SMART DETECTION FOR HIGH WATER LEVEL

By

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FINAL PROJECT REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
for the Degree
Bachelor of Engineering (Hons)
(Electrical & Electronics Engineering)

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CERTIFICATION OF APPROVAL

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Universiti Teknologi PETRONAS
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Approved:

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Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

June 2009

CERTIFICATION OF ORIGINALITY

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

Nurul Ain Abd Rahman

ABSTRACT

The objectives of this project are to implement a water sensor to detect the increasing water and SMS system to warn personnel for safety precautions. The water sensor will detect the increasing water until it reaches a limit. RFID reader will send the signal with the data of personnel to the personnel mobile phone. By using GSM modem which it can be an external modem device; inserting a GSM SIM card into this modem, and connecting the modem to an available serial port on the computer, SMS will be sent through hand phone to the respective person in charge. The safety precautions can be taken after receiving the alert message. The methodologies involved are mastering Virtual Basic for the SMS system (GSM modem) and construct a water sensor. Radio Frequency Identification (RFID) will be linked to the sensor as it can transmit a signal. Simultaneously, at the end of this study, a small model is fabricated for further understanding of the project.

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CHAPTER 1
INTRODUCTION

1.1 Background of Study

During undergo the internship program at Telekom Malaysia Berhad (Kelantan), the cases of high water level into the cabinet during flood are on rise. The only means to prevent this is to continuously monitor the increasing of water level into the cabinet.

The cable department is in charge of providing the telephone lines, data, telegraph and telefax services to subscribers. The cable department is divided into the underground and the overhead cable. The underground cable is known as the main cable path. It starts from the MDF (Main Distribution Frame) test desk to manhole and finally to cabinets. Overhead cable starts from the cabinet to DP (Distribution Point) and continues to subscriber's homes .The schematic diagram of underground cable path is shown below:-

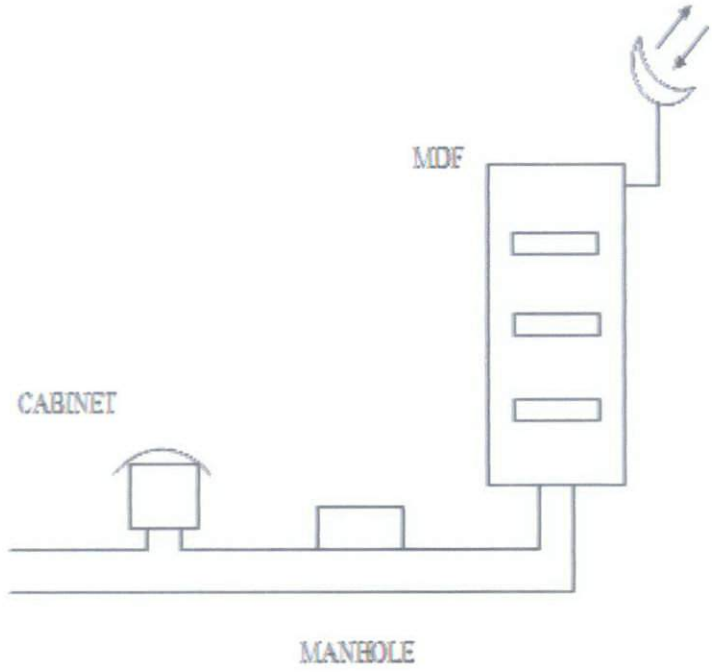


Figure 1 : Underground Cable Path

Cabinet is a flexibility point and is used for the termination of the primary cables and secondary cables. The cables pairs are terminated to terminating units/connecting modules. The unit/module used for primary cable pairs is known as Exchange-side (E-side), whereas for secondary cable pairs are known as Distribution-side (D-side). The connection between the E- side and D-side is done by using jumper wire. Cabinet also acts as a testing point when localizing faults.

On the other hand, the maintenance groups are responsible to do the maintenance job according to report order or docket. There is six phases of testing the docket in the maintenance guideline such as:

1. From LI (exchange) to verticals in MDF
2. From verticals to exchange side at cabinet
3. From exchange side at cabinet to distribution side at cabinet
4. From distribution side at cabinet to distribution point (DP)
5. From distribution point (DP) to last point, which located at subscriber's residential
6. Internal wiring and set (telephone and telephone socket) in subscriber's premises

This procedure is importance because it has some target to be achieved every year on dockets and maintenance quality.

