DETECTING INDOOR POSITIONING OF MOVING OBJECT USING WIFI TRIANGULATION ALGORITHM FOR KID TRACKER APPLICATION

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A thesis submitted in fulfilment of the requirements for the award of the degree of Bachelor of Computer Science (Hons.) (Graphic & Multimedia Technology)

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LIST OF ABBREVIATIONS

ABBREVIATION	TITLE
API	Application Program Interfaces
BSSID	Basic Service Set Identifier
FFH	Fast-Frequency Hope
GPS	Global Position System
GSM	Global System for Mobile communications
GNSS	Global Navigation Satellite System
HT12E	Encoder integrated circuit of 2^{12} series of encoders
IPS	Indoor Positioning System
iOS	Mobile operating system developed by Apple
ISM	Industrial Scientific Medical
IEEE	Institute of Electrical and Electronics Engineers
LSB	Least significant bit
MSB	Most significant bit
MAC Address	Media Access Control Address
NLOS	None light of sight
PNG	Portable Network Graphics
RFID	Radio Frequency Identification
RF	Radio Frequency
RSSI	Received Signal Strength Indicator
SDK	Software Development Kit
SMS	Short Message Services
SNR	Signal-to-noise-ratio
SSID	Service Set Identifier
TOF	Time-of-Flight
Wi-Fi	Wireless fidelity

WLAN	Wireless Local Area Network
WPANs	Wireless Personal Area Networks
WRC	Wireless Research Centre

LIST OF SYMBOLS

dBm	-	Decibel-milliwatts
GHz	-	gigahertz
kHz	-	kilohertz
km	-	kilometre
Mbps	-	MegaBytes per second
MHz	-	megahertz

LIST OF APPENDICES

DETECTING INDOOR POSITIONING OF MOVING OBJECT USING WIFI TRIANGULATION ALGORITHM FOR KID TRACKER APPLICATION

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ABSTRACT

The increasing number of missing kid from days to days is become main concern for parents. Hence, 'Detecting Indoor Positioning of Moving Object using Wi-Fi Triangulation Algorithm for Kid Tracker Application' as a part of process in Kid Tracker Application to keep track our kids movement by focusing inside the building (shopping mall). It will use Wi-Fi technology with the integration of smartphone capability to recognise our kids' position which will display it on smartphone. Based on the research, there are few similar applications on the market, but mostly developed for outdoor environment using GPS technology. Because of GPS signal based on satellite which created for outdoor environment, it does not fit for indoor environment. In addition, most of them are provide limited location accuracies range. Overall, this proposed system is a part of process in Kid Tracker Application in order to get kid position in indoor environment. The main objective for this research is to calculate the position of the object based on the distance using Wi-Fi Triangulation Algorithm. Others are to obtain the significant distance of the object by using three Wi-Fi access points and to assess the position of movement object in real time. Hence, this research focuses for indoor positioning and the searching range will cover for one level. Besides that, the Wi-Fi will cover up to 20 meters inside the building and use Wi-Fi signal strength which is Level and Frequency to collect the data and to determine the location detection. Agile Methodology is used in developing this system to get better quality of final system. As a result, this application can detects real time kids' position with acceptable time but not in accuracy due to some signal problem of Wi-Fi access point.

