

DEVELOPMENT OF A PC-BASED ELECTRONIC BULLETIN BOARD

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ABSTRACT

In an organization, communication plays a vital role in keeping a good relationship among its members. Communication, in any form, makes dissemination of information possible. Dissemination of information is a means of communicating messages or information to make it known to a specific group of people or to public. Communication has evolved while coping up with the changes and advancement in technology, from posters, print ads and other circulatory articles up to the recent multimedia advertisements and public notice being shown in televisions and World Wide Web. In educational institutions, apart from school publications and other circulatory article, bulletin boards have been used as a medium in disseminating information. For most schools, bulletin boards are often used in communicating notices and information but it was found out that some problems exist in using those bulletin boards. This paper applies the concepts of SMS and web technology to improve the current bulletin board system as well as to address the problems which causes the delay and failure to disseminate information.

Keywords: *Electronic Bulletin Board; Short Messaging Services (SMS); Visual Basic Studio; Microsoft SQL Server Management Studio*

INTRODUCTION

Bulletin boards are often used to disseminate information. These are surface to which notices, messages and announcements

are being posted to make it available for to the public, but due to some problems, the bulletin board tends to fail to disseminate these information effectively and efficiently. Moreover, the capability of the bulletin board to inform the public has been affected by its limited features.

The proponents have successfully enumerated some of the problems and inconvenience that has been encountered in using the current bulletin board system which cause delay and even failure in disseminating information, these are the following:

1. The manual bulletin boards have limited space which cannot handle more announcements when needed.
2. The manual bulletin boards response or processing is not real-time.
3. The manual bulletin boards sometimes have an unorganized look and are often ignored.
4. The manual bulletin board requires a lot of manual effort such as preparing, printing or photocopying the notices.

The purpose of the study is to develop an enhanced version of the electronic bulletin

board integrated to a PC-based system. The system will use an LED/ LCD monitor to provide an interface for the output of the Electronic Bulletin Board (EB board). This will be implemented to Engineering Department of Lyceum of the Philippines – University. The system aims to develop a higher sense of awareness to the resident of the university.

EB board is a PC-based bulletin board; basically, the EB board has a single LED monitor which displays the messages or announcements being sent. The incoming information will follow the pre-installed format upon reaching the device. Compared to previous studies like the SMS capable EB board, the information can be sent by various medium such as SMS, more than that information can also be sent and registered through the website which can be accessible as long as the terminal device is connected to the Local Area Network. On the other hand, the employees and authorized group of students will receive their respective accounts upon their registration and account verification. These accounts will give them their privileges and access to the system.

The Development of PC Based Electronic Bulletin Board is an attempt to develop a computer-base system, which can disseminate information. It is integrated with SMS/ mobile technology and web technology to aid the dissemination of the information. The system was developed under Visual Basic Studio programming platform and Microsoft SQL Server Management Studio. The system was evaluated by conducting a series of test

which particularly aims to measure the system's reliability and accuracy in terms of response.

Objectives

The prime objective of this study is to develop a PC-based Electronic Bulletin Board and improve the dissemination of information.

Specifically, this study aims to:

- a. To make the EB board handle all the announcements within the College of Engineering including all its sub organizations.
- b. To have the system be designed with an enhanced user-friendly interface.
- c. To secure the system from unauthorized access.
- d. test and evaluate the performance of the developed system

CONCEPTUAL FRAMEWORK

Related Literature and Studies

PC based Electronic Bulletin Board is a computerized system that simulates the environment of bulletin board as well as its functionalities. It is intended to improve the dissemination of information among the students and employees of the College of Engineering. The proponents have enumerated some important concepts in developing the proposed system. These are as follow:

A. Global System for Mobile Communications (GSM)

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity comprising 80% of the global market [1], thus attracting more attention in the field of mobile telecommunication [2].

B. Short Messaging Services (SMS)

SMS is a basic protocol to send and receive message in a form of a text thru hand phone, PDA, Blackberry and other devices. This has been one of the most important revenue sources of wireless carriers. The proponents have considered to integrate SMS technology to this study because of the following reasons [1]:

1. SMS messages can be sent and read at any time.
2. SMS messages can be sent to an offline device.
3. SMS is a suitable technology for wireless application to build on.

C. Subscriber Identity Module (SIM)

The card containing a microprocessor. It is inserted into cellular phones. It contains subscriber identification data that are unique to each users and can be used to access services on the network [3].

D. Visual Basic .NET

It is a redesign of the underlying Visual Basic programming language. It is an evolution

of Visual Basic that was engineered around adding built-in type safety; object-oriented functionality; and ability to target Windows, Web, and mobile devices [4].

E. Database and Database Security

Databases are the single most important technology driving the Information Age enabling critical systems from eCommerce to enterprise information infrastructures [5]. It is important for a program to have a database if it involves a lot of information handling and management. With a database [6]:

1. The information is stored together within the database.
2. The information can be portable.
3. The information is easy to access at any time.
4. The information is easier to retrieve.
5. Many people can access the same database at the same time.
6. Improved data security.
7. Reduced data entry, storage, and retrieval costs.

