The data gathered, helped in the development of the project and acknowledging the problems and requirements that need to be covered, and hence from there the hypothesis was formed.

3.2.3 Design Phase

The design phase follows the analysis phase, which involves a good knowledge in designing systems layout and the user interface. In the design phase, author started off using both logical and physical system models to document the requirements of the proposed system. The logical model shows what the system does; they are implemented independently; that is they depict the system independent of any technical implementation. The physical model shows not only what the system does, but also how the system is physically and technically implemented. Use Case diagram, context diagram as well as data flow diagram (DFD) are being incorporated in this documentation in order to enhance the understanding of the whole portal.
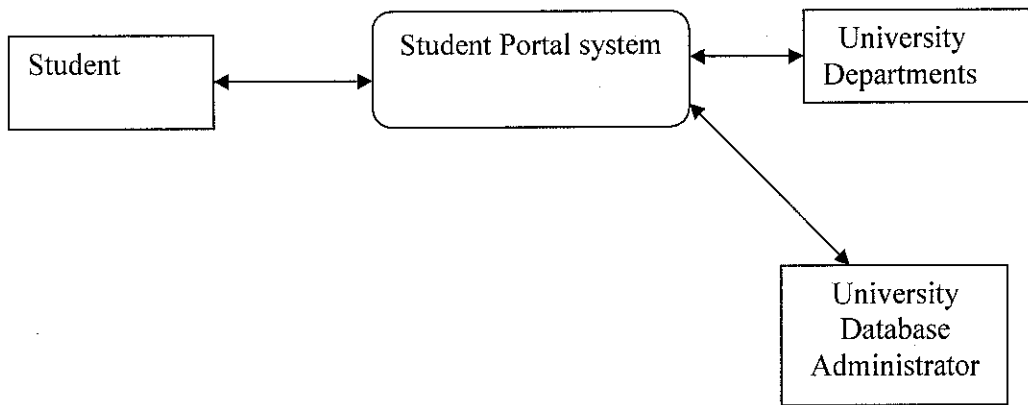
Figure3.2 level 0 Context Diagram of Student Portal

Data Flow Diagram

The diagram shown in Figure 3.2 below is the physical data flow diagram (DFD) of the system and the work or processing performed by the system, from the time the user inserts their Smart Cards into the Mainframe, to the time the user completes his/her interaction with the system and removes their Smart Cards , the process is first examined from a high-level through the context diagram, and then each process in the context diagram is broken down into its own process components, which shows the flow of data that occurs when the smart card is inserted in , how read and write operations can be perform.
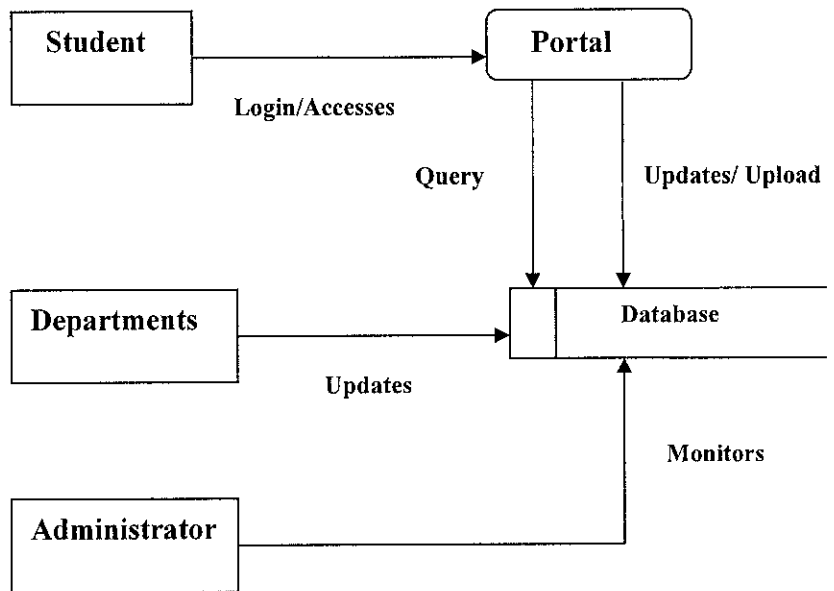
Figure 3.3 DFD level 0 of the student Portal