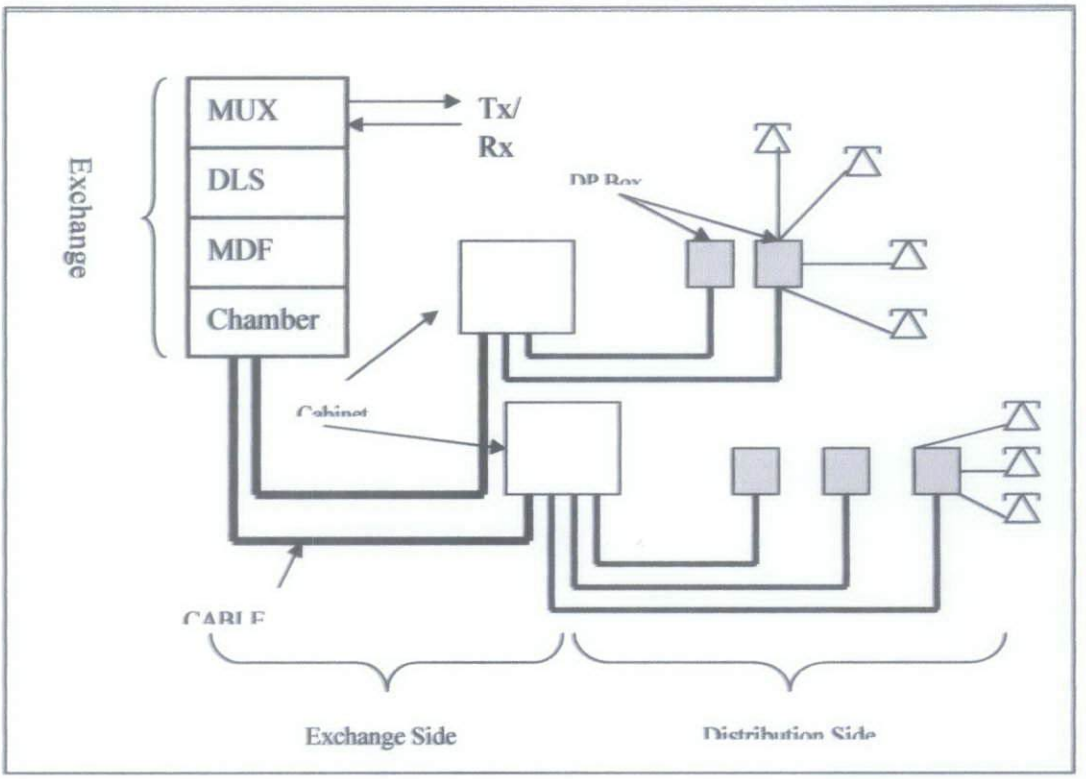


Figure 2 : Block diagram of Subscriber Line

So, here is where technology comes into play. The Radio Frequency Identification (RFID) allows the personnel in-charge to continuously monitor the increasing of high water level. And, they also will be informed about the status of the water by message sent through GSM modem.

The RFID is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID reader from RFID tags or transponders **[1].** An RFID tag is an item that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal and can also be used for other specialized functions. The second is an antenna for receiving and transmitting the signal **[2].**

The message to the technician is sent by the GSM modem, which function like a basic phone. GSM Modem is connected to PC to link the output from Microsoft Visual Basic in order to send SMS to receivers. This GSM Modem uses the HyperTerminal instruction that has been reprogrammed by Microsoft Visual Basic to trigger the sending sequence automatically **[3].**

1.2 Problem Statement

During flood, Operation and Maintenance (O&M) unit will face problem of increasing water into the cabinet. It happened at the low places. Low places will tend to flood during rain. Flooding sometimes will hinder the access to the cabinet. As the water is increasing and moving into the cabinet, it will suspend the telecommunication system. When the water level is high, it is impossible for the repair team to do maintenance at that moment. This is not because the cabinet itself filled with water, but the place itself is in flood. The restoration process will be done after the water is decreased to a safety stage. The SMS system is to be implemented as the safety precautions.

1.3 Objectives and Scope of Study

The objectives of this study are to implement a system to detect the increasing water by using water sensor and using GSM modem in order to warn O&M unit for the safety precautions during flood.

Besides, this project is to apply the RFID (Radio Frequency Identification) technology to reduce the delay of the telecommunication system. By employing the RFID (Radio Frequency Identification) technology, the aimed are to:

- Monitor the increasing of water level
- Be informed as the water passed the limit
- Reduce the rate of delaying of restoration process

The software involved is Visual Basic 6 to create the source codes which will be programmed into GSM modem. In making sure the project fulfills the requirement, the cistern system is another aspect needed to be understood before stowing into the feature.

CHAPTER 2
LITERATURE REVIEW

This system contains four parts, namely water sensor, the RFID, the SMS system and a specially designed computer program and the cabinet itself. All these work together to produce our **Smart Detection for High Water Level**.

2.1 Cabinet

Cabinet is a flexibility point and is used for the termination of the primary cables and secondary cables. The cables pairs are terminated to terminating units/connecting modules. The unit/module used for primary cable pairs is known as E-side, whereas for secondary cable pairs are known as Distribution-side D-side. The connection between the E-side and D-side is done by using jumper wire. Cabinet also acts as a testing point when localizing faults. The maximum numbers of cable pairs that can be supported are 600 pairs. Types of cabinet that are used in the local network, whether existing or currently practice are:

- APO Type

The cabinets come in two sizes, which are 900 and 1800 pair. Both cabinets are cylindrical and have a certain rocket shape with the same diameter. The three main parts are the base, the cover and the cap.