Information systems, generally manage and hold a lot of data. Some of these data are confidential and therefore needs farther safe keeping. The practice of securing data in an information system is referred to as "Database Security".

Database Security has three basic concepts under consideration; these are prevention, detection and visibility. Prevention is to stop inadvertent changes to sensitive data. Detection involves the tracking of the malicious

access to the database. Visibility focuses on how the data is changing over time [7].

F. Microsoft SQL Server Management Studio

SQL Server Management Studio is an integrated environment for accessing, configuring, managing, administering, and developing all components of SQL Server [8].

G. Electronic Bulletin Board

Current manual bulletin boards rely on putting up notices using papers. This is time consuming since there is a need for a time to prepare the notices. There is also wastage of paper; if there is a need to renew the notices, a new hardcopy is to be provided [1].

An electronic bulletin board is a common device that is used to display information. The information or messages are displayed using dot matrix. Presently, almost all electronic bulletin boards are designed using wired system [9].

Electronic Bulletin Board System which is consider as an information system manages the appropriate posting on the bulletin board of messages and views important messages, giving the students faster and easier way to be informed in different events and activities of the department [10].

Synthesis

Considering the studies and systems cited, the development of the proposed PC-Based Electronic Bulletin Board System is feasible.

Table 2.2a shows the features and functionalities that the proponents have identified to make the system feasible. The basic concepts for each item have been considered in developing the system.

Table 2.2a Synthesis and System Concepts

CONCEPT	APPLICATION
SMS and GSM	The researchers have chose this kind of technology because it is a powerful tool in wireless communication. It is also recognized globally and has been comprising a large part of the global market due to the increasing number of its users.
Broadband Dongle	The researchers have chosen broadband dongle as a substitute for GSM modem. GSM Modem has a price which is relatively higher than the broadband dongle; it is more economical if the researchers use a broadband dongle especially in the due process of testing and evaluation.
SIM	To enable the system from receiving SMS, the researchers need a SIM which serves as an identification card of the system to be recognized by its respective network provider. The researchers have used GLOBE as its network provider. <i>(Note: Any SIM of other network provider can be used)</i>
VB.NET	For this study, the researchers have used Visual Basic .NET because of its flexibility and vast range of options in developing the applications. It is more simplified and totally object-oriented making it ideal for Rapid Application Development.
Database and Database Security	Every system should have a database especially when it deals with a huge amount of information. Handling information is a critical part to consider in every system, thus in designing the prototype the researchers need to provide a database to handle the information going in. There is also a need for this information to be secured to avoid unauthorized access.
Microsoft SQL Server Management Studio	It is used as the development platform for the database because of the following compelling reasons: a.) it is scalable, b.) it is reliable, c.) it is more secure client/server database engine.
Stored Procedures	The researchers have used stored procedures to avoid the embedding it to the system. This will make program execution faster. It isolates the database from the main application, leaving the main application untouched in case of modification.
ASP.NET MVC 3	This framework used for the bulletin board system's web version. The researchers have used this framework it is more flexible and has more testability features (includes the ability to write test scripts to simulate user interactions)

The previous development of related systems has an implication that the proposed system is feasible. The proponents have used the Visual Basic .NET in coding. Microsoft SQL Server Management Studio will provide the system its database where data will be organized and managed accordingly. To enable the SMS feature of the system, the proponents have chosen to use a broadband dongle as an alternative GSM module. The external monitor will serve as the interface between the system and the users. The PC will be the server where the system will be installed and ran.

The proponents have tabulated the identified functions of the proposed system. The following functions have been referred from the evaluations and assessment of the

previous studies cited in the earlier part of this chapter. Refer to the **Table 2.2b**.

Table 2.2b System Features and Functions

Item No.	Functions	Description
1	Centralized	Storage of information, messages or notices is located in a single PC. The updating of notices is also done in a single PC.
2	Faster Data Updates	Real-time and automatic updating of notices upon encoding or sending the message.
3	Data Monitoring and Security	The system only recognizes the registered accounts and users, thus it will only accept your message once you are registered. The system has a built in database to screen and block inappropriate words.
4	User-friendly	The system was made under Visual Basic .NET platform and has a design that can be easily understood and learned by its users.
5	Informative	The system helps to retain and develop the knowledge base of the college. It helps in effective dissemination of information. A lot of sharing of information occurs
6	Saves Time, Energy and Environment	Less time consumed and less effort exerted in preparing the notices before posting. The use of paper is eliminated.
7	Easy Data Transfer	Information, messages or notices can be sent easily through the specified methods of the system.

Conceptual Framework

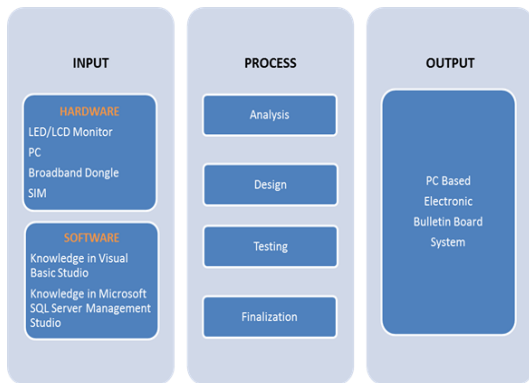


Figure 2.3a Conceptual Framework

METHODOLOGY

Design Process

In the development of the system, the proponents have employed a systematic approach for the study.