This is an extended DFD that illustrates the data flow in the system between the main entities which are the student, Administrator and Database admin.
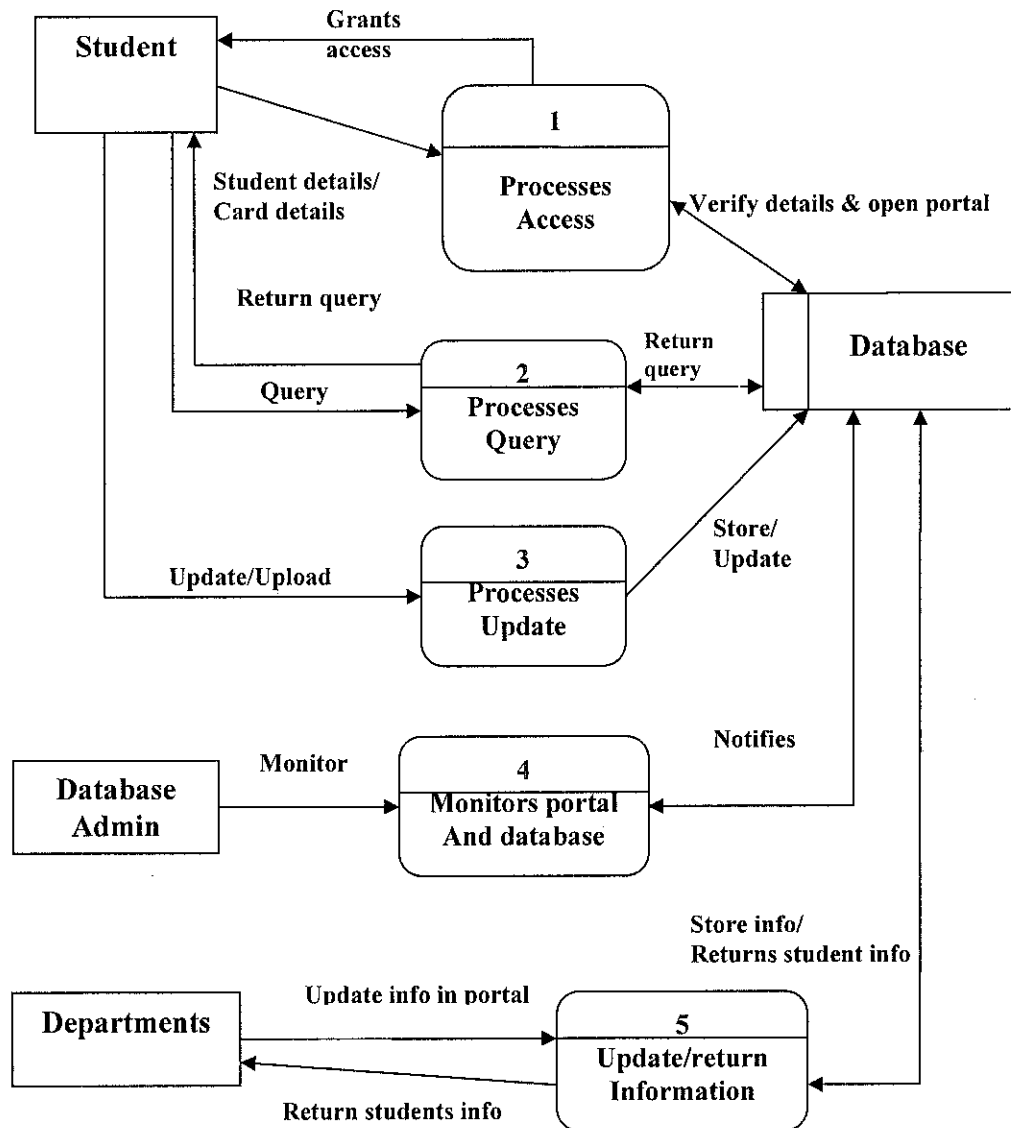
Figure 3.4 Extended Data Flow Diagram

Use Case Diagram

Students interact with the system in several ways; they can login, upload forms, query information, send messages and update their personalized information and profile. Both updating information and submitting of forms require that the user inputs be verified by the system.

On the other hand departments can update the database and get information the database, the database administrator monitors the system and makes any corrections.

Figure 3.5 Use Case Diagrams

Portal Architecture model and Students Accessibility

```
┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│  Academics   │      │   Library    │      │  Exam Unit   │
│  Department  │      │              │      │              │
└──────────────┘      └──────────────┘      └──────────────┘
        ▲                     ▲                     ▲
        │                     │                     │
┌──────────────┐      ┌──────────────┐              │
│  Security    │◄─────│   Student    │──────────────┘
│  Department  │      │   Portal     │──────────┐
└──────────────┘      └──────────────┘          │
        │                     │                  ▼
        ▼                     ▼          ┌──────────────┐
┌──────────────┐      ┌──────────────┐   │  Finance     │
│   Clinic     │      │Student Support│   │  Department  │
│              │      │   Service    │   └──────────────┘
└──────────────┘      └──────────────┘
```
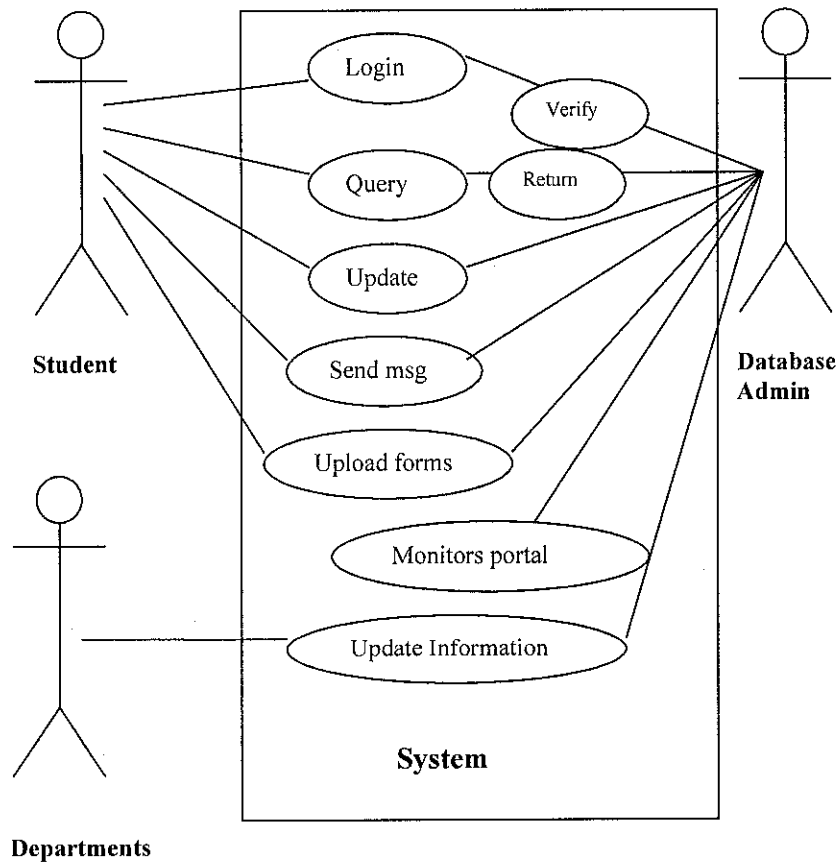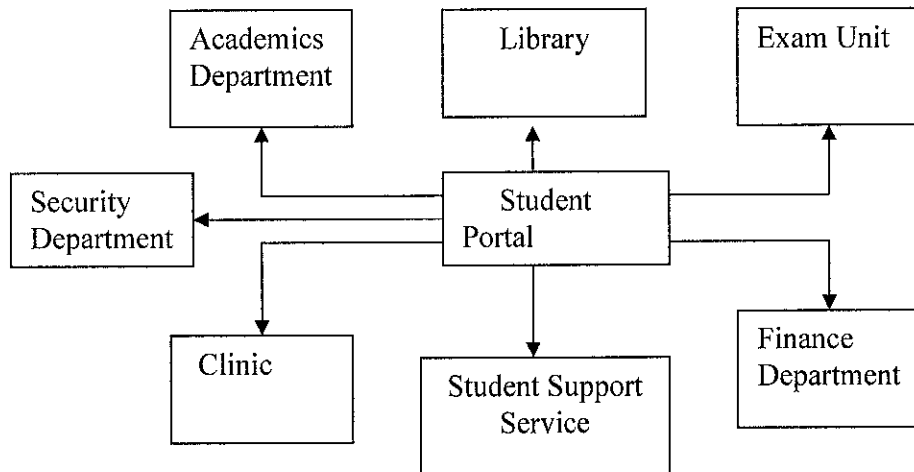
Figure 3.6 Architecture and Students Accessibility

