



MARA UNIVERSITY OF TECHNOLOGY

**WIRELESS ACCESS POINT WITH
LOCATION BASED AWARENESS**

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**BACHELOR OF SCIENCE (Hons.)
IN DATA COMMUNICATION AND NETWORKING**

**FACULTY OF
INFORMATION TECHNOLOGY AND QUANTITATIVE SCIENCE**

NOVEMBER 2007

WIRELESS ACCESS POINT WITH LOCATION BASED AWARENESS

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A project paper submitted to
FACULTY OF INFORMATION TECHNOLOGY AND QUANTITATIVE SCIENCE
UNIVERSITI TEKNOLOGI MARA

In partial fulfillment of requirement for the
BACHELOR OF SCIENCE (Hons.) IN DATA COMMUNICATION AND
NETWORKING

Major Area: Network

Approved by:



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CERTIFICATION OF ORIGINALITY

I declare that the work in this thesis was carried out in accordance with the regulations of MARA University of Technology. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any other degree of qualification.

In the event that my thesis be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree and agree be subjected to the disciplinary rules and regulations of MARA University of Technology.

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ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and Most Merciful. All praise be to Allah, for all the bless that he gave.

First and foremost, I would like to express my deepest appreciation and sincere thanks to my dedicated supervisor Puan Rosanita Adnan and my advisor, Encik Mohd Faisal Ibrahim, for his guidance, encouragement, ideas, and tolerance and support me, which led to the completion of this project. I am very lucky to have this opportunity to learn and gain experience from such experienced lecturer.

Special thanks go to all the lecturers and staffs of FTMSK for their time and expertise that had helped me. A special thanks to my entire friends, who have been very generous in lending and sharing their time and expertise during this period. No words can express my gratitude for all the assistance or help received.

I would like to express my gratitude to those who have been involved in contributing their time, effort and support me in making this project successful. I am most fortunate to have the advice and guidance of many talented people, whose knowledge have enhanced this project in so many ways.

I would like to express my deepest appreciation from the bottom of my heart. Thank you.

ABSTRACT

The declining cost of mobile computing devices, wireless devices and the rapidly increasing in number of wireless networks and there is increasing interest in the development of location aware applications. These applications include context aware systems to collect or disseminate information, robotics, duress alarms in institutions such as universities and hospitals. There are many technologies that may be used to sense the location of mobile devices or personnel, including those based on infrared, ultrasonic, radio frequency tags and magnetic sensing. Most of these technologies require the deployment of devices specifically placed to support the location system. This paper focuses on a location system based on the Radio-Frequency (RF) of packets on the wireless network. This technique has the great advantage that it may be implemented using off the shelf hardware that is generally already deployed to support the data network. The primary function is to locate and track the wireless devices, which is connected to the access point in real-time and their activities and attributes are captured, logged and reported. This project is develop using Bash, Perl, C programming and also PHP on Linux based platform, as an Wireless Access Point. From the finding this research, it will estimate identifying where the host is connected display their direction based on the location of the Wireless Access Point.

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LIST OF ABBREVIATIONS

AP	Access Point
WAP	Wireless Access Point
GPS	Global Positioning System
WLAN	Wireless Local Area
WMAN	Wireless Metropolitan
WWAN	Wireless Wide Area
Wi-Fi	Wireless Fidelity
STA	The Station
BSS	Basic Service Set
DHCP	Dynamic Host Configuration
RF	Radio Frequency

CHAPTER I

INTRODUCTION

1.1 Introduction

Recent advances in Wireless Local Area Network (WLAN) technology and falling costs of WLAN devices are expected to lead to a rapid increase in the proliferation of wireless networks. It has been predicted that there will be 39 million WLAN users worldwide by the end of 2004 and this number is predicted to grow to 120 million by 2008 (IT Facts.biz 2004). and the wireless product company revenues for the first quarter of 2007 is exceed to 150 million (IT Facts.biz 2007).

With the rapid growth of wireless networks there is a growing interest in techniques to determine the physical location of wireless devices. In traditional wired networks, networked devices are usually situated in fixed locations that can be determined with reference to building plans and cabling diagrams. This is not the case with wireless networks. It is possible to determine the sub network to which a mobile device is attached. However, depending on the topology of the network this may reveal very little about the physical location of the mobile device and at best will only indicate that a device is within the coverage area of one or several wireless access points.