Waterfall Process Model is a sequential design process, often used in software

development processes, in which progress is seen as flowing steadily downwards.

For this study, the proponents have found using the Waterfall Process Model as the most appropriate model to use, since the study needs to undergo different processes to ensure that the defined milestones and objectives are being met accordingly, other than that Waterfall Process Model was chosen by the proponents because of the following reasons [12]:

- a) Simple and easy to use.
- b) Easy to manage due to the rigidity of the model
- c) Facilitates allocation of resources (due to sequential nature of phases
- d) Works well for smaller projects where requirements are very well understood.

Figure 3.1a shows the phases involved and used in a Waterfall Process Model [13]; for each phase, a particular milestone or goal is expected to be achieved.

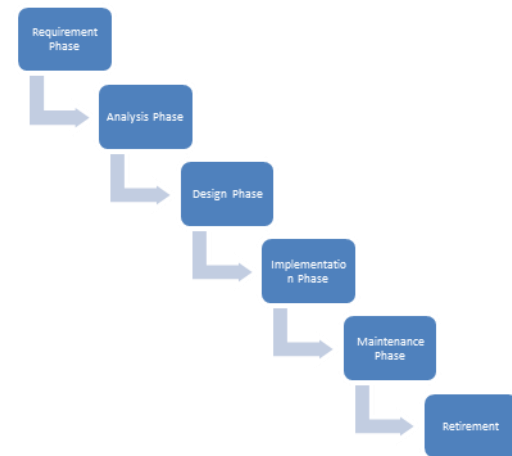


Figure 3.1a Waterfall Process Model

1. Requirement Phase

This phase involves the process of gathering of data and requirements for the system.

2. Analysis Phase

Plans and schedules for the development of the system are generated; these will guide the proponents in the process of developing the system.

3. Design Phase

In this phase, the proponents have created the design of the prototype and a draft of the proposed system, which includes flowchart, block diagram, and its functionalities.

4. Implementation Phase

The phase which is the highlight of the study; it involves the development of the system, coding the program and testing the functionalities of the system.

5. Maintenance

The proponents have conducted several assessment and evaluation of the system. Some minor troubleshooting were also done by the proponents to assure that it complies with the expected output.

6. Retirement

This phase basically is the terminal part of the project.

Hardware and Software Specification

Hardware

1. Computer Unit

A Computer unit or PC as the server of the application to which the only the administrator can access.

2. Broadband Dongle

A device that enables it users to connect to wireless internet comes in 3G, 4G and other versions. The system is compatible with broadband of any network provider. The proponents have used Globe as the network provider.

3. SIM card

SIM card from any network provider (Globe, Smart or Sun Cellular)

4. Local Area Network Connection

The system needs to be connected to the Local Area Network of the place to which it has to be implemented.

5. LED Television

This would be the terminal device of the system application. Approved notices and announcements are to be displayed in the LED television. The recommended resolution is 1366 x 768 dpi

Software

1. .NET Framework

The framework required by the system to work properly. The proponents have used .NET framework v.4.0

2. Visual Basic Studio

This is the programming language from which the system application has been compiled and created. The proponents have used the 2010 version of the software.

3. Microsoft SQL Server Management Studio

The database platform that the proponents have used to store and retrieve information that are relevant and significant for the system. Version 2008 and higher

4. Operating System

It is the environment to which the system application can run. Microsoft Windows XP and higher version

RESULTS AND DISCUSSION

Prototype

This study focuses on the development of a PC based Electronic Bulletin Board System. PC based Electronic Bulletin Board System is an innovative approach in disseminating information; it basically has the basic functionalities of the traditional bulletin board but with additional features which make use of

the mobile and web technology to lessen, if not eliminate human intervention. These following sections discuss the concept, process flow and features of the prototype.



Figure 4.1a. PC based Electronic Bulletin Board Environment

Figure 4.1.a is the screenshot of the actual bulletin board environment. This was subdivided into sections. The labeled parts are the major sections of the bulletin board.

1. High Priority Notices

These are notices that have a designated priority number of '1'. These notices have a higher urgency for posting.

2. Low Priority Notices

These are notices that have a designated priority number of '2'. These notices run as marquee at the lower part of the screen.

3. Birthday Corner

This shows the birthday celebrants for the current month.

4. Multimedia Corner

A section especially designed for other purposes where images and video can be

uploaded. This can be done to entertain the viewers or even to advertise and promote products.

5. Heading

It contains the name of the school, the specific department of that school as well as the time and date.