After the flows of the diagrams have been designed and studied, authors proceed with the development of the system.

3.2.3.1 The Proposed Design for the Hardware

No hardware will be covered in this project, since it's not feasibly in terms of cost and time, only the software will be designed, but the hardware that will be recommended and required will be Mainframe that has an internal smart card reader embedded with the hardware this card reader detects the card and reads it, after authenticating , it will direct the user to the personalized web portal that resides in the server, the users perform their transactions and from there the Smart Card updates the database and performs queries and transaction. The main goal of this card which is

multi functional is to grant the user access to their personal portal where they can monitor their activities and perform their quires, after the session is ended by the user the database is updated and closed, and the user is ready to remove their Smart card form the card reader.

Through this connection, software on a personal computer (PC) may transmit commands and data to the reader in the Smart Card here we use the contact communication of the card. On the other hand when using the Smart Card as a contact-less card it can be held two to three inches away from the reader because the reader and the card are designed with antenna.

Smart Card technology is partially standardized. Chip operating systems (COS) are typically proprietary to the card manufacturer, whereas reader interface systems follow standards such as Java card, Open Platform, and PC/SC to ensure smart cards are compatible in various readers on campus.

The Smart card operating system's (OS) main aim is to provide common services such as file and data management, communication and command execution.

However in this project, the system will reside a server and will be accessed using an internet connection, but the proposed hardware and smart card to access the system from a Mainframe and with no internet connection will be recommended for future implementation.

3.2.3.2 The proposed Design for the Smart Card

When approaching to work on a system that has the Smart card as its main feature, understanding the architecture and structure of the smart card is essential and important. Smart cards improve the operational aspects of an organization. One single card holds various type of information in electronic form with sophisticated security mechanisms in it.

The smart card being introduced here has a contact ship, contact-less chip and a magnetic strip.

This gate way works by simply accessing it from a stable internet connection (as demonstrated in this project), or by simply inserting the smart card into a card reader that uploads a web portal where students can monitor their activities that would be recommended.

The Smart Card is inserted into a Smart card reader that connects to the card's conductive micro module (typically a gold plated area on the surface). The requirements of the system being accessed via a mainframe and card reader are basically the requirements of the smart cards which are:

- Reliable electrical power for card readers
- Dial-up facility to periodically update central processing site
- Processes, policies, and staff resources for handling lost, stolen or damaged cards and enrolling students.
- Software integration between cards, readers, and central management information system (MIS)

This multi functional card will bring many benefits to the university such as:

- Automated transactions
- More secure user identity and account information
- Built-in limits on credit and other accounts
- With stored data, less or no need for reader to access central server
- No repetitive form filing
- Quicker MFI administrative functions
- Improved transaction accuracy

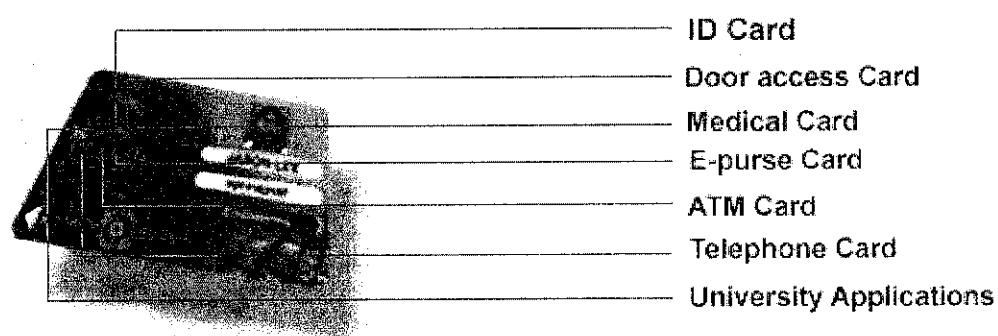The proposed architecture of the smart card is shown in Figure 3.2

Figure 3.7 Architecture of the Smart Card

The proposed card will be encapsulated with three different technologies which are:

- Contact chip
- Contact-less chip
- Magnetic strip

The smart card architecture will contain three technologies, not all of these technologies will be covered in the system due to time limitations, but implementing this technology now, will allow for further development and improvement of the smart card and further applications can be implemented without changing or upgrading the smart card. The monitoring system that is being proposed will only need the contact chip, so when inserted it will direct the user to a web portal where the students can start their queries and monitoring activities.