There are two main reasons why it could be advantageous to know the physical location of mobile computing devices attached to a network. The first of these reasons has to do with locating a mobile device for security, safety, maintenance or administration purposes. The second reason is to provide location information to the mobile device as part of a location aware application.

When the ability to write and modify your own management software is the main objective, a custom-built wireless access point with the location-based awareness system is the way to go. Take a look at what's involved in building a wireless access point using Linux, including software and hardware considerations.

In this project, wireless access point is develop based on Fedora 7 (one of Red Hat distribution or family). The goal is to provide a wireless access point that can operate generally like GPS (Global Positioning System) or specifically as Location Based Awareness. This means that the custom-built access point can track back connected users exactly where the users located is.

1.2 Problem Statement

Since the first experimental satellite was launched in 1978, GPS (Global Positioning System) has become an indispensable aid to navigation around the world, and an important tool for map-making and land surveying. GPS also provides a precise time reference used in many applications including scientific study of earthquakes, and synchronization of telecommunications networks.

The current situation, with current technology; GPS can only determine our location and direction outside the building. This will create a problem when we want to find a location inside the building.

Generally this research attempts to solve the problems by using approach to tackle the problem of location determination and tracking by using widely available radio frequency(RF) based wireless network in an in-building environment.

1.3 Project Objective

The objectives of the project are:

- a) To define the requirement criteria for implementing access point with location based awareness.
- b) To develop and implement an open source location based system using wireless access point.
- c) To determine the signal strength of the wireless access point.
- d) To evaluate the information based on searching criteria.

1.4 Scope of the Project

This project focused on the development of an open source wireless access point and also location based awareness system. This project was developed using Perl, Bash and PHP language. This system will run under open source operating system, Fedora 7.

This project will be implemented at one of FTMSK's building that is expected to be used by the students, lecturers, UiTM's staffs and especially visitors.

1.5 Significance of the Project

The implementation of this project will allow user to locate current location and display information based on searching criteria. The access point has the ability to integrate smoothly with the existing infrastructure without additional oversized hardware.

The technology infrastructure required to implement this system should not be too expensive because we only need a customize access. Moreover, this technology can easily be implemented.

The user will also save their time to find their location by using this technology because they do not have to manually ask people for information.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

As we all concerned, the rapidly increase of wireless local area network and mobile computing devices has formed a mounting interest in location-aware system and services. In this paper, basically it has addressed the problem of user location and tracking in an in building radio-frequency (RF) wireless network. Thus, to be prices, the simplest solution for enable such services in user location and tracking.

Through this paper, it describes this problem in the context of RF network technology. I have come up to the problem recording and processing real-time signal strength information available at several base stations positioned to enable coverage in the desired area. I had employ techniques that combine experimental measurements with signal broadcast modeling and present concrete tentative results. This demonstrates the probability of estimating user location with a high degree of accuracy.

While the experimental method is greater in terms of accuracy, the signal broadcast method generalizes to a much greater extent. From the study, it has shown that despite the unreceptive nature of the radio channels, they are actually able to locate and track a user with a high degree of accuracy. Through experiments using RF network, I determined the median resolution of location estimation to be in the range of 2 to 3 meters, which is about the size of a usual office room.

As to conclude, from the results, it is confidence that it is possible to build an appealing class of location-aware services, based only on the RF in-building wireless data network and is believe, and is a significant contribution of my research.

2.2 Definitions of Terminology

Accuracy

The deviation of the estimates from the true location must be minimal and the resolution of the system must be sufficiently fine-grained.

Integrity

The data (both radio measurements and location information) must be protected from tampering, or if tampering occurs, it must be evident.

Availability

The location information must be available when it is needed and as often as the need arises.

Radio Frequencies (RF)

A radio wave is an electromagnetic wave propagated by an antenna. Radio waves have different frequencies, and by tuning a radio receiver to a specific frequency you can pick up a specific signal.

Wireless Local Area Network (WLAN)

Two or more computers or network devices linked without using wires. WLAN utilizes spread-spectrum technology based on radio waves to enable communication between devices in a limited area, also known as the basic service set. This gives users the mobility to move around within a broad coverage area and still be connected to the network.

