AN ANDROID-BASED SMART SECURITY TOURING SYSTEM FOR REAL-TIME DATA RECORDING USING NFC, GPS AND GSM TECHNOLOGY.

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AN ANDROID-BASED SMART SECURITY TOURING SYSTEM FOR REAL-TIME DATA RECORDING USING NFC, GPS AND GSM TECHNOLOGY.

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Dedicated especially to my Father, Mother, my siblings, my beloved mate and my

truly friends.

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ABSTRACT

Number of robberies increasing by day thus it is very crucial to have a security guard touring system in every place. Most of the current market-ready security guard touring system is not a cost-efficient and real-time data recording system. Guards can easily manipulate the security touring system by skipping the checkpoints, or by manually transferring the data from the checkpoints because most of the guard touring system is not a real-time data recording. Despite this, guard are not safe during patrolling period because there is no connection between main centre and guard. If they are attacked by any intruders during touring, management authorities unable to track down the current location of the guard during the attack. For my project, an android-application is built which comprise of NFC, GSM and GPS technology and can provide real-time data recording. This application can send the data captured from the NFC tag at the checkpoint, GPS current position, latitude and longitude magnitude to the personal computer at the main control centre. Besides, an interactive GUI is also built and will be used in main control centre in order to process and store the data sent by the android-application via SMS. In this way, all the data sent will be protected. Basically, this project will be a complete guard touring system consists of guard details, phone number and checkpoint details which only can be viewed by administration.

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CHAPTER 1

INTRODUCTION

The security touring system is becoming very crucial in residential areas, business buildings, schools and universities. Although those areas have a guarding system the number of robberies is still increasing by the day. This is certainly because of inefficiency of the current security touring system. Guards can easily manipulate the security touring system by skipping the checkpoints, or by manually transferring the data from the checkpoints because most of the guard touring system is not a real-time data recording. Despite it is not real-time monitoring system, management authorities will not be able to track down current location of the guard, in case guard attacked by any intruders during patrolling period. Thus, safety of the guard not considered in the current guard touring system.

An android application can be used as medium for producing real-time data recording because it is user-friendly and safe in protecting data. For my project, an android-application is built with the use of NFC, GSM and GPS technology which can provide real-time data recording. This application can send the data captured from the tag at the checkpoint, GPS current position, latitude and longitude magnitude to the personal computer at the main control center. Besides, an interactive GUI is also built and will be used in main control center in order to process and store the data sent by the android-application via SMS. In this way all the data sent will be protected. As a conclusion, the android-application will be used as a medium in capturing all of the necessary information such as location and time and send the data to the main center which is then will be stored in a GUI system in the personal computer at the main center. Basically, this project will be a complete guard touring system which will have all the guard details, phone number and checkpoint details which only can be viewed by administration.

1.1 Background of the Project

An android-based smart Security Touring system for Real-time Data Recording using NFC, GSM and GPS Technology is the title of this project where the main idea is to implement a system on the security guard touring system in order to solve the problem faced by current market-ready security touring system. This system will be a smart and intelligence system that is able to solve and minimize the problems faced by the current market-ready security touring system. Basically, the use of android can reduce the usage of complex hardware and overall cost of security guard touring system. This system will use the NFC, GSM and GPS technology which are already available in the android itself. Thus, surely this project will be very convenient and also very efficient in producing real-time data recording. The application is able to receive data from the NFC tag and able to send a message automatically to the main CPU at the main center. The entire objective, scope and other will be discussed in the next chapter.

1.2 Problem Statement

The security touring system becoming very crucial in every place such as residential, business places, universities and schools as the number of crime rates is increasing by the day. But, the problem with the current security touring system is it is not cost-efficient, real-time data recording and not easy to set up. In the earlier system, when the security guard is starts moving from one checkpoint to another, he or she must swipe the specific tag in every checkpoint using access cards. The data recorded will not be available in main system automatically as they have to manually transfer the data after the patrolling is done. In this case, the problem is, sometimes all the data can be lost. And, in most cases the system unable to retrieve the old data which is very important for management to track back all the guard patrolling information.

In addition, in the current market-ready system the guard can easily manipulate the security touring system by skipping the checkpoints or just transferring the data in main system without patrolling the respective area. Besides, the guard is unable to notify the person in the main center if he or she attacked by robbers during the patrolling period. And, also the current system will not be able to track down the current location of the guard during the attack. As a conclusion, the robbery will still happen because the current system has more constraints.

1.3 Objectives

To study on Real-Time Data Recording which are developed with several objectives. Those objectives are:

a) To study on java based android application system and functionalities.
b) To develop an android-application which comprise of Near Field Communication (NFC), Global System for Mobile Communication (GSM) and Global Positioning System (GPS) technology.
c) To develop a Graphical User Interface(GUI) which can record and save the data captured in android-application.