Contact Chip

Contact Smart Card requires insertion into a contact reader. The contact portion serves many applications and services. The following applications utilize the contact technology:

Educational Applications

- Library application
- Medical application
- Student Voting system
- Examination results
- Electronic Purse application (e-purse)
- Alumni information
- Information KIOSK
- Chip base ATM application
- Debit card system (tuition fees)
- Facilities booking system
- Student information system

Corporate Applications

- Time Attendance
- E-Procurement
- Staff Information
- Medical Application
- Electronic Purse Application (e-purse)
- Information KIOSK
- Chip based ATM Application
- Debit Card System (bill payment)
- Facilities Booking System

The financial applications have to be integrated with a bank. The chip holds various types of information in electronic form. The card is further made formidable with sophisticated security mechanisms. All transactions use either online or offline type of transactions. Smart Card can also be used throughout the nation for MEPS CASH and ATM applications.

Contact-less Chip

The contact-less portion of the Smart Card requires close proximity to a designated antenna. The contact-less chip has its own memory area and is Mifare compliant. Access control or security access allows the smart card holders to interface with front-end applications with certain access privileges via smart terminals, workstations and readers/controllers.

The following applications are used in contact-less area:

• Door Access System
• Time Attendance System
• Touch & Go System (LRT, Toll, Buses)

3.2.4 Construction phase

The author has started the construction phase of the system during this phase; during the construction the author was concerned with both the design of the system (the web portal) and the design of the back end, the database and the server side of the system. Another concern was how the author was going to demonstrate this project (the web portal) with a smart card reader which will be handled in the testing phase.

3.2.4.1 The construction of the Web Portal

With the objectives in mind and the data gathered from the analysis stage it was time to start the forth stage of the system development life cycle witch was the construction phase.

During this phase the author had to draft the Story Boards of the system and to determine how the system was to look like how the interfaces were going to be linked and the contents of each web page.

The systems architecture and interfaces, and the way there are connected together are shown below in figure 3.1.
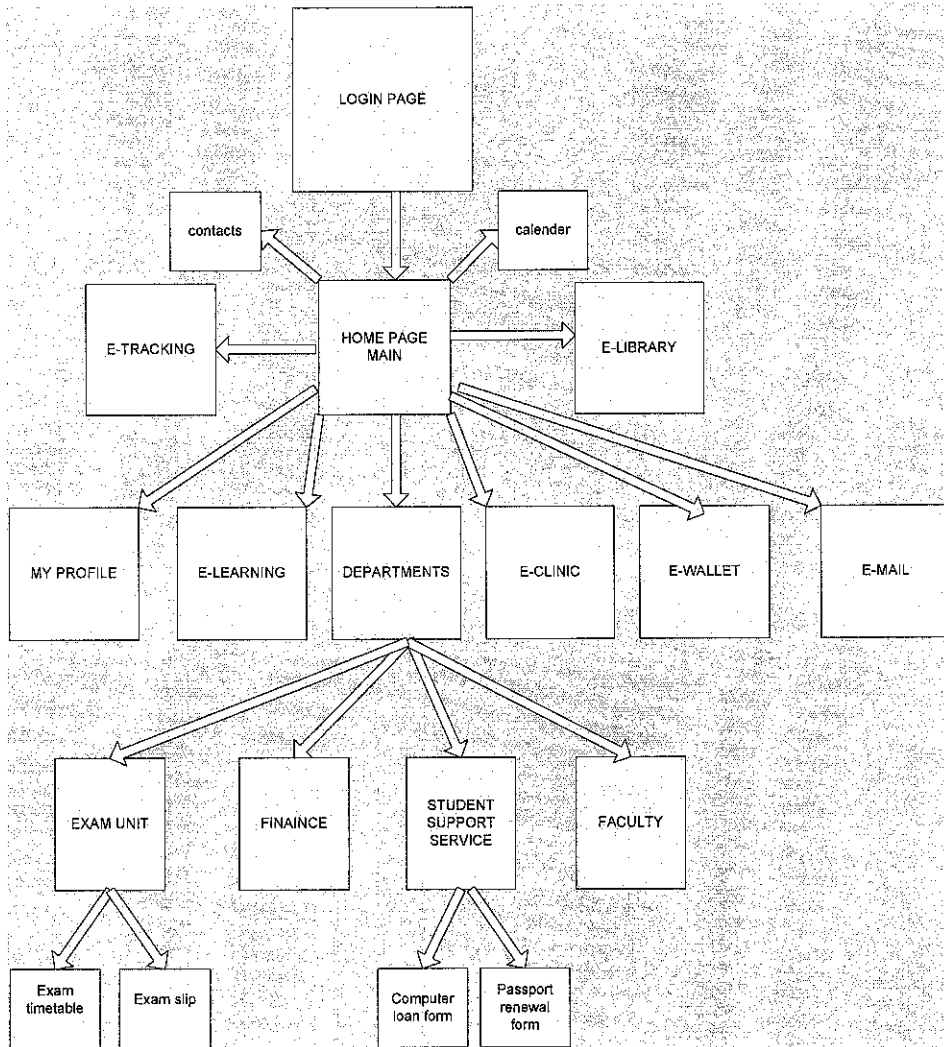
Figure 3.8Blue print of the Interfaces

After that coding of user interfaces was carried out the next stage was setting up a server and designing the database that's going to store the information.

The systems interfaces are ready by this stage and were stored on a users hard drive and were accessed using the users local IP address, the purpose of this was to demonstrate that the Portal was functioning properly and is error free and that it's able to run on a network.