- Pouyet Type

Its shape is like a box where one part is for line connection to exchange while the other two parts is continues to distribution box. For exchange cable, it is situated in the middle of the cabinet and number of line installations depends on the number of subscribers.

- Krone Type

Its shape is similar to the pouyet type but it has different arrangements. Its inner side has 2 blocks that is the E/S that connects the line from exchange to cabinet and the D/S

that connects the line from cabinet to subscriber's homes. Mostly, this cabinet is available in housing areas or towns.

Figure 3 : APO type

Figure 4 : Pouyet type

Figure 5 : Krone type

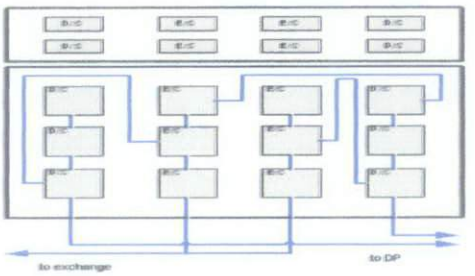


Figure 6 : Schematic diagram of APO Cabinet

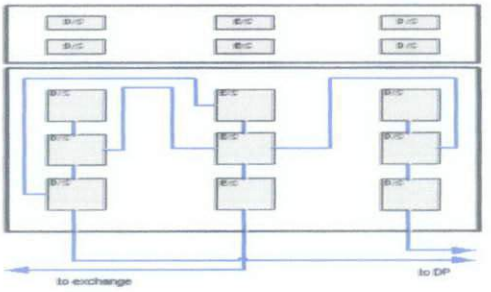


Figure 7 : Schematic diagram of Krone Cabinet

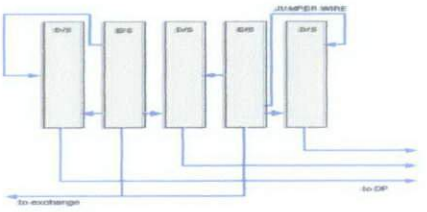


Figure 8 : Schematic diagram of Pouyet Cabinet

2.2 RFID

RFID is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders **[5].** An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. RFID (Radio Frequency Identification) is a mean of storing and retrieving data through electromagnetic transmission to an RF compatible integrated circuit. RFID systems have several basic components or technical characteristics that define them. These comprise of a reader/interrogator (receiver), including an antenna (the device that is used to read and/or write data to RFID tags), a tag/transponder (a device that transmits to a reader the read and/or write data to RFID tags), a tag/transponder (a device that transmits to a reader the data, known also as RFID transmitter) and the contact between them. RFID uses a defined radio frequency and protocol to transmit and receive data from tags.

A range of devices and associated systems are available to satisfy an even broader range of applications. RFID systems have a wide range of frequencies. For lower frequencies, it is less expensive. RFID ranges are from 850-900MHz and 2.4GHz-2.5GHz are defined as high frequencies and 300-500 kHz which is categorized as low frequencies. Despite this assortment, the principles upon which they are based are quite straight forward, even though the technology and technicalities concerning the way in which they operate can be quite sophisticated.

RFID tags can be divided into two major classifications according to their power source:

a) Passive tags

Passive tags can be either battery or non-battery operated, depending on the intended application. Passive tags reflect the RF signal transmitted to them from a reader or transceiver and add information by modulating the reflected signal. A passive tag does not use a battery to boost the energy of the reflected signal. It may use a battery to maintain memory in the tag or power the electronics parts that will enable the tag to modulate the reflected signal.

b) Active tags

Active tags contain both a radio transmitter and battery to power the transmitter. Active tags have an onboard radio and therefore have substantially more range

(~ 300feet/100m) than passive or "active/passive tags". Active tags are also more expensive compared to passive tags and, as with any battery-powered product; the batteries must be replaced after a certain time.

In this project, passive RFID tags are used. Passive RFID tags have no internal power supply **[6].** The minute electrical current induced in the antenna by the incoming radio frequency signal provides just enough power for the CMOS integrated circuit in the tag to power up and transmit a response. The passive tags signal by backscattering the carrier wave from the reader. This means that the antenna has to be designed both to collect power from the incoming signal and also to transmit the outbound backscatter signal **[7].**

2.3 GSM Modem

The main component in this system is GSM Modem (Global Systems for Mobile Communication). GSM Modem provides multiple applications such as the right industrial interfaces for GPRS class 8 data, voice, fax and SMS (Short Messaging Service). SMS application is the simplest way to deliver data to mobile phone because of the widely used and also the fastest way to get high-speed wireless data communication. A built-in SIM card reader makes it easy to plug. When a SIM card is inserted into that modem and powered up, that modem is all-ready to send out SMS (through correct programming approach using AT commands).

Figure 9 : GSM Modem

2.4 Water Level Sensor

The water level sensor used the mechanism of cistern. It functions as an indicator to indicate the water level as it increased to a certain level of high water level.