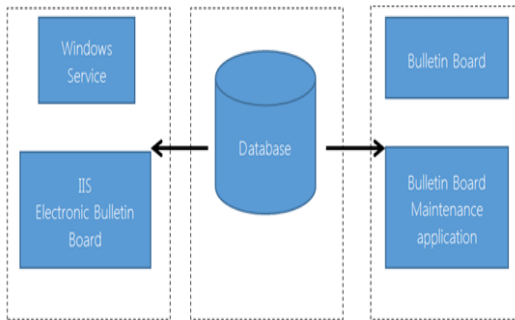


Figure 4.1.b Block Diagram

The block diagram shows the interaction of the system components with each other. The database component is the resource of all other component. It is where data are being stored and retrieved. Windows service is a background process that is responsible for the systems' capability to retrieve and process SMS messages. IIS or the Internet Information Service provides the web server of the system. The Bulletin Board Maintenance application is a component of the system from which administrative capabilities like registration of users, approval of notices and defining blocked words are being featured. Bulletin Board is the actual environment which is being exposed to the students and employees for public viewing and use.

4.2 System Features

1. Account Management and Security

The system would only be accessible by the user and administrator. Each account would have their respective accounts and password to secure the system from unauthorized access.

2. Registration

Students or employees who are to register their name as a user will be accommodated by the administrator. The new user will be registered according to his or her desired user name and password.

3. Posting of notices

Posting of notices will be done by using the following methods:

a. SMS

The user will be able to send notices through SMS messaging provided that they follow the defined format of the system. The system will ignore messages with invalid format.

b. LAN

Through connecting to the Local Area Network of the Lyceum of the Philippines University- Laguna, the user can access the system by browsing and using the web application version of the bulletin board system.

4. Approval of notices by the administrator

This feature gives the administrator the ability to evaluate and scan the content of the

announcement and notices before it has to be posted.

5. Notice Duration

This enables the user to assign the starting and ending period of the notice or announcement.

6. Notice Priority

This feature is a way to organize the incoming notices and announcements. The user is to include the priority of the notice which can either be ‘High’ or ‘Low’. This depends on the urgency of the notice. ‘High’ priority notice will be posted on the main panel while the ‘Low’ priority notice will be posted on the running head.

7. Data Storage

Data will be stored on the created database which was developed under the Microsoft SQL Server Management Studio.

8. Notification system

This feature requires the administrator to provide a load for the broadband; it notifies the student for new posts or their transaction.

9. Word Filter

Words which are considered obscene, foul, unprofessional and inappropriate will not be accepted by the system for posting.

10. Enhanced User Interface

The system was design with an interface that can be easily understood and learned.

Evaluation

A series of test for the “PC based Electronic Bulletin Board System” was done to check whether the system operates properly as what proponents have expected. The proponents have included several students and employees under the College of Engineering as participants of the study.

Table 4.3.a Test for SMS method

Students				
Name	Phone Number	Network Provider	Trial	Remarks
Baldemor, Allen	09398314382	Smart	1	Successful
Bañagale, Jezie Raphael S.	09437059045	Sun cellular	2	Successful
Enero, Girlie M.	09353007884	Globe	3	Successful
Lambarte, Reneboy M.	09283116666	Smart	4	Successful
Saul, Maicah Xyril	09357845471	Globe	5	Successful
Tominaga, Rizza A.	09359963576	Touch Mobile	6	Successful
Employees				
Engr. Rionel Caldo	09213499132	Smart	7	Successful
Mr. Marvin Flavier	09437251214	Sun cellular	8	Successful

Table 4.3.b Test for LAN Method

Trial	LAN	Process	Remarks
1	LPU-L	Posting	Successful
2	LPU-L	Posting	Successful
3	LPU-L	Posting	Successful
4	LPU-L	Posting	Successful
5	LPU-L	Posting	Successful

The remarks noted as “Successful” means that the participants have successfully posted their notice on the system. The results for the posting in the web application, SMS method and local or server application is shown in **Table 4.3.c.**

Table 4.3.c Test for All Methods

Record ID	Board Title	Content	Approval Status
1	Announcement 1	This is an announcement.	Bypassed
2	Announcement 2	Announcement for ECE only	Bypassed
3	Announcement 3	Announcement to.	Bypassed
4	Announcement 4	Hehehe	Approved
5	hello	this is rhendell	Approved
6	New SMS Announcement	ow yeah!!!!	Approved
7	hi	van	Approved
8	New SMS Announcement	welcome to cl4 laboratory	Approved
9	New SMS Announcement	hi guys :)	Approved
10	Testing !	This is a sample announcement !!	Approved
11	CpE	Hello Earth	Approved

Table 4.3.d ISO 9126 Quality Model Evaluation

Characteristics	Sub Characteristics	Index	Average
Functionality	Suitability	3.90	3.8375
	Accurateness	3.90	
	Interoperability	3.75	
	Security	3.80	
Reliability	Maturity	3.45	3.55
	Fault Tolerance	3.70	
	Recoverability	3.50	
Usability	Understandability	3.45	3.6
	Learnability	3.45	
	Operability	3.65	
	Attractiveness	3.85	
Efficiency	Time Behavior	3.20	3.2
	Resource Utilisation	3.20	
Maintainability	Analysability	3.75	3.7625
	Changeability	3.75	
	Stability	3.80	
	Testability	3.75	