1.4 Scope of the Project

The scope of this project is to build a system that will function properly based on the objectives and to solve problem faced as much as it can. The scope of this project is to build a system using android application. The Java will be used for programming and building this application. The project scope is to capture data from the tag and send it automatically to the main CPU at the main center. And at the main center, a Graphical User Interface (GUI) will be developed to receive and store the data. The entire process is a real time data recording which means there is always a link between the android, tag and main CPU at the main center.

Basically, the scope for my project based on the following statements :

a) Develop an android-application for Smart Security Touring system using Java coding.

b) Android-development based on NFC, GSM and GPS technology to produce real time data recording.

c) Develop graphical user interface (GUI) to process and store real time data received from android-application.

CHAPTER 2

LITERATURE REVIEW

2.1   Literature overview

This chapter will explain about the comparison between Market ready security touring system. Besides that, Introduction of Near Field Communication (NFC), Global System for Mobile Communication (GSM) and Global Positioning System (GPS) is also included in this chapter where advantages, disadvantages and potential development of technology are discussed. A comparison between Java and other programming language is also comprised together with this topic. Moving on to real-time data recording, it is overviewed using technical parts of the project.

2.2   Market ready Security Touring System

There are two types of security touring systems are available in Malaysia. Mostly the system is comprised in two types, conventional and also digital. They are conventional clock system and digital electronic system. The following subtopics will explain and compare some market available security touring system in Malaysia. Both of the systems also records the time and date when the security guard reaches the designated location.

2.2.1 Mechanical Watchman Clock

Figure 2: Mechanical Watchman Clock

In the mechanical watchman clock, the security guard carries the watchman clock to each checkpoint where a numbered key is being fixed at the designated location. That key will then be inserted into the watchman clock where it will make an imprint to the carbonized paper tape. The management people will collect the watchman clock from the security guard whenever they want to check the patrol record. They need to unlock the watchman clock and take out the paper tape and check the record. These clocks are provided, in addition to the usual clock dial, with a record dial having identifying indicia for the various stations and graduated to indicate hours and fractional parts thereof. This dial is perforated or otherwise marked by the insertion of a special type of key to which the necessary impulse is given to mark the dial by a part of the clock mechanism. While it is more or less difficult to falsify the record dial, it is necessary each day to insert a new dial and wind the clock mechanism at the office of the plant.

However, watchman clock carried by the watchman can be abused so as to make the mechanism inoperative and thus afford an excuse to the watchman for his failure to turn in a completed record of his rounds. Besides, the clock dial used need

to be replaced with a new one for daily basis. And, all the records in the paper tape can be lost as well.

2.2.2 Digital or computerized guard tour patrol system

Figure 2.1: Various types of digital device for touring system

Figure 2.2: UMEI Guard Patrolling system

The security guard brings digital recorder and go to those locations and read the checkpoints / station points. Each checkpoint has a unique serial number at the message button, so that user or the guard tour patrol system can identify it is located at which location. Some guard tour patrol systems have software installed in a computer. After the data in recorder is downloaded to the computer, it can process the data and produce reports. If the security guard is never patrol according the timing being instructed, the "missed patrolled points" will be highlighted in the guard tour patrol system's report. Basically, this electronic device that is used to monitor the security guards patrolling patterns and the time they reached the specific locations. From the report, we can know where the guards were and if they have performed their duty as per instructed. A guard tour patrol system also known as digital watchman clock, electronic watchman clock, computerized watchman clock.

However, this digital watchman clock is very costly and comprises of many devices to operate. They will have a RFID reader device, USB serial cable, RFID Tag, and memory card. Another drawback of this system is it is not a real-time monitoring system which means the checkpoints information collected by guard via

RFID reader must transferred manually to the computer. Besides, management authorities unable to track back guard current location in case guard attacked by intruders during patrolling period.

2.2.3 Comparison between the market ready Security Touring System

Table 2.0: Comparison between the market ready Security Touring System

Product	Record time and location	Patrol record	Retrieving old data	Trace back security guard location	Real time data recording	Cost < RM 1000
Watchman clock	✓	✓	✗	✗	✗	✓
Digital	✓	✓	✓	✗	✗	✗

2.3 Introduction to Near Field Communication (NFC)

Figure 2.3: Type of NFC (peer to peer mode)

In NFC, the communication occurs when two NFC compatible devices are brought together less than four centimeters, or simply by touching themselves. It

operates at 13.56 MHz and can transfer data up to 424 Kbits per second [1]. In an NFC model two devices are involved in the communication, which are called initiator and target. Initiator is an active NFC device which is responsible for starting the communication. Also it has an embedded energy component whereas target can be either a tag, RFID card or an NFC device which responses the initiator's requests [2].