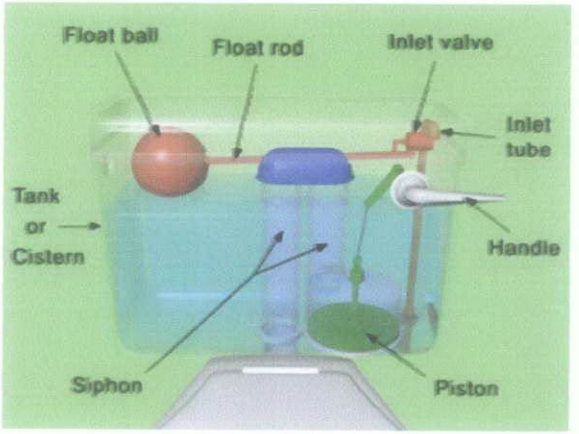


Figure 10 : Cistern and its components

2.5 Computer Program

Lastly, the specially designed computer program is built based on Visual Basic 6 and Microsoft Access. Visual Basic 6 is to create the interface for this program and Microsoft Access prepares the database. It is used to implement the software with the ability to control, sense and perform measurement.

CHAPTER 3
METHODOLOGY

3.1 Operation

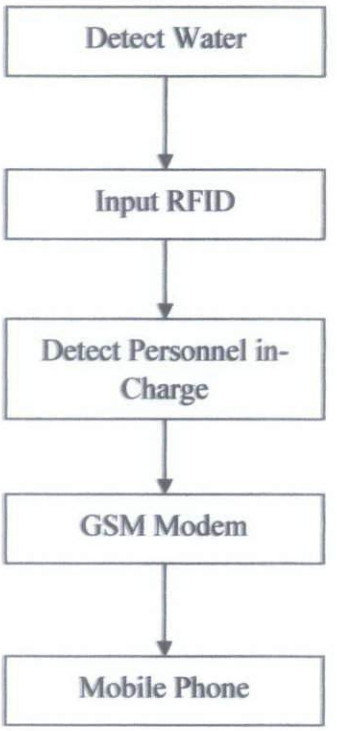


Figure 11 : Flowchart

3.2 Detailed Explanation

3.2.1 Detect Water

- Water sensor will detect the increasing water as it reaches the level.

3.2.2 RFID Reader

- RFID Reader will receive the signal from the tag.
- RFID Reader will scan the increasing of water as the water passes through the limit point.
- Light will turn on as it scanned the water.

3.2.3 Detect Personnel in-Charge

- Cabinet ID will match the following data; time/date, staff in-charge, message and communication port.

3.2.4 GSM Modem

- By inserting a GSM SIM card into this modem, the modem is connected to an available serial port on computer.
- SMS gateway can simultaneously support modem, provided that the computer hardware has the available communications port resources.
- GSM Modem will send the message which contain the cabinet ID, the appropriate time and date, staff in-charge name, and also the message of awareness.

3.2.5 Mobile Phone

- As the SIM is inserted to the GSM Modem, an instant message will be sent to the staff in-charge mobile phone.
- The following information will be display on staff in-charge screen; cabinet ID, the appropriate time and date, staff in-charge name, and also the message of awareness.