Wireless Access Point (WAP)

Wireless access point is a device that connects wireless communication devices together to form a wireless network. The WAP usually connects to a wired network, and can relay data between wireless devices and wired devices. Several WAPs can link together to form a larger network that allows "roaming". Wireless access points have IP addresses for configuration.

Open Source Software

Open source software refers to computer software and the availability of its source code as open source under an open source license to study, change and improve its design.

Wi-Fi

Wi-Fi is a brand originally licensed by the Wi-Fi Alliance to describe the underlying technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications. It was developed to be used for mobile computing devices, such as laptops, in LANs, but is now increasingly used for more services, including Internet and VoIP phone access, gaming, and basic connectivity of consumer electronics such as televisions and DVD players, or digital cameras. More standards are in development that will allow Wi-Fi to be used by cars in highways in support of an Intelligent Transportation System to increase safety, gather statistics, and enable mobile commerce (see IEEE 802.11p). Wi-Fi and the Wi-Fi CERTIFIED logo are registered trademarks of the Wi-Fi Alliance - the trade organization that tests and certifies equipment compliance with the 802.11x standards.

Wireless Adapter

A wireless adapter allows a device to connect to a wireless network. These adapters connect to devices using various interconnects such as PCI, miniPCI, USB, and PCMCIA.

PCI

The Peripheral Component Interconnect, or PCI Standard (in practice almost always shortened to PCI) specifies a computer bus for attaching peripheral devices to a computer motherboard. These devices can take any one of the following forms:

- An integrated circuit fitted onto the motherboard itself, called a *planar device* in the PCI specification.
- An expansion card that fits into a socket.

The PCI bus is common in modern PCs, where it has displaced ISA and VESA Local Bus as the standard expansion bus, but it also appears in many other computer types. The bus will eventually be succeeded by PCI Express, which is standard in most new computers, and other technologies.

The PCI specification covers the physical size of the bus (including wire spacing), electrical characteristics, bus timing, and protocols.

Fedora

Fedora (previously called Fedora Core) is an RPM-based Linux distribution, developed by the community-supported Fedora Project and sponsored by Red Hat. It aims to be a complete, general-purpose operating system that contains only free and open source software.^{[1][2]} Fedora Core is derived from the original Red Hat Linux distribution, and it is intended to replace the consumer

distributions of Red Hat Linux aimed towards home users. Support for Fedora comes from the greater community; While Red Hat employs many of the Fedora developers, it does not provide official end-user support for the distribution.

Linux

Linux is a Unix-like computer operating system family. Linux is one of the most prominent examples of free software and of open source development; its underlying source code is available for anyone to use, modify, and redistribute freely. Linux is packaged for different uses in Linux distributions, which contain the kernel along with a variety of other software packages tailored to requirements.

Unix

Unix (officially trademarked as UNIX®) is a computer operating system originally developed in the 1960s and 1970s by a group of AT&T employees at Bell Labs including Ken Thompson, Dennis Ritchie and Douglas McIlroy. Today's Unix systems are split into various branches, developed over time by AT&T as well as various commercial vendors and non-profit organizations.

During the late 1970s and early 1980s, Unix's influence in academic circles led to large-scale adoption (particularly of the BSD variant, originating from the University of California, Berkeley) of Unix by commercial startups, the most notable of which is Sun Microsystems. Today, in addition to certified Unix systems, Unix-like operating systems such as Linux, Mac OS X and BSD derivatives are commonly encountered.

GPS

The Global Positioning System (GPS), is currently the only fully functional Global Navigation Satellite System (GNSS). More than two dozen GPS satellites are in medium Earth orbit, transmitting signals allowing GPS receivers to determine the receiver's location, speed and direction.

The GPS is made up of three parts: satellites orbiting the Earth; control and monitoring stations on Earth; and the GPS receivers owned by users. GPS satellites broadcast signals from space that are picked up and identified by GPS receivers. Each GPS receiver then provides three-dimensional location (latitude, longitude, and altitude) plus the time.

Wardriving

Wardriving is the act of searching for Wi-Fi wireless networks by a person in a moving vehicle using a Wi-Fi-equipped computer, such as a laptop or a PDA, to detect the networks. It was also known (as of 2002) as "WiLDing" (Wireless Lan Driving, although this term never gained any popularity and is no longer used), originating in the San Francisco Bay Area with the Bay Area Wireless Users Group (BAWUG). It is similar to using a scanner for radio.