One of the advantages of NFC technology is that mobile devices can be used both as information storage or an NFC reader. They can read information from NFC tags and display that information on the screen with an ability to make additional processing. Also they can be used as a digital storage e.g. storing credit card information.

Other most important advantages of NFC technology include:
   a) The technology is compatible with existing RFID
      structures, existing RFID tags and contactless smart cards[1].
   b) It is easy to use and familiar to people because users.
      don't need to have any knowledge about the technology. All a user has to do is to start communication by bringing two devices together [3].
   c) The transmission range is so short that, when the user separates two devices, the   communication is cut. This brings inherent security. If there isn't any other device close, there is no other communication.

NFC equipped devices normally operate in three different modes; Card emulation mode, peer-to-peer mode, and reader-writer mode. In card emulation mode NFC device behaves like a reader e.g. NFC tag. This tag has the capacity to store data securely and the applications of this mode are electronic ticketing and payments. In peer to peer mode two devices equipped with NFC can exchange data directly by touching each other.

Applications of P2P mode are transferring data between laptop and cell phone. The printing of data is by touching laptop with printer. In reader writer mode NFC device can read or write the tags in similar fashion like RFID tags [6]. NFC can read and write data on RFID chip. And RFID (Radio Frequency Identification) chip

can be embedded in everything starting from paper to machinery. RFID is manly used for tracking and identification through radio waves [04]. NFC core applications include connecting electronic devices. Accessing digital contents and making contactless transactions.
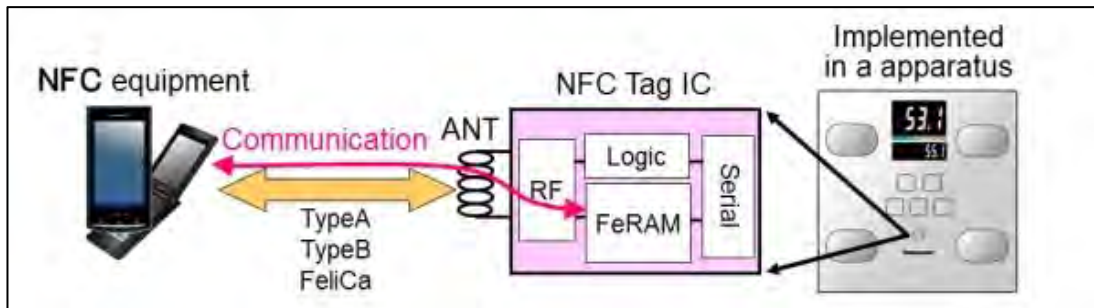

Figure 2.4: Example of NFC communication modes

2.3.1 NFC Modes of operation

RF signal transmission between transmitter and receiver creates the main distinction between NFC and other RF wireless communication modes. NFC depends upon straight magnetic/electrostatic coupling between devices instead of freely broadcasting of radio waves, such as in Wi-Fi. NFC devices can operate on low electric or magnetic field strengths due to its short range communication property [4]. Field Strength of NFC system can operate either in active or passive mode depending upon requirements.

a) Active mode

In this mode both devices generate RF (radio frequency) field to transfer data. In this situation any of the devices can be the initiator and other will be the target. While in passive mode, only one device generates the RF field and other uses load modulation to transfer data. In this situation initiator of the communication will generate field and target will use load modulation. During the communication, the initiator starts the communication in a particular mode at a specific speed. Target finds out the current speed and replies back to the initiator.

Termination of the communication takes place either when two devices move out of the range or application gives command to terminate it [1]. During communication either initiator or target generates RF field of level H min that does not go beyond the field level of H max.

b) Passive mode

This mode has a key benefit for battery powered devices. For battery powered devices low consumption of battery is the basic priority. Thus NFC allows battery powered devices such as cell phones to operate in passive mode. In this mode RF field is generated on the other side. Thus battery power is saved that was needed to be used for generating RF field. In passive mode target operates continuously between H min and H max magnetic field strength [9]. NFC protocol is also compatible with connectionless smart card protocols like Felicia and Mifare. NFC device can work with both smart card and smart card reader. Another benefit of he NFC device is that it can be used as smart card, as well as smart card reader [1]. Devices are unable to change mode of communication (Active/Passive) during single transaction unless target is removed or deactivated. Even transfer speed of target to initiator and vice versa may not affect the change in mode.

2.3.2 NFC standards and protocols

Table 2.1: NFC standards and Protocols

Mode Details	ISO/IEC 18092	ISO/IEC 14443	IOC/IEC 15693
Mode of Operation	Equipment to equipment communication (NFC mode)	Reader to Tag communication (PCD1 mode)[a]	Reader to Tag communication (VCD2 mode)[b]
Power supply	Active and Passive	Passive	Passive
Communication Distance	10 cm	10 cm	1 m
Data Rate (kbps)	106, 212, 424	106	≥ 26