DEVELOPMENT OF IOT BASED SMART PARKING SYSTEM BY USING ARDUINO
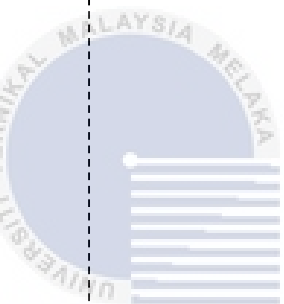
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2020

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BACHELOR OF COMPUTER ENG. TECH. (COMPUTER SYSTEMS)

2020   UTEM

UTeM

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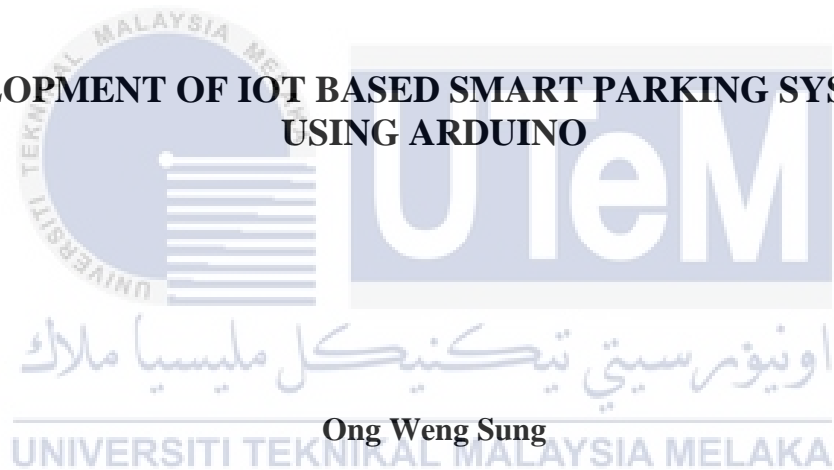# DEVELOPMENT OF IOT BASED SMART PARKING SYSTEM BY USING ARDUINO

ONG WENG SUNG

BACHELOR OF COMPUTER ENGINEERING TECHNOLOGY (COMPUTER SYSTEMS) WITH HONOURS.

2020

Faculty of Electrical Engineering And Electronic Engineering

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Ong Weng Sung

Bachelor of Computer Engineering Technology(Computer Systems) with Honours.

2020

DEVELOPMENT OF IOT BASED SMART PARKING SYSTEM BY USING ARDUINO

ONG WENG SUNG

This thesis is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Sesi Pengajian: **2020/2021**

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I hereby, declared this report entitled Development of IoT Based Smart Parking System by Using Arduino is the results of my own project except as cited in references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature: …………………………………

Author : ONG WENG SUNG

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

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Supervisor Name :   TS ZAHARIAH BINTI MANAP

Date   :   17-Feb-2021

DEDICATION

To my beloved parents.

ABSTRACT

Nowadays, cars are the most used transportation in most of the countries all over the world. The number of cars increases rapidly leading to the increased demand for expanding the parking spaces especially in the cities and urban areas. As the traffic in urban areas is becoming heavier every day, the drivers tend to double park because they won't take the risk of going elsewhere to park their car just because they have no idea of what awaits them in other parking areas. This leads to the need of an efficient smart parking system. In this project, a smart parking system is developed to provide an efficient parking space utilization using Internet of Things (IoT) technology. The developed system consists of two main components which are an on-site device and mobile application. The on-site device updates the information about parking availability and its location in a cloud server. The data can be accessed by the user through a mobile application. This system informs the user the nearest parking area and gives the availability of parking slots in that respective area. The accuracy for the IoT based Smart Parking System is analysed through a series of real time testing. By comparing the actual condition of the on-site device and the result shown in the Blynk mobile application, the percentage of accuracy of IoT based Smart Parking System is 100%. All of the actual results of the on-site device are synchronized with the result in Blynk mobile application. The speed of the refresh rate is about 1.5s and the speed can also be affected by the upload speed of the Wi-Fi network connected. The results showed that the average time response increased by 1s when every estimated 5m further from the router.

