# AUTOMATIC METER READING

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**This report is submitted in partial fulfillment of the requirements for award of Bachelor of Electronic Engineering (Computer Engineering) with Honours**

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FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

**BORANG PENGESAHAN STATUS LAPORAN**

**PROJEK SARJANA MUDA II**

AUTOMATIC METER READING

**Tajuk Projek**    :    ...............................................................................

**Sesi Pengajian**    :

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TEI YAH LI

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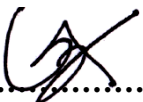
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*Dedication to my family especially my parent, brothers, sister and to my entire friend.*

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# ABSTRACT

In order to upgrading the automatic meter reading system for more user friendly and delivery good service to the user, and enhance the current automatic meter reading system is developed. This project is intent to create the function to make user can access to the system anywhere and anytime. This project system can reduce the manpower and user can check and know the power consumption had been used. Besides, the use of billing system user also can limit they self to reduce using the electric. There is important to design a interface of a system in order to make sure the system easy to used, clear and user friendly. The programming language had been use for this project is visual basic and the database of the system is Microsoft Office Access.

# ABSTRAK

Untuk menaik taraf sistem automatik bacaan meter kepada lebih mesra untuk pengguna dan menyampaikan perkhidmatan yang lebih baik kepada pengguna, dan meningkatkan sistem automatik bacaan meter terkini. Projek ini adalah niat untuk mewujudkan fungsi untuk membuat pengguna boleh akses ke dalam sistem di mana-mana sahaja dan pada bila-bila masa. Sistem yang dibuat dalam projek ini boleh mengurangkan tenaga kerja dan pengguna boleh menyemak dan mengetahui penggunaan kuasa telah digunakan. Dengan menggunakan sistem bil ini pengguna juga boleh menghadkan mereka sendiri untuk mengurangkan kegunaan elektrik. Antara muka untuk rekabentuk bagi sistem ini adalah penting itu hentaklah mudah difahami dan digunakan. Bahasa pengaturcaraan telah digunakan untuk projek ini adalah visual basic dan sistem pangkalan data ialah Microsoft office Access.

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# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| AMR | - | Automatic meter reading |
| BSC | - | Base Station Controller |
| BSS | - | Base Station Subsystem |
| BTS | - | Base Transceiver Station |
| GSM | - | Global system for mobile communication |
| GMSC | - | Gateway Mobile Switching Center |
| GUI | - | Graphical user interface |
| MSC | - | Mobile Switching Center |
| PSTN | - | Public switched telephone network |
| SMS | - | Short Message Service |
| VB | - | Visual Basic |

# CHAPTER I

# INTRODUCTION

## 1.1    Introduction

Automatic meter reading is a technology that will automatically collecting consumption, and data status from metering devices such as gas, electric or water meter and transferring that data to a central database for billing, troubleshooting, and analyzing.

In Malaysia, the automatic meter reading (AMR) system that had only been used for the large or industrial customers and the system is only for monitoring but cannot controlling the power load in the customer side. There is a lot of the ordinary customers are using the conventional system which is humanity dependent. That is waste a lot of the human power to go one by one house and the conventional system that cannot avoid human mistake.

Thus, the purposes for this project are to upgrading the metering system which user can use access to the billing system and check their bill at anywhere and anytime. The conventional system meter reading system is humanity dependent and sometime the bill will be lost course by human mistake. Using this project system can reduce the manpower and user can check and know the power consumption had been used. Infect, user also can limit they self to reduce using the electric.

First of all, creating a system that can calculate the payment depend the power consumption that had been used. The system is including the database which is save the payment history to the database, so that user can compare that payment for each month. This system will make user more easily check their bill time by time.

## 1.2    Problem Statement

The problem statements of this project are:

- How to calculate the electric bill effectively.
- How user can access to the system and check their bill remotely.
- How to avoid human mistake that mistaken the reading on the power meter.

## 1.3    Objective

The objectives of this project are:

- To enhance the billing system that user can more easily check their electrical bill remotely.
- To reduce the humanity dependent and avoid human mistake when taking data.
- To delivered better service to the customer.