After completing this stage successfully it was time to launch the next stage witch I believe is the most challenging and it was the testing phase.

3.2.5 Testing Phase

The testing phase which includes demonstrating that the system (web portal) is able to be accessed using a smart card and that we can successfully access the web portal and it can read and write to the database using the smart card.

Finding a smart card reader and a smart card that's programmable was a challenge to the author, which led to another challenge of how the author was going to use the smart card reader and smart card that were in hand. This is the most critical part of this project, is putting the theory in action and testing the efficiency of the system, those the scope of this system was stated at the beginning of this project it's a challenge to the author now to learn how to implement it.

The testing will be carried out by programming a Java Card and demonstrating using a Smart Card reader.

3.3 TOOLS REQUIRED

Below are the tools used throughout the development of the system.

1. **Managerial Documentation Tools**

   - Microsoft Word

Used for writing reports, documentation and preparation of thesis.

   - Microsoft Visio.

Visio was used to generate professional system diagrams such as DFD, UML, the system's Architecture and the Story boards.

   - Microsoft PowerPoint

This tool was used for Presentation purposes.

2. Development tools

- Microsoft Dreamweaver MX

  This software was used to code the system and to create the user interfaces.

- Microsoft Front page.

  Was used along with Dreamweaver MX to code the system and create the interfaces.

- MySQL

  This was used to store the information the users will submit to the server (Database).

- MyPHP

  This tool was used to connect MySQL to the server.

- Apache Server

  The apache server was installed in the user's computer to demonstrate that the portal was running effectively and was used to server the system to hosts accessing it form the Local Area Network, and is basically used for testing purposes.

- Microsoft Flash

  Flash was used to create the buttons and animations on the web portal.

- Adobe PhotoShop

  This tool was used to create the banner and to edit the photos available on the web portal.

- Chip Drive Development Pack

This tool which comes with a smart card reader and programmable smart cards was used to illustrate that the smart card application which is web based is tested and works, this tool help the author back up their theory.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter discusses the results and finding of the whole project, basically the output of this project so far will be discussed here, and this chapter can actually determine if the objectives and problem statement were addressed. With the methodology in mind, considering the analysis stage if the results found imply that the project is going to reveal a positive output the next step must be launched of the project and system development life cycle must execute within the given timeframe. Intensive research and data gathering were carried out in the analysis phase to test the feasibility of the problem statement and whether the project is worth executing.

Data gathered from the analysis phase and the questionnaires; with the knowledge learned from the Literature Review in chapter 2, sufficient data had been incorporated and can be applied to the design and construction phase, as well as the development of the new system.

Predicted output

The systems scope was among the first things configured after stating the problem statement. A complete Gateway to students knowledge using smart card technology, is a very large scope, and isn't feasible to carry out in terms of cost and time.
Hence this project is a smaller version of the portal, with limited applications, and recommendations for future developments.

This portal will stand as a Management information system (MIS), access via smart card although demonstrating this with the proposed hardware is not feasible here due to the time constraints and lack of hardware, however it will be demonstrated and tested on a smaller scope using a basic card reader. However the architectural design of the smart card to be recommended was completed with three different types of chips embedded, the contact chip which covers the University applications was our main concern.

From the analysis and the output of this chapter the project will forge on, beginning with a study that would verify some of the findings of the experts as discussed in the Literature Review.

4.2 RESULTS OF THE LIFE CYCLE EXECUTION

4.2.1 Results of the Analysis Stage

4.2.1.1 Results of the Questionnaire

A questionnaire was distributed to 30 students 15 Male and 15 females, with 15 majoring in technology course and 15 in Engineering course. The following results were found.

- Nearly half of these students which study in a Technology university don't have an idea of what a smart card is the following statistics were found.
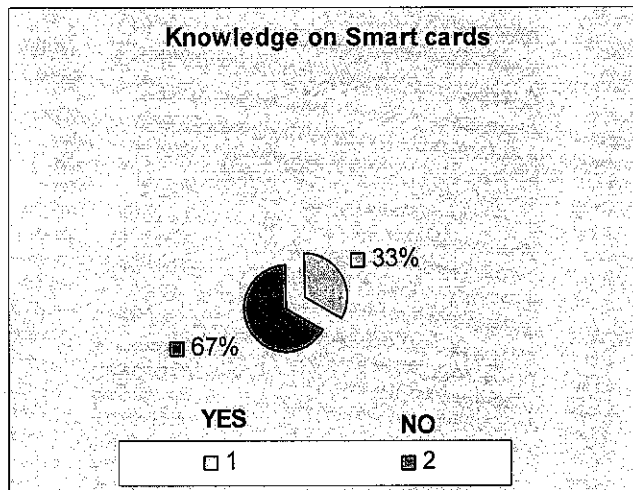
Figure 4.1 Knowledge on Smart Cards

- Nearly most students participating in the questionnaire and attached to a technology university feel that their current smart card is not smart in its technology and is not unique compare to other universities.