Many wardrivers use GPS devices to measure the location of the network find and log it on a website (the most popular is WiGLE). For better range, antennas are built or bought, and vary from omnidirectional to highly directional. Software for wardriving is freely available on the Internet, notably, NetStumbler for Windows, Kismet for Linux, and KisMac for Macintosh.

Wardriving was named after wardialing (popularized in the Matthew Broderick movie WarGames) because it also involves searching for computer systems with software that would use a phone modem to dial numbers sequentially and see which ones were connected to a fax machine or computer, or similar device.

(Audio commentary on the WarGames DVD says that wardialing was named after the movie and the software did not openly exist before the movie.)

2.3 Overview of wireless access point, location based awareness system and open source software

2.3.1 Wireless Access Point (WAP)

Low cost and easily-installed WAPs grew rapidly in popularity in the early 2000s. These devices offered a way to avoid the tangled messes of category 5 cable associated with typical ethernet networks of the day. Whereas wiring a business, home, or school often requires stringing many cables through walls and ceilings, wireless networking offers the ability to reduce - or eliminate entirely - the stringing of cables. Wireless networks also allow users greater mobility, freeing individuals from the restrictions of using a computer cabled to the wall. In the industrial and commercial contexts, wireless networking has had a big impact on operations: employees in these areas now often carry Portable Data Terminals integrating barcode scanners and wireless links, allowing them to update work in progress and inventory in real-time.

One IEEE 802.11 WAP can typically communicate with 30 client systems located within a radius of 100 m. However, the actual range of communication can vary significantly, depending on such variables as indoor or outdoor placement, height above ground, nearby obstructions, other electronic devices that might actively interfere with the signal by broadcasting on the same frequency, type of antenna, the current weather, operating radio frequency, and the power output of devices. Network designers can extend the range of WAPs through the use of repeaters and reflectors, which can bounce or amplify radio signals that

ordinarily would go un-received. In experimental conditions, wireless networking has operated over distances of several kilometers.

A typical corporate use involves attaching several WAPs to a wired network and then providing wireless access to the office LAN. Within the range of the WAPs, the wireless end user has a full network connection with the benefit of mobility. In this instance, the WAP functions as a gateway for clients to access the wired network. Another use involves bridging two wired networks in conditions inappropriate for cable: for example, a manufacturer can wirelessly connect a remote warehouse's wired network with a separate (though within line of sight) office's wired network.

Another wireless topology, a lily-pad network, consists of a series of access points spread over a large area, each connected to a different network. This provides hot spots where wireless clients can connect to the Internet without regard for the particular networks to which they have attached for the moment. The concept can become organic in large cities, where a combination of coffeehouses, libraries, other public spaces offering wireless access, as well as privately owned open access points, allow clients to roam over a large area (like hopping from lily pad to lily pad), staying more or less continuously connected.

In a society where everybody has his own WAP within range of the neighbors' WAP, it's possible to set up a wireless community network, creating an intra-city communication network without the need of wired networks.

A WAP may also act as the network's arbitrator, negotiating when each nearby client device can transmit. However, the vast majority of currently installed IEEE 802.11 networks do not implement this, using a distributed pseudo-random algorithm instead.

2.3.2 Location Based Awareness System

In computer science it refers to the idea that computers can both sense, and react based on their environment. Devices may have information about the circumstances under which they are able to operate and based on rules, or an intelligent stimulus, react accordingly. Location aware devices may also try to make assumptions about the user's current situation.

For example: A location aware mobile phone may know that it is currently in the meeting room, and that the user has sat down. The phone may conclude that the user is currently in a meeting and reject any unimportant calls.

Location awareness is used to design innovative user interfaces, and is often used as a part of ubiquitous and wearable computing. It is also beginning to be felt in the internet with the advent of hybrid search engines.

Location based awareness that can be aware of their physical (and virtual) environment or situation, and respond intelligently based on such awareness. It is among the most exciting trends in computing today, fueled by developments in pervasive computing, including new computers worn by users, embedded devices, sensors, and wireless networking technology.