3.3 Overall Project Flowchart

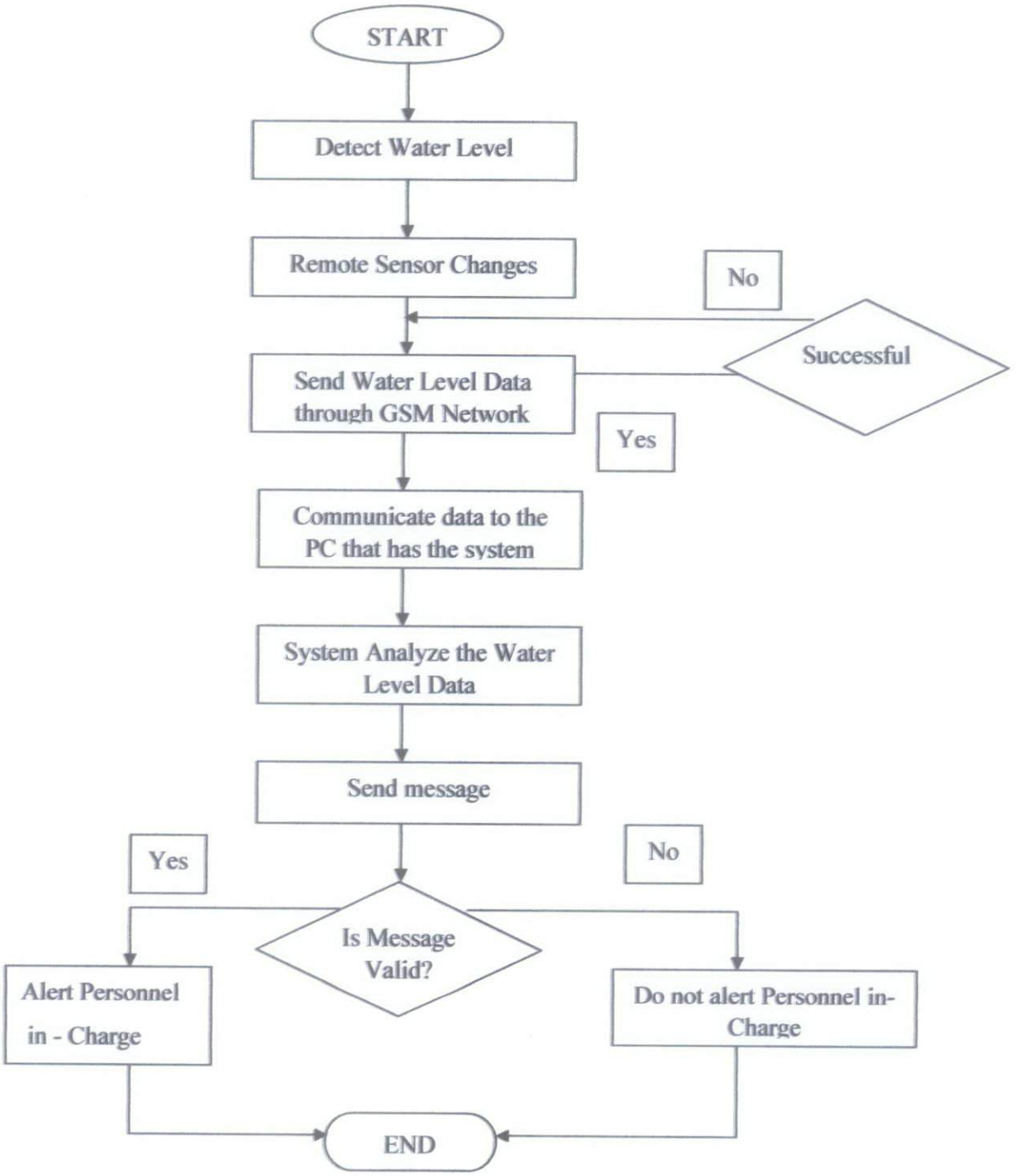


Figure 12 : Overall System Flowchart

CHAPTER 4
RESULT AND DISCUSSION

4.1 Text Delivered and It's Limitation

The interface through Virtual Basic is implemented and the text will be sent to mobile phone:

"*WBU001 has reached the high priority level and, and action should be takens immediately*"

The message indicates that the water level has increased to a certain limit. Once the SMS has been received, prompt action has to be taken.

The sender's original phone number has been set out in the SIM (Subscriber Identity Module) card, which was slotted into the GSM module. Therefore, the received SMS will reveal the original sender's phone number.

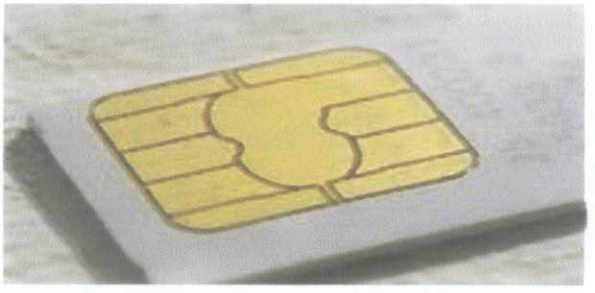


Figure 13 : SIM card

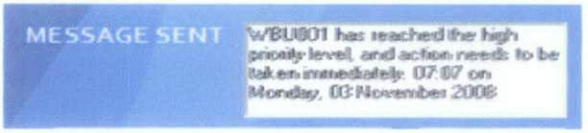


Figure 14 : Text message displayed on interface

Here, is the interface designed for Smart Detection For High Water Level. As the Cabinet ID is requested, the following information will be displayed as below.

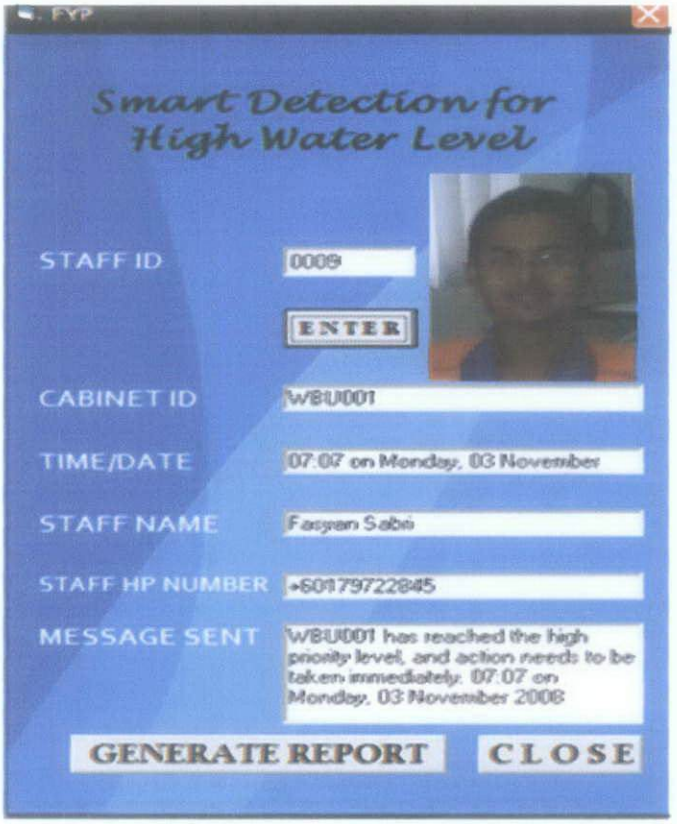


Figure 15 : Interface

The sample of database, and programming are shown below.

