

**SMART DEVICE TRACKING SYSTEM USING RFID.(DeviceTrex)**

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## ABSTRACT

Smart Device Tracking System Using RFID (DeviceTrax) is a system developed to track the devices at laboratory. The devices that can be tracked are switches and routers at block X, FSK 11, which are located inside the Faculty of Computer Systems & Software Engineering (FSKKP) laboratory. Devices are tracked by implementing new technology which is Radio Frequency Identification (RFID). This technology is using Radio Frequency (RF) to transmit signal in order to track the devices. The problem faced by FSK 11 laboratory is the weak security implementation to protect the devices. Admin just use door lock system as a security in this laboratory. Because of the weak security and no special protection for devices inside the laboratory, last year, there is a case where a router is missing. To overcome this problem, DeviceTrax is developing in order to enhance the current security system. The methodology that is used in this system is Software Development Life Cycle (SDLC). As we know, SDLC can be divided into five phases which are, planning, analysis, design, implementation, and maintenance. Every phase must be followed step by step in order to be more systematic and well arranged. This system is developed by using RFID passive tag, RFID antenna, RFID reader, and laptop as a host computer for hardware parts. While for software parts, these systems use Visual Basic.net, and Microsoft Access 2007 for database. The result from this system is, if the RFID tag shows red colour, the message box will inform that the device is not found and the admin must take action. This system has successfully developed and runs smoothly.

## ABSTRAK

Sistem Bijak Mengesan Peranti Menggunakan RFID (DeviceTrax) adalah sistem untuk mengesan peranti di makmal. Peranti yang boleh dikesan adalah switch dan router di blok X, FSK 11, yang terletak di dalam makmal Fakulti Sistem Komputer & Kejuruteraan Perisian (FSKKP). Peranti dikesan dengan mengaplikasikan teknologi Radio Frequency Identification (RFID). Teknologi ini menggunakan Radio Frequency (RF) untuk mentransmisikan signal untuk mengesan peranti. Masalah yang dihadapi oleh makmal FSK 11 adalah implementasi keselamatan yang lemah untuk melindungi peranti. Admin hanya menggunakan sistem kunci pintu sebagai keselamatan di makmal ini. Kerana keselamatan yang lemah dan tidak ada perlindungan khusus untuk peranti di dalam makmal, pada tahun lalu, terdapat kes di mana sebuah router telah hilang. Untuk mengatasi masalah ini, DeviceTrax dicadangkan untuk meningkatkan sistem keselamatan di makmal ini. Metodologi yang digunakan dalam sistem ini adalah Software Development Life Cycle (SDLC). Seperti yang diketahui, SDLC boleh dibahagikan kepada lima fasa iaitu, perancangan, analisis, lakaran, pelaksanaan, dan penyenggaraan. Setiap tahap harus diikuti langkah demi langkah untuk memastikan sistem ini lebih sistematik dan teratur. Sistem ini dihasilkan dengan menggunakan tag pasif RFID, antena RFID, RFID reader, dan laptop sebagai tuan rumah. Manakala untuk bahagian perisian, sistem ini menggunakan visual basic.net, dan Microsoft Access 2007 untuk database. Keputusan daripada sistem ini, jika tag RFID menunjukkan warna merah, kotak mesej akan memaklumkan bahawa peranti tidak ditemui dan admin harus mengambil tindakan. Kejayaan sistem ini telah dicapai dan berjalan lancar.

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**LIST OF ABBREVIATION**

DeviceTrex	-	Device Tracking
RFID	-	Radio Frequency Identification.
UHF	-	Ultra High Frequency
SDLC	-	Software Development Life Cycle
SDK	-	Software Development Kit
GUI	-	Graphical User Interface
VB.NET	-	Visual Basic.Net

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## **CHAPTER 1**

### **INTRODUCTION**

The first chapter of this report presents an outline of the entire project and overview what actually this project will do. Other than that, this chapter also will give an introduction into problem statements, objectives, scopes and thesis organizational.

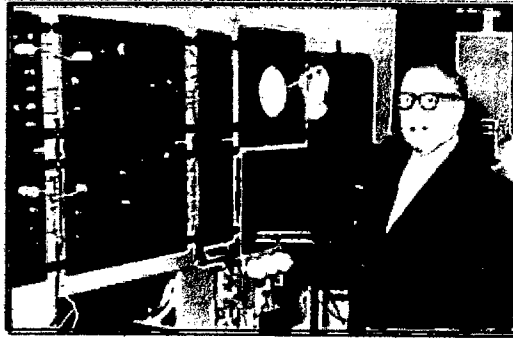
#### **1.1 Introduction**

What is RFID? RFID or Radio Frequency Identification is a new technology in management which develop to improve the efficiency of inventory tracking and management. RFID is generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies. [1]