## 1.4    Project Scope

The scopes of this project are:

- Familiarization with the Automatic Meter Reading system. This project supported with billing system and user can more easily check the current balance but that is no include the billing.

- Familiarization with the system interface. The software will be used is visual basic and the database Microsoft office access.
- Familiarization with the GSM system. GSM is communicating between the data base and user mobile.

## 1.5    Intend Audience

The primary audience of this project will be Powering The Nation and the users of it. User can get the friendlier and better service from this upgrading system. By using this system user can checking their bill anytime and anywhere from that user can know that how many power consumption they use already so they can limit they self to reduce using the electric.

Beside that, Powering The Nation can reduce the human dependent so they no need to sent people one by one house to get the reading of the meter. Indirectly, that can avoid human mistake.

## 1.6    Expected Result

At the end of this project, a upgrading system of probability will be built on a visual basic interface system. This system will automatic generate the power consumption unit and then will calculate the power consumption according to the calculate method of Powering The Nation. User can access to the system to check their power consumption, the system will calculate and give the result to user the power consumption of they had used.

# CHAPTER II

# LITERATURE REVIEW

## 2.1 Automatic Meter Reading

Automatic meter reading (AMR), is a technology that automatically collecting consumption, diagnostic, and status data from metering devices such as water, gas, or electric meter and transferring the data to a central database for the purpose billing, troubleshooting, and analyzing. This technology mainly helps the energy provider save the manpower so they no need send worker by periodic trips to read the meter. The other benefit of this technology is the billing system can make based on near real-time consumption. AMR technologies include handheld, mobile and network technologies based on telephony platforms (wired and wireless), radio frequency (RF), or powerline transmission.

## 2.1.1 Handheld of AMR

A meter reader consist a handheld computer and a built-in or attached receiver or transceiver that use radio frequency to collect meter readings from an AMR capable meter. Handheld computers may used to manually enter readings without the use of AMR technology as a backup but that not support full data which can be accurately read using the meter reading electronically.

### 2.1.2 Mobile

Mobile meter reading is where a reading device is installed in a vehicle. The reading device will automatically collect the meter readings when the meter reader drives the vehicle. For mobile meter reading the reading equipment includes navigational and mapping features provided by GPS and mapping software. The reader does not need to read the meters in any particular route order, just only drives the service area until all meters are read.

### 2.1.3 Fixed network

A method where a network is permanently installed to capture meter readings is called fixed network. That consists of a series of antennas, towers, collectors, repeaters, or other permanently installed infrastructure to collect transmissions of meter readings from AMR capable meters and get the data to a central computer. There have several types of network topologies used to get the meter data back to a central computer. The most common is a star network, where a meter transmits its data to a central collector or repeater. There is some systems use only collectors which receive and store data for processing. Others also use a repeater which forwards a reading from a more remote area back to a main collector without actually storing it. A repeater may be forwarded by RF signal or sometimes is converted to a wired network such as telephone or IP network to get the data back to a collector.

Mesh networks are developing by some manufacturers, meters act as repeaters passing the data to nearby meters until it makes it to a main collector. Mesh network may save the infrastructure of many collection points, but is more data intensive on the meters. The disadvantage of mesh networks is may need more power for increased frequency of transmitting. It requires that the meter devices are receivers as well as transmitters potentially making individual transceiver cost higher. The additional cost may be more than by the savings of multiple collectors and repeater antennas and finding places to mount them.

Some fixed network systems are also able to install as a hybrid AMR system which is mobile and fixed network are intermixed by design. A hybrid system, there is some part of the system is read by fixed network, and another parts may read by mobile or other technology, or both. Utilities with low density countryside areas may not cost justify the fixed network infrastructure for parts of their service area, using it only for higher density zones or commercial accounts. Some hybrid networks allow reading of a meter by both methods at the same time as a source of redundancy.

### 2.1.4 RF technologies commonly used for AMR

Below are the technologies there commonly used for AMR
- Narrow Band (single fixed radio frequency).
- Spread Spectrum.
    - Direct-sequence spread spectrum (DSSS)
    - Frequency-hopping spread spectrum (FHSS)

There are also meters using AMR with RF technologies such as cellular phone data systems, ZigBee, Bluetooth, Wavenis and others.