Location	rfID	Staff	HP	Time	Status
WBU004	0014644949	TEAM D	60179722845	6/10/2008 10:09:51 PM	1
WBU005	0014652725	TEAM E	60179722845	4/10/2008 1:39:14 AM	1
WBU002	0014653068	TEAM B	60179722845	4/10/2008 1:37:51 AM	1
WBU003	0014659565	TEAM C	60179722845	4/10/2008 1:39:18 AM	1
WBU006	0015250272	TEAM F	60179722845	3/10/2008 2:45:21 AM	0

Figure 16 : Database

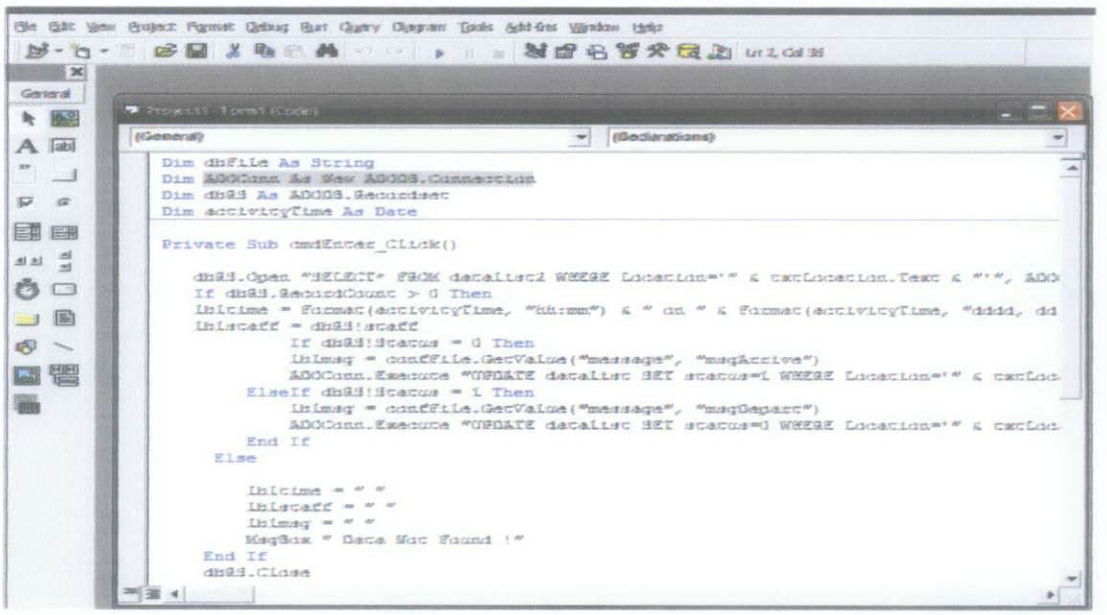


Figure 17 : Programming

Here is the interface that will be displayed if the wrong data is being key-in. It cannot match with the data kept in the storage data.