The history of RFID technology began when the Germans, Japanese, Americans and British were all using radar, which had been discovered in 1935 by Scottish physicist Sir Robert Alexander Watson-Watt. The function of the radar is to warn of approaching planes while they were still miles away. But, the problem occurs when there was no way to identify which planes belonged to the enemy and which were a country's own pilots returning from a mission. The Germans discovered that if pilots rolled their planes as they returned to base, it would change the radio signal reflected back. This crude method alerted the radar crew on the ground that these were German planes and not Allied aircraft (this is, essentially, the first passive RFID system). Under Watson-Watt, who headed a secret project, the British developed the first active identify friend or foe (IFF) system. They put a transmitter on each British plane. When it received signals from radar stations on the ground, it began broadcasting a signal back that identified the aircraft as friendly. This implementation was related with RFID work. A signal is sent to a transponder, which wakes up and either reflects back a signal (passive system) or broadcasts a signal (active system).

Then, advances in radar and RF communications systems continued through the 1950s and 1960s. Scientists and academics in the United States, Europe and Japan did research and presented papers explaining how RF energy could be used to identify objects remotely. Companies began commercializing anti-theft systems that used radio waves to determine whether an item had been paid for or not. Electronic article surveillance tags, which are still used in packaging today, have a 1-bit tag. The bit is either on or off. If someone pays for the item, the bit is turned off, and a person can leave the store. But if the person doesn't pay and tries to walk out of the store, readers at the door detect the tag and sound an alarm. [2]





**Figure 1.1 : Watson-Watt with the first radar apparatus**

The following below are summary of history of RFID technology:-

**Table 1.1 : The decades of RFID technology**

<b>The Decades of RFID Decade [3]</b>	<b>Event [3]</b>
1940 - 1950	Radar refined and used major World War II development effort. RFID invented in 1948.
1950 - 1960	Early explorations of RFID technology, laboratory experiments.
1960 - 1970	Development of the theory of RFID. Start of applications field trials.
1970 - 1980	Explosion of RFID development. Tests of RFID accelerate. Very early adopter implementations of RFID.
1980 - 1990	<u>Commercial applications of RFID enter mainstream.</u>
1990 - 2000	Emergence of standards. RFID widely deployed. RFID becomes a part of everyday life.

There are many innovative uses in domain application of RFID technology as listed below:

- i. Asset tracking
- ii. Manufacturing
- iii. Supply chain management
- iv. Retailing
- v. Payment systems
- vi. Security
- vii. Access control

For example, in Japan, consumers can download movie tickets to their cell phones and enter a theatre by swiping an RFID tag in the phone past a reader in a turnstile. MasterCard and Visa are also experimenting with RFID cards and key fobs for small payments usually made with cash. [4]

The benefits by using RFID technology are listed below:

- i. Enable consumers to get more information about the products they want to purchase, such as when the items were made, where, whether they are under warranty and so on.
- ii. Consumers will be able to read the tag with a reader embedded in a cell phone or connected to a computer and download data from a Web site when RFID tags put on packaging of individual products.
- iii. Provide it to their customers to build trust and loyalty.
- iv. Help to improve environment by identifying hazardous materials that should not be dumped in landfills.
- v. Solution to recovery the lost or stolen items.
- vi. RFID tags can be read at much greater distances; an RFID reader can pull information from a tag at distances up to 300 feet. [20]

Besides benefits, RFID technology also got weakness such as [21]:

- i. The price of this technology is quite expensive.
- ii. RFID systems can be easily disrupted
- iii. RFID tags are difficult to remove

An RFID system may consist of several components such as tags and readers. Passive tags are cheaper than active tags. Readers can be divided into internal or external antennas. For readers with external antennas, it can have one or more ports for connecting reader antennas (the newest readers have up to eight antenna ports). Readers can also have input/output ports for connecting to external devices. An input port might be connected to an electric eye that runs on the reader when something breaks its beam. An output port might connect to a program logic controller, conveyor sorter or other device controlled by the reader. Readers also have ports for connecting to a computer or network. Older readers use serial ports. Most new readers have Ethernet, Wi-Fi or USB ports [6].

Middleware is a generic term used to describe software that resides between the RFID reader and enterprise applications. It's a critical component of any RFID system, because the middleware takes the raw data from the reader. Some middleware manages RFID readers such as monitoring their health, configures them, sends software updates and so on. Other middleware may manage the data recorded in databases for enterprise applications to use. And some middleware has its own applications, often for a specific industry. One application might be confirmation of shipment and receipt. When a product is sent to a retailer, the middleware confirms the shipment and sends an electronic message to the retailer with the EPCs in the shipment. When the retailer receives the goods, receipt is confirmed and a message is sent to the supplier. The retailer doesn't need to be running the same middleware because most RFID middleware is based on standardized Internet languages, such as XML, and protocols, such as Simple Object Access Protocol. Companies will also need to purchase servers to run middleware within a warehouse, distribution centre or production facility. These servers are sometimes called edge servers, because they are close to the edge of the network where the digital world meets the real world.