- Students were asked if they feel the technology in their daily student transactions in the university, since the university emphasizes on technology the following results were found which implied that students do most transactions manually and in the traditional way.
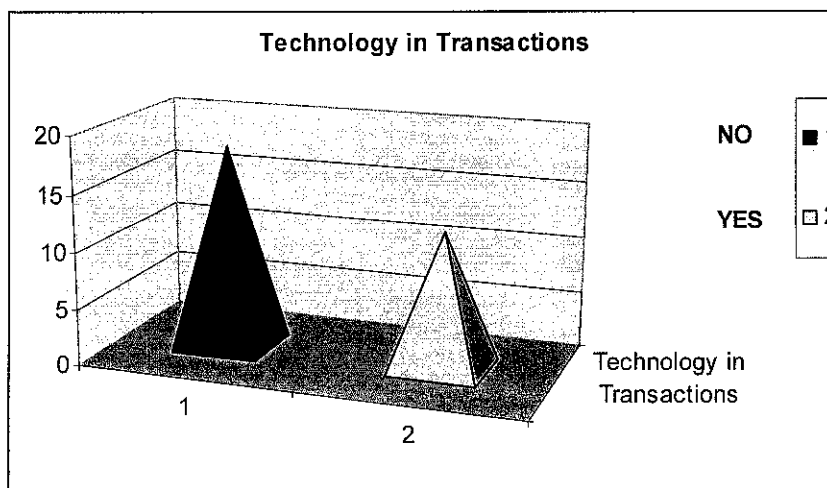

Figure 4.2 Students opinion about technology in transaction

- The current identification card that exist in the university are only used for checking out books from the library and identification, all student have agreed that these are the only functions that can be performed using the Student card, thus students Cards should be smart and accommodate automated functionalities and transaction.

- On the other hand some students indicated that carry their Student cards stated that the only reason they carry their student cards in the university is to avoid any fine from the security guards, and more then half of the students said they never carry their student cards, from here its clear that the current Student cards are not of any importance to students.

- Students indicated that the use the E-learning more then once a day to check for announcements and information, to avoid missing out on anything.

- When asked about the reliability of the UTP website and E-learning as sources to obtain updated reliable information thy have indicated that the sources are not reliable as they aught to be.
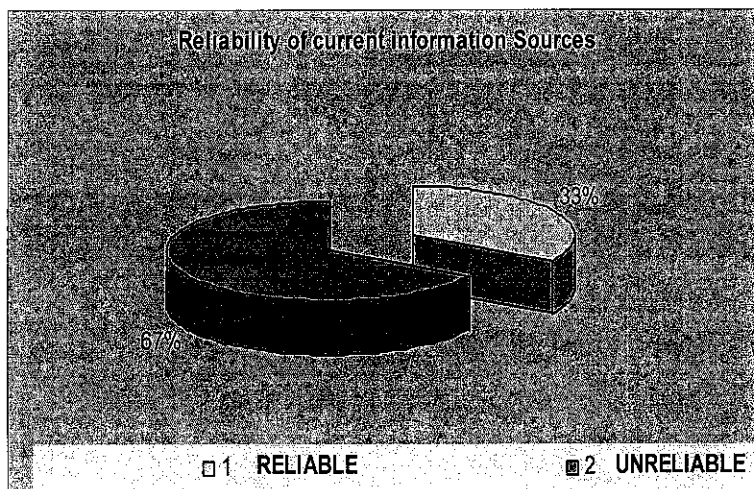

Figure 4.3 Reliability of current Information Sources

- Students were asked of they ever miss out on important announcements and deadlines because they were not informed and didn't know, students indicated that they do, due to the unreliability of Information sources.
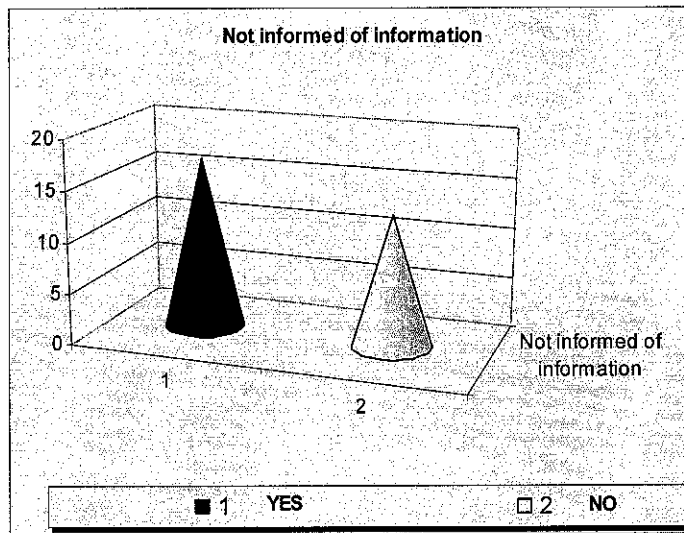
Figure 4.4 Uninformed of Information

- Students also indicated that the internet plays a major role in their student's lives and it's a struggle to get to reliable internet connection on campus, as the server is down or that the internet is slow, by introducing mainframes on campus students can simply insert their Smart Cards and obtain relevant customized information.
- Students were asked about the transactions they perform of campus as part of their daily student activities, the activities can be attendance, accessing labs, filling up forms, purchasing items on campus, printing notes, checking out books from the library and buying books. Students were asked if they feel that these transactions are manual and tedious and time consuming and wish they were transacted students indicated the following.

47
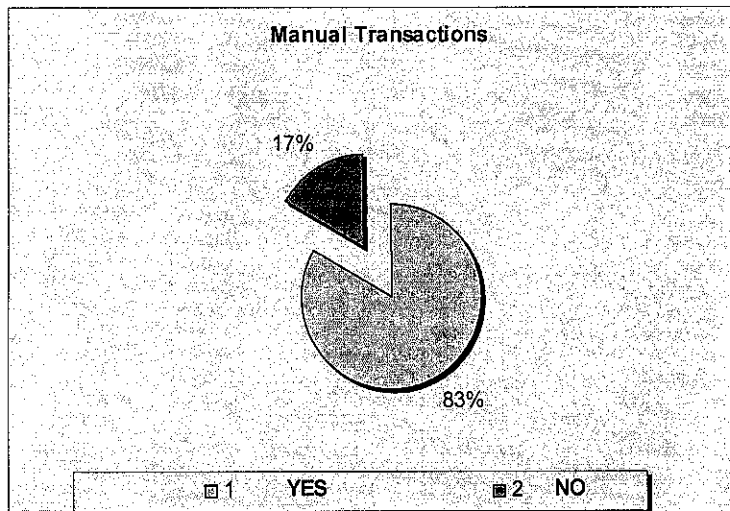
Figure 4.5Percentage of Manual transactions

- The frequency of students performing these manual transactions by going to relevant departments such as (Student Support Service, Finance department, Academic department, Exam unit and library) and enquiring and filling up forms is regularly, thus its importance of automating these transactions for the comfort of Students and Staff.