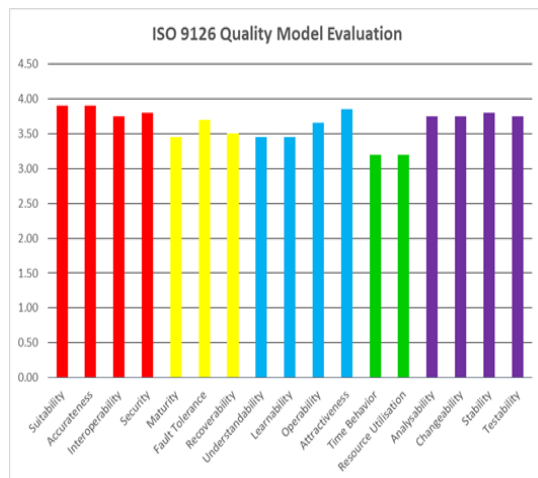


Figure 4.3.a ISO Quality Model Evaluation

Each of the sub characteristics of the ISO 9126 Quality Model have been considered in the evaluation. The results show that the indices of each characteristics and sub characteristics are within the range of acceptability. This implies that the system is acceptable in terms of its functionality, usability, efficiency and maintainability.

CONCLUSION

The new “PC based Electronic Bulletin Board System” has effectively addressed the problems of the existing system; the following features highlight the systems’ affectivity and efficiency:

1. The new system has been designed with a user-friendly interface. The system can easily be understood by its users. The users have provided a favorable response regarding the system after evaluation
2. The system has implemented an effective account management structure to secure the system from unauthorized access.

RECOMMENDATION

The proponents have offered the following recommendation for related research and study in the field of Computer Engineering:

1. It is recommended for the future proponents to embed the system into a microcontroller. Embedding it to such

device will make it more portable and easier to install whenever it is needed.

2. Since mobile technology has offered a vast range of opportunity for different fields and applications, the proponents recommend the development of an application that is compatible to Smartphones. This application would be an extension program to which users can view the bulletin board through internet.
3. The proponents also recommend publishing the web application under the domain of the university to make it available anywhere as long as there is an internet connection.
4. It is also recommended for the other departments of the university to implement this kind of electronic bulletin board system.
5. Notification via e-mail can also be considered as a future enhancement.

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THE DEVELOPMENT OF VENDO PRINT: A COIN-OPERATED PRINTING KIOSK

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ABSTRACT

This study is a prototype mainly controlled by a microcontroller unit designed to offer service of printing files in PDF format, particularly for the students and professionals in Lyceum of the Philippines-Laguna. The prototype is coin-operated which requires a correct amount of payment to be inserted into the coin acceptor. It is also composed of switches and relays which are vital for ensuring that the printing service is delivered well and income collection is secured.

Keywords: coin-operated; vending; printer; VendoPrint; microcontroller

INTRODUCTION

Since the emergence of computer technology, the requirement and desire of submitting printed outputs such as reports, letters, projects and the like have been practiced up to the present, which mainly involve students and professionals, as these computerized outputs provide a cleaner and more professional-looking expression of written communication.

Thus, to produce the said output, it would require the use of computer and of course, a printer.

Today, almost every company, household and individual have their own personal computers, handheld devices and other means

to make their document. However, not everyone has their own printer.

The researchers of this study have seen the opportunity of developing VendoPrint- A Coin-Operated Printing Kiosk which can be accessible to many. Nowadays, majority of the printer users are Professionals and Students. To those who do not own one, they would avail printing services from computer shops which may be inconvenient to some.

In Lyceum of the Philippines-Laguna, the researchers have observed that students who do not own a printer or those who are within the campus already and immediately in need of printing their files, have no other choice but to go to the nearest computer shop to avail a printing service.

Within the area, there are two computer shops close to the institution. The researchers measured the distances of both shops using a Global Positioning System (GPS) and were measured 385 meters from the school. The first option is towards Calamba City Proper. They would have to leave the campus and walk the said distance. For the second option, the students will have to walk an estimated 30 meters to use the pedestrian overpass with two 28-step stairs and walk a few meters more. In

the time study conducted by the researchers, getting to either of the two computer shops will take an average of four minutes. Thus, the total time travelled will be eight minutes.

Meanwhile, if the student will not consider the use of overpass it will only take him three minutes, however, since the institution is along the National highway which is passed by many vehicles, the life of the student is at risk. Another option is to ride a jeepney which will cost a student 14 pesos back and forth on transportation alone.

This study aims to develop a printing kiosk where users can print Portable Document Format files from their USB flash drive by integrating into one a Microcontroller Unit, coin acceptor and a printer. The researchers also aimed to provide the needed computer program and mechanisms to execute the desired functions of the machine.

Objectives

This study primarily aims to develop a coin-operated printing kiosk.