Edge servers are standard computer servers. They typically do not have any special hardware, and they connect to readers using serial or Universal Serial Bus (USB) ports [6].

For this project, RFID technology will be implementing in tracking the loss of device at FSK 11 laboratory. All devices at FSK 11 laboratory will implement RFID technology to protect the device from being stolen and act as security in this laboratory. This project name as 'Smart Device Tracking System Using RFID (DeviceTrex).

## 1.2 Problem Statement

Faculty of Computer System and Software Engineering (FSK KP) is the one of several faculties that available at University of Malaysia Pahang (UMP). As computer student, FSK KP also have their own laboratory to do the lab session. FSK 11 is the several example of FSK KP laboratory. FSK 11 is the only laboratory using by student of Bachelor in Computer Network (BCN) to do their network class before new laboratory have added this year, which is at FSK 2. Last two year (2008), the device (router) at FSK 11 laboratory has been stolen, but nobody can detect who have stolen the device (router). This problem make the laboratory management became worried if this case occur again because the price of this device (router) is expensive.

Because of this case, many problems occur such as:

- i. Students need to wait outside the laboratory until the lecturer or person-in-charge the laboratory opens the door.
- ii. Laboratory management become so strict especially when students want to use this laboratory outside of class time to protect the devices.

From research, we have found that this stolen of device (router) occurs because of this reason:

- i. No special security in this laboratory was implementing by the laboratory management. They just implement door lock system.
- ii. No special security for all devices in this laboratory.

To overcome this problem, the implementation of RFID technology in tracking the loss of device at FSK 11 laboratory will be done so that this case won't occur again and will make student easy to use this laboratory anytime and the laboratory management does not have to worry for the safety of all devices.

### **1.3 Objective**

The objectives of this project are:

- i. To develop a prototype by using RFID technology in order to tracking the loss of device at FSK 11 Laboratory.
- ii. To test the reliability of pairing RFID technology with device.

### **1.4 Scope**

- i. FSKKP Laboratory (FSK 11) will be a location for this system.
- ii. Only administrator will use this system.

## **1.5 Thesis Organization**

This thesis is organized as follows: Chapter 1 consists five parts namely introduction, problem statements, objectives, scopes and thesis organization. In Chapter 2, the previous system and the technology or a method that has been used in developing their system are described. The introduction, project methodology, justification of choosing the methodology, the software and the equipment needs are discussed in Chapter 3. Chapter 4 proposes the documentation about all process that involved in developing the project. The result and discussions about the project are presented in Chapter 5. Finally, Chapter 6 will conclude the system of this project.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This topic will analyze project at available market that related with the title of project as guideline for student to complete their project. In this topic, student should get as much information about the related project before do the research. There are two sub topics, which are current project and techniques / method / tools / technology that implemented in the previous project. The example of previous project which related to the title is Fitness and RFID Go Hand In Glove, U.K Start up Sees Pregnant Opportunity, Hush Puppies Footwear Implement RFID, and finally Golf Tournament Sees up RFID. Students should explain about the sub topics clearly and make the comparison on previous project at the end of this chapter.

## **2.1 Fitness and RFID Go Hand In Glove**

### **2.1.1 Introduction**

Fitness Korzo, a health club in the city of Sumperk, is located in the north eastern part of the Czech Republic. It was the first fitness that enthusiasts utilize RFID tags that slip into their gym gloves to open and close changing-room lockers. Other than that, they can also use the gloves to pay for food, beverages and services, such as aerobics classes and massages. [7]

### **2.1.2 Application of RFID**

The application is similar to many that rely on RFID, based access cards. But, Petr Hermann of Mad Max Sportswear, the Prague company that manufactures the gloves said that, it is unique because the RFID tag is slides into a gym-goer's glove and have been sold through online merchants and at sporting goods stores in Austria and the Czech Republic. The system that supports the gloves, known as Your Real Identity, was created by Mad Max and software developer Inspire, to enable RFID-based access systems, lockers and payment systems at gyms. In the Czech Republic, some 30 or 40 gym operators presently employ the system, or elements of it and Mad Max is developing an online marketing drive for the system. Hermann declines to reveal how many gyms worldwide are currently enabled for the company's RFID gloves, though he does indicate that the gloves' RFID tags can be read by a variety of RFID systems. He also says that gyms need not install the solution designed by Inspire and Mad Max. [7]