- The students were asked about the frequency of with they use the E-learning and UTP website for enquiring information if the internet connection was stable, the following was revealed indicating the importance of Information sources to students.
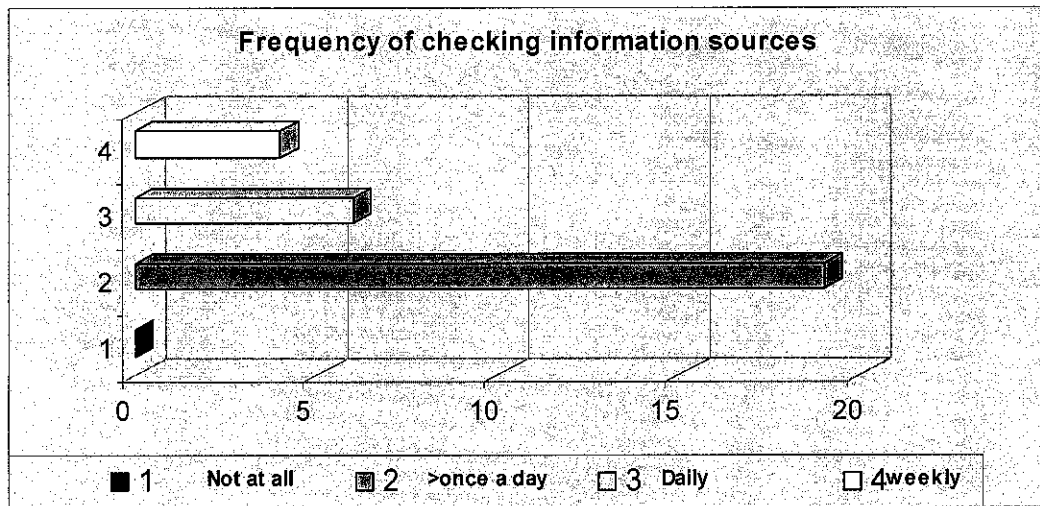
Figure 4.6 Frequency of usage of information resources

- Nearly all students have agreed on the fact that the university exhausts it paper resources by pasting announcements on the walls and doors and that the university must find a possible mean of reducing this paper wastage, by automating announcements.

- The idea of a personalized portal was appealing to students and all students were excited with the idea, and an enhancement in the current smart card was encouraged. Students have also favored a smart card that can act as E-wallet, telephone card, Debit card, health insurance card, Class attendance card and a door access card.

4.1.2 Results of the Design and Construction phase

After the completion of the execution of this phase, the outcome of the design phase was the proposed design of the Smart Card and an explanation of the technologies that it encapsulates, along with the proposed design of the hardware, the design of the information flow and accessibilities and function of the students.

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In the construction phase the output was a prototype of the system, a complete look and feel of the user interface was completed; the student has access to the system either through a stable internet connection or through the insertion of the Smart card into a smart card reader witch will be illustrated in testing stage of the system.

The student that is granted access to the system is able to access information, all sorts of announcement, such as university announcement and well as personalized announcements. Students have access to departments such as E-learning, Exam Unit, E-library, E-wallet etc... in each department student has the ability to access information, upload files, fill in forms, query the department by sending messages or queries, information is captured from the user and is used to update the data base. Students have the ability to access coursework marks, exam slips, world news, course registration detail, personal profile, exam timetable, medical history, email and bulletins.

4. 3 DISCUSSION

Finally the result found from the questionnaire and literature review has encouraged the launch of the Design and Construction phases in the SDLC.

The prototype designed in this project is a good illustration of a Student Management Information System, but the advantage of the MIS is that is accessed with a Smart Card and that security is stressed when designing, this system will prohibit invasion of privacy and protect each students personal information.

Due to the time restrictions only the (Contact) based technology of the smart card was illustrated that covers educational aspects and university related processes and transactions.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 RECOMMENDATIONS

After intensive data gathering, through analysis of the current situation using various Data collection methodologies, and observation of literature review, we can see an obvious mean to carry out this project and hence develop the student portal system and implement a Smart Card system.

From our survey we can confirm that the there are problems with the current cards in use today in UTP, all the problems existing today are listed in the problem statement in chapter 1. Moreover, the current Cards in use today are of limited functionality and have no Smart feature whatsoever. After having collected enough information of the current system and its limitations it's evident that a need for change exists.

After designing a new Smart card system and student Information system portal, there is still many room for improvement in this portal, the system emphasizes on University applications that are crucial to the students, according to our Survey. There is room for expansion of the system, to add more functionality and to fully utilize the Smart Card. The proposed design of the Smart Card, which enables, 3 different kinds of communication technologies (Contact communication, Contact-less communication and Magnetic strip) was designed in mind of expansion and upgrade.

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Hence further applications and be implemented with using the same Smart Card.

The Portal being designed in this project covers University applications (that use the contact-communication technology) and some of the other applications but in a broad manner, future upgrade of the portal is also possible.