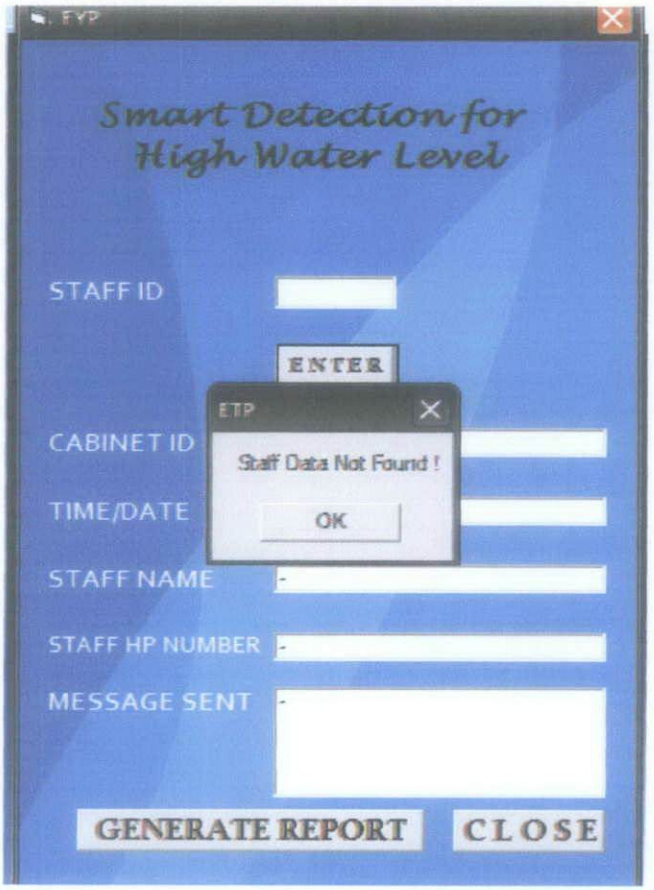


Figure 18 : Note found data interface

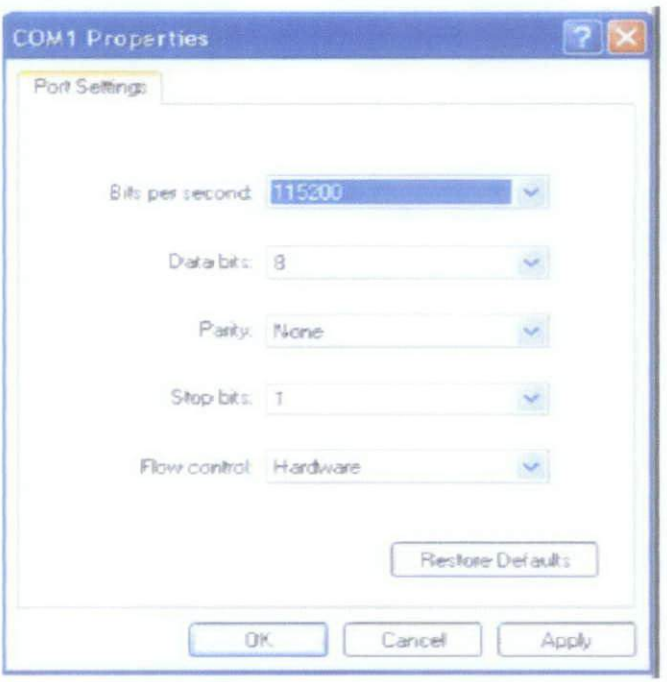
4.2 Modem Basic Operation

Instead of using GSM Modem, in order to make it operation, the connection is set by using Hyper Terminal.

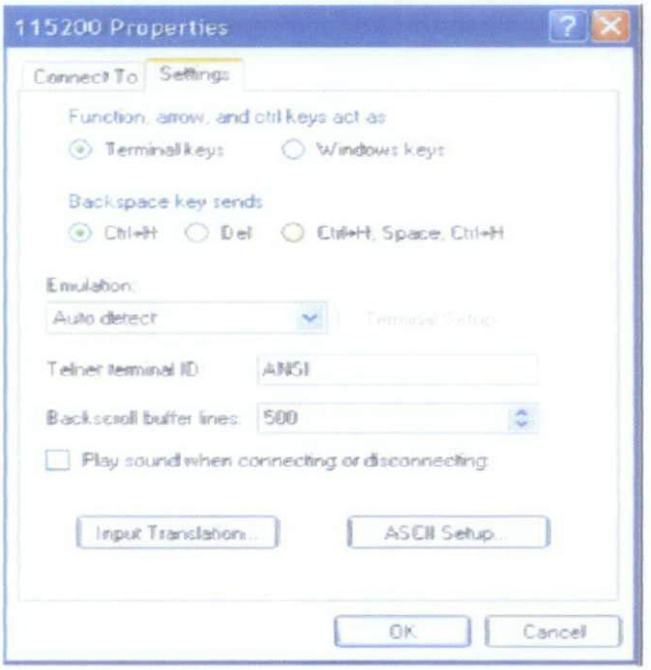
1. To establish the connection, firstly open the Hyper Terminal from All Programs → Accessories → Communications and setting up relevant parameters. The module baud rate is 115200

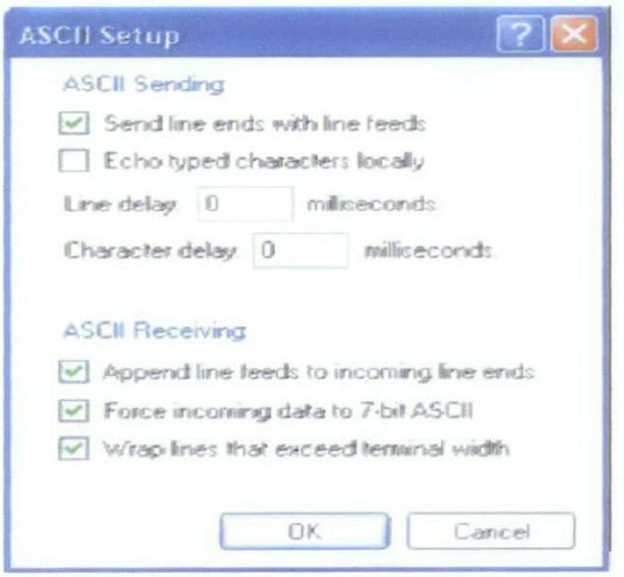
2. The usage port is then setting up.