### 2.1.5 Power line communication

Power line communication (PLC) is a method electronic data is transmitted over power lines back to substation, and then convey to a central computer in main office. The network being the distribution network which the utility has built and maintains to deliver electric power is considered a type of fixed network system. Some providers have interfaced gas and water meters to feed into a PLC type system.

### 2.1.6 AMR Hosting

AMR Hosting is a back-office that allows a user to check his/her electricity, water, or gas consumption over the Internet. A centralized database by high-end data software is used to collect and stored in all data in near real-time. By using various

online analysis tools user can view the data via a secure web application, and can analyze the data. The user can easily chart load profiles, analyze tariff components, and verify his/her utility bill.

### 2.1.7  Old conventional

Below are the disadvantages of the old conventional meter which is stand alone meter:

- Highly human dependant.
- Human errors cannot be avoided.
- Energy Audits performed based on bill collection which is highly inaccurate.
- Billing done mainly on estimated or monthly average basis.
- No able to monitor and control discrete loads.
- Billing cycle requires more time.
- Meter data used only for billing cannot help in analysis like demand analysis, energy audit, and pinpointing losses.

Although there are many disadvantages for the old conventional meter but there still have some important for old conventional meter that is old conventional is support for the rural area and less resident area using old conventional is more save cost on there.

### 2.1.8  Advantage of AMR

Below are the advantages of the old AMR:

- Able to detect tamper events and outage occurrences.
- Remotely connect or disconnect power supply through meter.
- Calculate transformer loading and sizing from interval data
- 15 minute interval data gives accurate load information for supply scheduling, switching operations, planning etc

- Monitor voltage at each premise to know conditions when to operate capacitor switches or regulators

- Consistent and granular data for improved accuracy

## 2.2 Global System for Mobile Communications (GSM)

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.[6] GSM is a technology used open digital cellular to transfer the voice and data. It is use cell phone service that carrier the GPRS network to search the cell phone tower near by the area.

### 2.2.1 GSM System Architecture

A cell containing a Mobile is formed by the radio coverage area of a Base Transceiver Station (BTS). One Base Station Controller (BSC) is control a group of BTSs. The BTS and BSC are forming the Base Station Subsystem (BSS). The combined traffic of the mobile in their own cells is routed through the Mobile Switching Center (MSC). Databases are required for call control and network management: the Home Location Register (HLR), the Visitor Location Register (VLR), the Authentication Center (AuC), and the Equipment Identity Register (EIR).

The GSM system network can be divided into few subgroups that are interconnected using standardized interfaces: Mobile, Base Station Subsystem (BSS), Network SubSystem (NSS), and fixed line user or computer. These subgroups are further comprised of the components in the following sections.

Figure 2.1: GSM system architecture

### 2.2.1.1 The Base Station Subsystem (BSS)

The Base Station Subsystem (BSS) ensures transmission and management of radio resources consists of the Base Transceiver Station (BTS) and the Base Station Controller (BSC).

Base Transceiver Station (BTS): is responsible for providing the wireless connection between the handset and the wireless network. A series of radio transceivers that provide the points of entry to the GSM network was used by GSM called 'BTSs'. A BTS is comprised of a set of radio transmitters and receivers, and antennas to connect the mobile to a cellular network. The BTS takes in the calls within its coverage zone and ensures their proper handling.

Base Station Controller (BSC): Maintenance is the primary function of the BSC. The BSC also manages the routing of communications from one or more base stations. A BSC controls a group of cell towers. When the phone moves from one cell tower boundary to another BSC is responsible for setting up a voice or data call with the mobile terminal and managing handoff, without disruption of service. The BSC manages radio resources and ensures the passing of a subscriber from one cell to another with no affect of the quality of the communication. The BSC also serves as the switch for concentration towards the Gateway Mobile Switching Center (GMSC).

### 2.2.1.2 Network SubSystem (NSS)

Network SubSystem (NSS) establishes communications between a cell phone and another MSC, and takes care of the Short Message Services (SMS) transmission