I

ABSTRAK

Pada masa ini, kereta adalah pengangkutan yang paling banyak digunakan di kebanyakan negara di seluruh dunia. Bilangan penggunaan kereta meningkat dengan cepat menyebabkan permintaan meningkat untuk memperluas ruang parkir terutama di bandar dan kawasan bandar. Disebabkan trafik di kawasan bandar semakin tinggi, pemandu cenderung untuk memarkir bertindan kerana mereka tidak akan mengambil risiko untuk pergi ke tempat lain untuk memarkir kereta mereka kerana mereka tidak mempunyai maklumat tentang kesediaan parkir di kawasan memarkir lain. Disebabkan keadaan itu, sistem parkir yang cerdas yang efektif diperlukan. Dalam projek ini, sistem parkir yang cerdas akan dibangunkan untuk menyediakan penggunaan ruang parkir yang efektif menggunakan teknologi IoT. Sistem yang dibangunkan terdiri daripada dua komponen utama yang merupakan peranti di lapangan dan aplikasi bergerak. Peranti akan kemaskini maklumat tentang kesediaan letak kereta dan lokasinya dalam pelayan awan. Kemudian, data boleh dicapai oleh pengguna melalui aplikasi bimbit. Sistem ini boleh maklumkan pengguna untuk mencari kawasan letak kereta terdekat dan memberikan kesediaan slot letak kereta di kawasan masing-masing itu. Jadi sistem ini membantu mengurangi masa untuk mencari tempat letak kereta dan menyelesaikan masalah letak kereta untuk bandar. Ketepatan untuk IoT berdasarkan Sistem Parkir Pintar dianalisis melalui satu siri ujian masa sebenar.Dengan membandingkan keadaan sebenar peranti di lokasi dan keputusan yang dipaparkan dalam aplikasi bimbit Blynk, peratus keperluan Sistem Parkir Pintar berasaskan IoT adalah 100%.Semua keputusan sebenar peranti di lokasi disegerakkan dengan keputusan dalam aplikasi bimbit Blynk.Kelajuan kadar segar adalah kira-kira 1.5 saat dan kelajuan juga boleh dipengaruhi oleh kelajuan muat naik rangkaian Wi-Fi tersambung.Hasil menunjukkan bahawa tanggapan masa rata-rata meningkat dengan 1 saat apabila setiap kiraan 5 m lebih jauh dari penghala.

ACKNOWLEDGEMENTS

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LIST OF SYMBOLS

MHz	Mega Hertz
GHz	Giga Hertz
kHz	Kilo Hertz
V	Voltage
mm	Millimetre
cm	Centimetre
m	Metre
km	Kilometre
Mbps	Megabits per Second
kbps	Kilobits per Second
ms	Millisecond
s	Second
mA	Milliampere
KB	KiloBytes
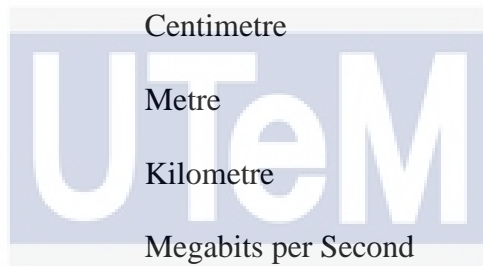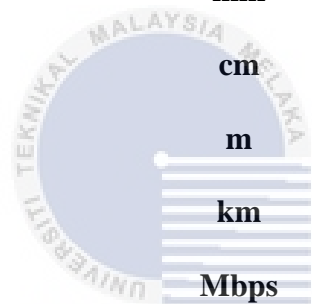
LIST OF ABBREVIATIONS