Specifically, it aims:

- To design a coin-operated printing kiosk applying microcontroller system
- To develop a software that will interface the entire system
- To test the accuracy and functionality of the system

CONCEPTUAL FRAMEWORK

The inputs, processes and the deliverables of the project were determined and summarized. These are presented using the Input-Process-Output (IPO) Chart which is a functional model and conceptual schema of a general system [1] shown in Figure 1.

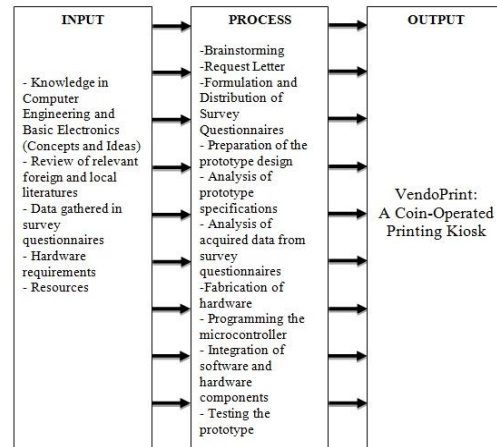


Figure 1. Input-Process-Output (IPO) Conceptual Model

A. Input

Knowledge in computer engineering has been applied in the project which includes assembly language programming, computer hardware and basic electronics concepts. Information and ideas from the proponents, open-sources, professionals, studies and literature are also vital for the completion of the study. Moreover, survey questionnaire responses from students and professionals contributed to the formulation of specifications of the prototype. The identification of hardware requirements is also essential in the development of the prototype.

B. Process

The processes done in the development of this project include the gathering of the information and inputs, research on the relevant concepts and studies, brainstorming and planning of the prototype design including the formulation of survey questionnaires, tallying and evaluating survey results, analysis of prototype specifications with consideration of the computer engineering concepts and the acquired data from survey questionnaires, fabrication of hardware components, programming the microcontroller, integration of hardware and software components along with the software and testing of the prototype.

C. Output

The deliverable of this study is a coin-operated printing kiosk that allows its users to print PDF files from their USB flash disk or memory card, with an embedded microcontroller that controls the operation of the kiosk. Moreover, the prototype is only capable of accepting one, five and ten peso coins only.

METHODOLOGY

A. Research Process

The research process done by the researchers was adapted from the systematic process of designing and analyzing systems and application which is the System Development Life Cycle or SDLC. The SDLC is used to ensure meeting user requirements in

support of strategic goals and objectives [2]. Figure 2 shows the SDLC flow which starts with the Preliminary System study.

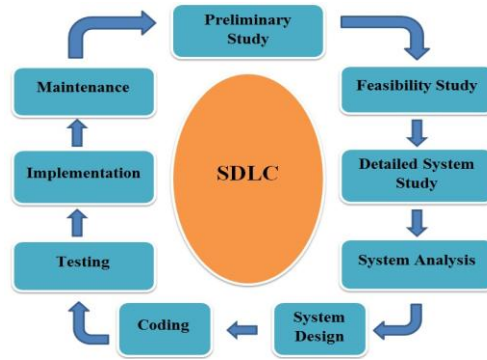


Figure 2. System Development Life Cycle

Table 1. Research Process

Phase	Inputs used	Process Involved	Outputs
Preliminary System Study	Knowledge in Computer Engineering; Research of Related Literature and System Studies	Identification of opportunities/problems, objectives of the study, constraints and the expected benefits of the project	System Proposal
Feasibility Study	Knowledge in Computer Engineering; Research of Related Literature and System Studies; Approved System Proposal	Identification of scope, delimitation, and system's workability; Determining the resources (financial, material and intellectual), methods of study and cost of entire study; Further brainstorming of objectives, purpose, description and goals	Scope, delimitation, and system's workability; Identified resources, methods of study and cost of entire study; Project Feasibility
Detailed System Study	Approved System Proposal; Feasibility Study	Population study; Identification of the population to be sampled; Formulation of Survey Questionnaires; Distribution and collection of Survey Forms; Tabulation of Results	Population Information; Survey Questionnaires; Survey Results
System Analysis	Printing practices and preferences of respondents obtained from survey; Approved System Proposal; Feasibility Study; Knowledge in Computer Engineering; Research of Related Literature and System Studies;	Redesigning of machine specifications according to the survey results; Identification of Process and data flows; Functions of the machine are specified in detail	Requirements and Specifications of machine; Algorithms and Flowchart
System Design	Printing practices and preferences of respondents obtained from survey; Knowledge in Computer Engineering; Research of Related Literature and System Studies; Algorithms and Flowchart	Detailing of how the parts of a system should be implemented; Designing the circuit and machine; Hardware designing	Circuit and project design
Coding	Printing practices and preferences of respondents obtained from survey; Knowledge in Computer Engineering particularly programming; Research of Related Literature and System Studies; Algorithms and Flowchart	Coding or programming of software needed to run the machine; Integration of software to the hardware	Project software integrated to hardware
Testing	Knowledge in Computer Engineering; Algorithms and Flowchart; Programmed machine	Running the prototype; Debugging; Review if specifications are met	Tested and debugged machine
Implementation	Tested and debugged machine	Implementing the system to the actual setting; Drawing conclusions and recommendations	Finished project; Coin-operated printing kiosk
Maintenance	Finished project; Coin-operated printing kiosk	Tuning the system to maintain its desirable operation	Well-maintained prototype

Table 1 shows in detail the inputs, processes done and output/s of each phase for the development of VendoPrint.