ABSTRAK

Peningkatan jumlah kanak-kanak yang hilang dari hari ke hari menjadi kebimbangan utama bagi ibu bapa. Oleh itu, ‘Pengesanan Objek Bergerak bagi Persekitaran Tertutup menggunakan Algoritma Triangulasi Wi-Fi untuk Aplikasi Pengesanan Kanak-Kanak’ adalah sebahagian daripada proses membuat Aplikasi Pengesanan Kanak-Kanak untuk mengesan pergerakan kanak-kanak di dalam bangunan (pusat membeli-belah). Teknologi Wi-Fi bersama keupayaan telefon pintar digunakan untuk mengenalpasti kedudukan kanak-kanak dan sekaligus dapat memaparkan lokasi tersebut didalam aplikasi. Berdasarkan kajian, terdapat beberapa aplikasi yang sama di pasaran, tetapi kebanyakannya menggunakan teknologi GPS dan khusus untuk persekitaran luar. Oleh kerana isyarat GPS adalah berdasarkan satelit yang dicipta khusus untuk persekitaran luar, sekaligus tidak sesuai digunakan untuk persekitaran tertutup. Di samping itu, kebanyakan aplikasi sedia ada memperuntukkan rangkaian ketepatan lokasi yang terhad. Kesimpulannya, sistem yang dicadangkan adalah sebahagian daripada proses Aplikasi Pengesanan Kanak-Kanak bagi mendapatkan kedudukan kanak-kanak di dalam persekitaran tertutup. Objektif utama kajian ini adalah untuk mengira kedudukan objek berdasarkan jarak menggunakan Algoritma Triangulasi Wi-Fi. Selain itu, untuk mendapatkan jarak objek menggunakan tiga pusat akses Wi-Fi dan menilai kedudukan objek dalam masa sebenar. Oleh itu, kajian ini fokus kepada penentududukan pada persekitaran tertutup dan rangkaian pencarian akan tertumpu pada aras satu. Selain daripada itu, Wi-Fi akan meliputi sehingga 20 meter di dalam bangunan dan menggunakan kekuatan isyarat Wi-Fi iaitu paras dan kekerapan untuk mengumpul data dan untuk menentukan pengesanan lokasi. Kaedah Agile digunakan dalam membangunkan sistem ini untuk mendapatkan kualiti yang lebih baik pada akhir sistem. Keputusannya, aplikasi ini dapat mengesan lokasi kanak-kanak dalam masa yang diterima pakai tetapi tidak dari ketepatannya kerana masalah yang timbul daripada isyarat pusat akses Wi-Fi.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Generally, a tracking system is used to observe a person or a moving object and providing a timely ordered sequence of respective location data to a model [1] for example, to track personnel inside the building. In the market nowadays, tracking device receives positive feedback from customers worldwide. Example of existing tracker device for moving objects are kid tracker and vehicle tracking system and for non-moving object is lost item tracker.

Nowadays, kid tracker device is very useful that help parent in securing their children lives. The kid tracker technologies are usually depends on the service and the company. But generally, kid tracking uses Global Position System (GPS) that capable to pinpointing a child whereabouts immediately by pinpoint a kid location on a map via satellite. Also, only the account holder which is specific registered parent can see the location of the kid.

However, GPS function has its own weaknesses, since it is the one of the popular location-based system that generally handled to route moving objects and rely on satellites to communicate using radio signals which is designed for outdoor environment [2] and does not work well for indoors and least reliable due to the problem of accuracy of the positioning. For example, based on research, the mobile GPS receiver power drops by another 10-100,000 times, and experiences reflections and path impairments [3]. Furthermore, the signals from the satellites are be impaired and scattered by roofs, walls and other objects [4] due to the multipath interference.

Therefore, due to the GPS weaknesses, an Indoor Positioning System (IPS) solution works to replace the GPS service. An IPS is a network of devices used to wirelessly determine objects or people inside a building using radio waves, magnetic fields, or other sensory information collected by mobile devices or by tag device [5].

In the era of technology, kid tracker system is set up through mobile device instead of computer device because it is easily to installed any applications, for example through play store for android user, also mobile device or smartphone has their own capability to support the tracking system. In addition, many smartphones are GPS-ready. Hence, kid tracker application is develop to collect the data and to determine the movement and position of kid by displaying it on the screen.

Last but not least, from the existing system there a few problems were detected. The famous positioning system is GPS technology, however the accuracy and entirely positioning problem has occur in a particular indoor region. Besides that, there are few technologies like GPS and RFID technology need additional devices that burden the parents to buy an expensive device in order to track their kid. Another existing tracking system that uses bluetooth connection which is a short-range wireless networking technology will limit parents to track their children inside the building. This is because bluetooth connections are typically limited to about 30 feet.

1.2 Problem Statements

There is a problem that have been identify in this research. It will be the motivation in developing 'Detecting Indoor Positioning of Moving Object using Wi-Fi Triangulation Algorithm for Kid Tracker Application'. The problem statements are state as below:

i. Almost the Kid Tracker Apps are used GPS locator positioning technologies to find the location. However, the location using GPS is not too accurate.
ii. The GPS signal is a satellite based positioning system which is designed for outdoor environment, thus it does not work well indoors [2]. The GPS signal is easily blocked by most construction materials and hence making it useless for indoor positioning.
iii. Usually the existing Kid Tracker System needs an additional device normally at a high price.
iv. Usually the existing Kid Tracker System provides limited location accuracies range.

1.3 Objectives

The main purpose of 'Detecting Indoor Positioning of Moving Object using Wi-Fi Triangulation Algorithm for Kid Tracker Application' is to help parent in saving their beloved child lives. There are some weaknesses of the existing tracking system. There are several goals to achieve:

i. To obtain the significant distance of the object by using three Wireless Fidelity (Wi-Fi) access points.
ii. To calculate the position of the object based on the distance using Wi-Fi Triangulation Algorithm.
iii. To assess the position of movement object (kid) in real time.