3. Then is to setting up the parameters.

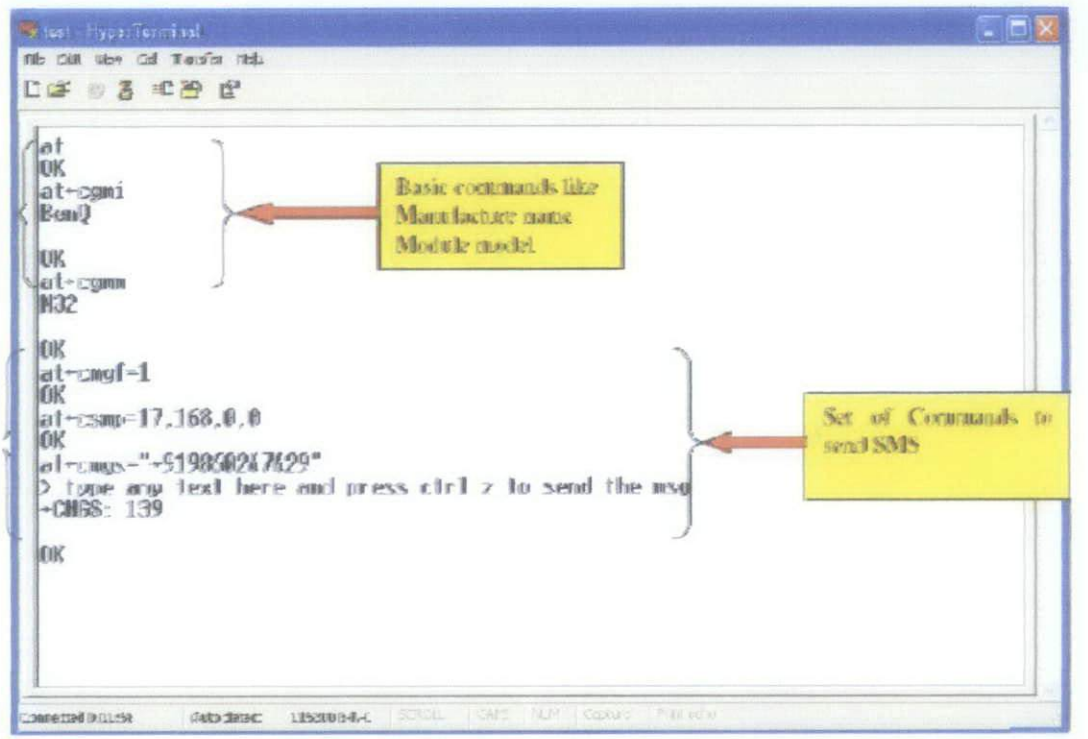


4. Then, setting up property in File menu of Hyper Terminal





In order to make sure it works properly, "AT" command is entered



4.3 Water Level Sensor

This water level sensor had been constructed in order to detect the increasing water. When the water is increasing until the certain level, the RFID tags will detect it and the data will be stored. Then, GSM modem will send the message to the mobile phone.

The prototype is constructed and it is working successfully as the floating ball reaches the limit point.

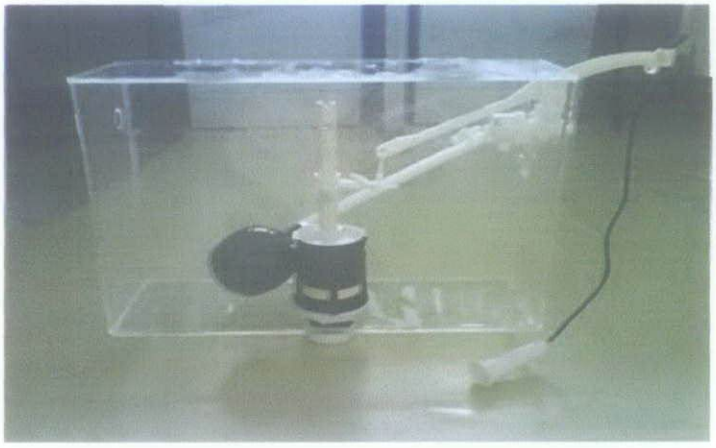


Figure 19 : Water Sensor

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The GSM modem will send the short message to the person in charge as the sensor detects the increasing of water to the limitation point. By implementing this system, safety precautions can be taken before the overflow water damages the communication system. In order to realization this project, the demand coding for the SMS detection is constructed by mastering Virtual Basic. Subsequently, a water sensor is created. The expected result is being analyzed to fulfill the objectives. A small-scale model is fabricated. Recommendations on the applicability of this concept would be highlighted.

Here, the conclusion of the project:

i. A prototype is built to integrate between hardware, software and the network that able to disseminate warnings to user.
ii. The potential of system damage can be reduced through an economical non structural approach.
iii. The changes on water level will be monitored and used to disseminate warning to staff in-charge.

5.2 Recommendation

These are some improvement that can be done to the system for better end product;

i. Upgrade the system to trace tag holder location by implementing real-time-location

ii. Upgrade the system by using active RFID for longer distance detection

iii. Upgrade the system to alert the technician when the signal is not receive within a period of time, for instance, 10 seconds.

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