THE PROTOTYPE: DESIGN, FUNCTIONS AND PROPERTIES

A. Prototype Design

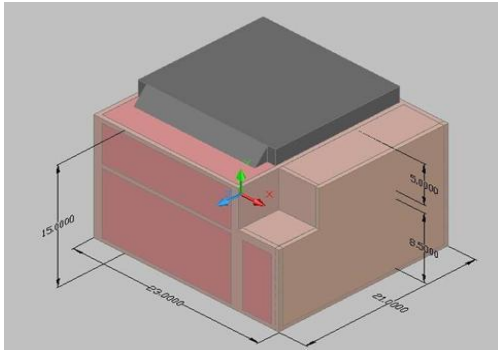


Figure 3. Three-Dimensional View of the Prototype

Figure 3 shows the physical design of the prototype including its dimensions illustrated in a three-dimensional view. The layout of this prototype is designed using Autocad software.

B. System Block Diagram

The prototype named VendoPrint is composed of different electronic components that are combined together to be able to accomplish its task: to print PDF files and ensure security of payment collection. The Microcontroller is one of the major components in the prototype; it is the brain of the system that sends command to its subcomponents to perform their functionalities. Seven-segment LED is one of its output display. It displays the balance, total amount paid by the customer and the total number of printed files.

On the other hand, the coin acceptor is considered as the input of the system. Coin acceptor validates the inserted coin/s of the user. Once validated to be acceptable, it will send a signal which will allow the microcontroller to run.

The Limit switch detects if the drawer is open or closed. The Infrared line sensor is responsible for sensing the total number of pages that the user will pay with a maximum number of 5 pages per transaction. The printer of the prototype is responsible for printing and accepting portable document format (PDF) from external devices such as USB flash drives. Moreover, the Solenoid keeps the drawer closed while the user has not paid the complete amount of his printed file/s.

The displayed figures on the 7-segment display will be the balance to pay for the availed printing service. The user should deposit the amount displayed on the coin slot. The inserted amount will again be validated by the coin acceptor. After validating the coins inserted, the 7-segment display decrements indicating the remaining balance. Once the remaining balance has been paid, the print-out door will be unlocked allowing the user to claim the printed files. The machine will turn off after the transaction is completed.

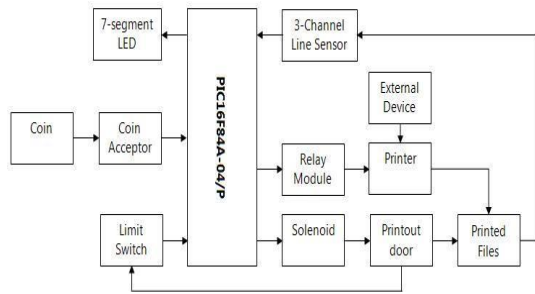


Figure 4. System Block Diagram

C. Properties of the Project

VendoPrint is a Microcontroller-based prototype that is programmed using assembly language. As microcontroller is defined, it is an embedded chip which is dedicated to run one specific program [3]. The program is interfaced to the microcontroller to achieve the functions set by the researchers.

The project is limited only to printing files in PDF and short-sized paper format. A maximum of five pages can be printed out per transaction. Peripheral devices such as flash drives can be connected to the kiosk to allow printing from external devices. Printing from memory cards is possible provided that the user has his own USB memory card reader. The machine can print in monochrome (black and white) or colored.

For the user's payment, the machine only accepts one peso coins. It does not provide change thus, exact amount of payment should be provided by the users. Moreover, paper bills are not accepted.

D. Functions of the Project

To understand the functionality of the project, the researcher tabulates them. Refer to Table 2 for the Functions of VendoPrint.

doors are secured with pin tumbler locks while the door on the upper side is fastened by a solenoid.

B. Testing

Tests were conducted to evaluate the functionality of the system. As one of the phase in SDLC, testing requires several trials to determine if the machine delivers the functions desired. Tables are divided into four columns: the number of trial, expected output, actual output and the remarks.

Table 3. Test Results for the Insertion of One Peso Coins

Case 1: Inserting 1 peso coin to the coin slot			
Test	Expected output	Actual output	Remarks
1	The coin will be accepted.	Accepted	Success
2	The coin will be accepted.	Accepted	Success
3	The coin will be accepted.	Accepted	Success
4	The coin will be accepted.	Accepted	Success
5	The coin will be accepted.	Accepted	Success
6	The coin will be accepted.	Accepted	Success
7	The coin will be accepted.	Accepted	Success
8	The coin will be accepted.	Accepted	Success
9	The coin will be accepted.	Accepted	Success
10	The coin will be accepted.	Accepted	Success

In table 3, the coin acceptor was tested if one peso coins were inserted. It shows that 10 out of 10 trials were successful. The “Success” remark means that the inserted coin is successfully validated and once a coin is validated, the coin acceptor will send signal to the microcontroller enabling the decoder to display the total number of coin inserted.