IoT	Internet of Things
RFID	Radio Frequency Identification
Wi-Fi	Wireless Fidelity
BLE	Bluetooth Low Energy
LoRa	Long Range
SPS	Smart Parking System
IR	Infrared
USB	Universal Serial Bus
RAM	Random-access memory
AC	Alternating Current
DC	Direct Current
LGPL	Lesser General Public License
GPL	General Public License
SoC	System-On-chip
MAC	Medium Access Control
PHY	Physical Layer
PAN-ID	Personal Area Network
GSM	Global System for Mobile Communication

SMS	Social Messaging Service
NFC	Near Field Communication
A2DP	Advanced Audio Delivery Profile
RSSI	Received Signal Strength Indicator
API	Application Programming Interface
LTE	Long-Term Evolution
ICSP	In Circuit Serial Programming
PWM	Pulse Width Modulation
IDE	Integrated Development Environment
SRAM	Static random-access memory
EEPROM	Electrically Erasable Programmable read-only Memory
GPS	Global Positioning System
APP	Application

XII

CHAPTER 1

INTRODUCTION

1.1   Introduction

The basic technique for finding a parking spot at most parking spaces is manual through luck and experience. This method involves resources and time, and if the driver in a high vehicle density city is searching for a parking spot, the worst case is that they will not find any parking spaces. To overcome the problem and enhance the parking management system, the Internet of Things technology has changed both in life and smart parking systems in various fields. Developing a smart parking network includes the introduction and application of wireless networking technologies such as ZigBee, Radio Frequency Identification (RFID), Wi-Fi, Bluetooth, and others into the SPS. All of these have their advantages and drawbacks for the smart car parking system. Apart from this, other types of sensors and processing systems are added to the PLC to detect the car's presence. The implemented processing unit has a close partnership with SPS wireless communication technologies. Each of the technologies has its particular method for it to work properly.

The goal of this project is to create an IoT based application for a smart parking system by using Arduino. Wi-Fi wireless communication technology is chosen because it can easily save cable costs and internet access anywhere. The proposed system assists a user in knowing parking spaces are available. The parking systems are designed to provide users with facilities such as finding, allocating and reserving the 'best' car park available to a user in a given area, providing navigation instructions to reach this lot. Such systems require the

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deployment of efficient sensors in the parking areas for occupancy monitoring as well as quick data processing units to gain practical insights from data collected from different sources.

1.2   Problem Statement

Nowadays, it is becoming more difficult to find a parking space because of the increase in automation production. Car users spend a lot of time trying to find where to park in the parking garage. Drivers rarely have time to waste in parking garages searching for spaces to park in the constantly busy working world of today. Parking problems in every major city are getting serious and growing at an alarming rate. To solve this issue, a smart parking infrastructure is being built to handle the task using the latest technologies. However, most of the existing smart parking implementations only provide on-site information about parking availability. For example, a smart parking system at a shopping mall displays the number of available parking slots at the parking entrance. Currently, the integration of a smart parking system with IoT devices is still a new area to venture into. This approach is predicted to provide a far convenient way of parking searching especially in high population cities.

This project aims to build an IoT-based smart parking system that saves driver time and achieves an accessible and user-friendly system. This is for promoting traffic movement inside the car park. The primary purpose of this is to develop a mobile application that will allow users to check the availability of parking within their area. A model of parking system is designed to illustrate the parking function, and consumers can use the mobile application to check parking slots availability near the facility.

1.3 Objectives

This project aims to develop an IoT-based smart parking system that can be accessed through a mobile application. There are three objectives as listed below;

1. To develop an on-site device for a smart parking system by using Arduino.

2. To create a smart parking mobile application that can interact with the on-site smart parking device.

3. To evaluate the performance of the developed system.

1.4 Scope of the project

My project's scope is to develop a mobile application that can access the on-site device that had installed in the Smart Parking System.

My project will separate into two parts which are the development of an on-site device for smart parking systems and implementation of smart parking mobile applications. In the smart parking system, each of the parking slot is detected and the data is sent to the Arduino to be processed. The data is uploaded to the Blynk cloud via Wi-Fi. In order to interact with the on-site smart parking device, the mobile application is developed on the Blynk IoT platform and serves as an interface for communication with the device by