Other applications that are recommended to be covered and implemented in the future using the same Smart Card are:

- Electronic Purse Application (e-purse)
- Alumni Information
- Information KIOSK
- Chip based ATM Application
- Debit Card System (tuition fees)
- Facilities Booking System
- Facilities Booking System
- Student Information System

Smart card system can be enhanced to cover student photocopying and discounts from department stores nationwide, Grocery stores, the airport, oversees computer shops, the Optimists and post offices.

Improvement can be by widening the scope of the functionalities and try and make it a Multi-purpose card that acts and the magic card and solves man of the current problems in the student's life.

Corporate Applications

- Time Attendance
- E-Procurement
- Staff Information
- Medical Application
- Electronic Purse Application (e-purse)
- Information KIOSK
- Chip based ATM Application

• Debit Card System (bill payment)

• Facilities Booking System

Contact-less Communications

• Door Access System

• Time Attendance System

• Touch & Go System (LRT, Toll, Buses)

Finally if future development of the above applications is carried out the smart card will be a multi-Functional card that acts as a:

1.   Key to your door

2.   ID card

3.   Wallet(credit card)

4.   Transport card

5.   Debit Card

6.   Medical insurance card

7.   University card

8.   ATM Card

5.2 CONCLUSION

After developing this System which emphasizes in university applications, many advantages are brought to both Students and the University. Both parties will be able to enjoy the benefits brought upon to them by the implementation of the System and a more enhanced Smart Card.

Some of the advantages are reducing handling costs, improve ease of use, lowered costs in infrastructural support, lower transaction cost and, Ability to carry out offline, online and peer-to-peer communication and provides multi transactions through one card.

The transactions that will be enabled will bring several advantages such as automated transactions, more secure user identity and account information, built-in limits on credit and other accounts, with stored data, less or no need for reader to access central server, no repetitive form filing, quicker MFI administrative functions and improved transaction accuracy.

Moreover with the implementation of this project the problems statements will be addressed and solutions will and will be avoided and addressed in the design of the portal, the solutions will promote, access rights and authorization, multi functionality of Smart Card, offers personalized monitoring portal, cutting down on resources such as financial resources and human resources, promotes security and eases Cash handling for students.

This project will be able to contribute tremendously to the reputation and development of UTP as a well established university recognized for its field in Technology and engineering, having integrated the two fields to bring up applications to be implemented and enjoyed by student, it will also be able to keep the university abreast of the latest Software technology. In terms of long term benefits, it will be a wise decision to implement Smart Cards to enhance the reputation of the university and save cost.

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APPENDICES

APPENDIX A – QUESTIONNAIRE

APPENDIX A – Questionnaire

The Following questionnaire will assist me in the Research of My FYP, please choose the answer you feel appropriate.

1. **What you field of study?**
    - Engineering
    - Technology

2. **Do you use your Student Card, in anyway other then as identification, and to check out books from the library?**
    - Yes
    - No

3. **Do you feel your student card has any uniqueness compare to other universities?**
    - Yes
    - No

4. **Do you know what a Smart Card is?**
    - Yes
    - No

5. **Do you think your current ID card is Smart in its technology?**
    - Yes
    - No

6. **UTP is a university that emphasizes on technology, can you feel the technology in your daily student life transactions?**
    - No
    - Yes
    - Haven't really thought about it

7. **Why do you usually carry your Student Card in UTP?**

- To be able to check-out books from library
- To avoid any harassment by security and possibilities of a fine
- You never carry your Smart Card.

8. **Do you feel that the current UTP website and E-learning are reliable sources to obtain information and announcements?**

- Yes
- No

9. **Do you ever miss out on announcements or important deadlines, because you weren't informed or didn't know?**

- Yes
- No

10. **How often do u use the internet and E-learning for inquires and to check announcements?**

Not At all	Once a week	Daily	More then once a day
1	2	3	4

11. **When on Campus, do you feel that it's a struggle to get to an internet to check out an announcement or inquiry?**

- Yes
- No

12. **Do you feel you do a lot of manual process and transactions in UTP?**

- Yes
- No

13. How frequent do you go to the Finance department, Academics, Exam Unit, Student support Service and library for enquires?

- 0-5 times a Semester
- 5-10 Times a Semester
- 10- 15 times a Semester
- All the time, can't keep track

14. With announcements paste to university walls, forms and attendance lists, do you feel that the university exhausts its Paper resources?

No	Don't know	Yes	Don't Care
1	2	3	4

15. Should the university find a possible mean of reducing paper wastage by automating transactions and processes and reducing costs on paper resources?

No	Yes	Don't Care (they are rich anyways)
1	2	3

16. How important is the availability of a personalized student portal to monitor activities and transactions in UTP, read relevant announcements, and check pending statuses?

Not important	wouldn't really matter	very important
1	2	3

17. If a Smart Card system would to be implemented in UTP and the functions are to be expanded, what functionalities do you feel are crucial and important?

	1	2	3	4
	{Not Important}			{Extremely important}
Smart card as an E-wallet	[ ]	[ ]	[ ]	[ ]
Smart card as Telephone Card	[ ]	[ ]	[ ]	[ ]
Smart card as a Debit Card	[ ]	[ ]	[ ]	[ ]
Smart card as a Health Insurance Card	[ ]	[ ]	[ ]	[ ]
Smart card as Class Attendance Card	[ ]	[ ]	[ ]	[ ]
Smart card as a Door Access Card	[ ]	[ ]	[ ]	[ ]

18. If it was possible to obtain information from departments in UTP from a Student Portal, what information are you in need of the most? (please Specify)

19. If it was possible to automate the manual transactions that you handle in your daily student life, what transactions would you like to automate? (please specify)

20. Are there any activities that you wish you can perform with your Student Card? If yes please specify?

20. If you had a UTP Smart Card and you had the ability to use it off-Campus, where, and how would you like to use it?

Thank you ☺