Table 4. Sensor Detection Test

Case 2: Sensor detection of printouts			
Test	Expected output	Actual output	Remarks
1	The sensor will detect the printout	Detected	Success
2	The sensor will detect the printout	Detected	Success
3	The sensor will detect the printout	Detected	Success
4	The sensor will detect the printout	Detected	Success
5	The sensor will detect the printout	Detected	Success
6	The sensor will detect the printout	Detected	Success
7	The sensor will detect the printout	Detected	Success
8	The sensor will detect the printout	Detected	Success
9	The sensor will detect the printout	Detected	Success
10	The sensor will detect the printout	Detected	Success

Table 4 shows that 10 trials were conducted to test the functionality of the system in detecting the pages printed through the sensor. The success rate for this test gains 100% of the total number of trials.

Table 5. Solenoid Testing

Case 3. Solenoid testing			
Test	Expected Output	Actual Output	Remarks
1	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
2	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
3	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
4	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
5	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
6	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
7	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
8	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
9	Solenoid opens after total transaction amount is paid	Solenoid opened	Success
10	Solenoid opens after total transaction amount is paid	Solenoid opened	Success

Table 5 shows that out of the 10 trials made for the testing of solenoid lock, all of these were successful which means that for each trial of having the transaction amount

paid, the solenoid lock opens to allow the user to claim his printed output.

paid, the solenoid lock opens to allow the user to claim his printed output.

Table 6. Reading of External Devices

Case 4: Reading of External Devices			
Test	Expected Output	Actual Output	Remarks
1	Inserted Flash Drive will be read	Read	Success
2	Inserted Flash Drive will be read	Read	Success
3	Inserted Flash Drive will be read	Read	Success
4	Inserted Flash Drive will be read	Read	Success
5	Inserted Flash Drive will be read	Read	Success
6	Inserted Flash Drive will be read	Read	Success
7	Inserted Flash Drive will be read	Read	Success
8	Inserted Flash Drive will be read	Read	Success
9	Inserted Flash Drive will be read	Read	Success
10	Inserted Flash Drive will be read	Read	Success

Table 6 shows a series of testing on the insertion of an external device into the printer. The test was conducted by inserting several flash drives. It indicates that the proponents got the expected output on the actual output resulting it to pass the test.

Table 7. Unlocking of Solenoid after a Complete Payment

Case 5: Unfastening of Solenoid after a Complete Payment			
Test	Expected Output	Actual Output	Remarks
1	The Solenoid will unlock	Solenoid unlocked	Success
2	The Solenoid will unlock	Solenoid unlocked	Success
3	The Solenoid will unlock	Solenoid unlocked	Success
4	The Solenoid will unlock	Solenoid unlocked	Success
5	The Solenoid will unlock	Solenoid unlocked	Success
6	The Solenoid will unlock	Solenoid unlocked	Success
7	The Solenoid will unlock	Solenoid unlocked	Success
8	The Solenoid will unlock	Solenoid unlocked	Success
9	The Solenoid will unlock	Solenoid unlocked	Success
10	The Solenoid will unlock	Solenoid unlocked	Success

Table 7 shows that out of the 10 trials made for the testing of solenoid lock, all of these were successful which means that for each trial of having the transaction amount

CONCLUSION

The operability of the kiosk depends on the signals sent to the microcontroller which includes the insertion of the coin to the coin acceptor and the outgoing of papers detected by the infrared line sensor which corresponds to the pages printed. This was made possible by writing the program dedicated to the specifications of the system that the researchers have set and by building circuitries appropriate to the goal of the project.

Relying on the survey conducted to the students and professionals, the idea of having a VendoPrint implemented on the institution gained high percentage of acceptance from both categories which provides a possible higher rate of patronage if implemented in the future.

On the other hand, after several trials and testing done by the researchers with the help of evaluators given with evaluation sheets, they conclude that they were able to meet the functions set including the security of income collection, which also concludes that the project is capable of providing its users the prototype's functionality and accuracy of providing coin-operated printing service.

RECOMMENDATION

The researchers of this technical study would like to recommend the following to the future researchers for further improvement:

- Adding a bill acceptor to allow payment in form of bills;
- Providing a mechanism or strategy for allowing options of printing in multiple sizes may also be improved;
- The faxing, copying and scanning feature of the printer unit used may be added to the services offered by the kiosk aside from printing;
- Since the prototype has no feature of notifying the user if there are remaining papers or ink on the printer's paper storage, an indicator can be installed which would signal that a maintenance person should be called. It can also be improved by adding a feature of sending an electronic message to the maintenance personnel once the paper or ink runs out.

- They also recommend developing a solution to the problem that would arise during a power failure.

REFERENCES

- [1] http://en.wikipedia.org/wiki/IPO_Model
- [2] <http://c2.com/cgi/wiki?SystemsDevelopmentLifeCycle>
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- [4] http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469
- [5] http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en023805