Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF PARKING GUIDANCE AND INFORMATION SYSTEM FOR MULTI-STORY BUILDING

NURUL AZARINA BINTI ABD RAHIM

Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2021

DEVELOPMENT OF PARKING GUIDANCE AND INFORMATION SYSTEM FOR MULTI-STORY BUILDING

NURUL AZARINA BINTI ABD RAHIM

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Development of parking guidance and information system for multi-story building

Sesi Pengajian : 20/21

Saya Nurul Azarina Binti Abd Rahim mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	**TIDAK TERHAD**	

Disahkan oleh:

azarina

(TANDATANGAN PENULIS)
Alamat Tetap: B314, TAMAN IMPIAN WARISAN, BATU 18, HULU LANGAT, SELANGOR

(COP DAN TANDATANGAN PENYELIA)
TS ZAHARIAH BINTI MANAP
Penyelaras Program BEET
Jabatan Teknologi Kejuruteraan Elektronik dan Komputer
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 10 JAN 2022

Tarikh: 11-01-2022

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report entitled entitled “Development of parking guidance and information system for multi-story building” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : azarina

Student Name : Nurul Azarina Binti Abd Rahim

Date : 10 JAN 2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

Signature : 

Supervisor Name : TS. ZAHARIAH BINTI MANAP

Date : 11-01-2022

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

To my beloved mother, Tuminah Bt Suriff, and father, Ghazali Bin Mohd Ariff,

and

To dearest family

ABSTRACT

The urbanisation in developing countries has resulted an increase in intensity of population in urban and downtown area. This situation has forced rapid development of multi-story buildings to accommodate the need of living spaces and commercial premises such as hotels, apartments, shopping centers, offices, hospitals, and airports. Subsequently, the number of vehicles is also increasing tremendously which leads to inefficient parking slot searching time and traffic congestions at the buildings' parking space. Therefore, a systematic parking management for multi-storey buildings is needed to overcome the issues, which in turn will provide a betterment in modern lifestyle. Most of existing parking management systems implement an automatic gate and a parking ticket. However, there are limited information about the parking slot availability provided, commonly using of LED display at the parking entrance. The integration between conventional parking systems with Internet of Things (IoT) technology is a good solution to provide more efficient and flexible parking management systems. This project aims to develop a smart parking system that provides an efficient parking space utilization using 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 availability of parking slots in that building with specified level. 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 calculated. All of the actual results of the on-site device are synchronized with the result in Blynk mobile application. This system allows the smart parking system and the user to interact. Which will allow the user to check the vacant parking slots at their hands.

ABSTRAK

Pembandaran di negara-negara membangun telah menyebabkan peningkatan intensiti penduduk di kawasan bandar dan pusat bandar. Keadaan ini telah memaksa pembangunan bangunan bertingkat yang pesat untuk menampung keperluan tempat tinggal dan premis komersial seperti hotel, pangsapuri, pusat membeli-belah, pejabat, hospital, dan lapangan terbang. Selepas itu, jumlah kenderaan juga meningkat dengan pesat yang menyebabkan masa pencarian slot tempat letak kenderaan yang tidak cekap dan kesesakan lalu lintas di tempat parkir bangunan. Oleh itu, pengurusan tempat letak kenderaan yang sistematik untuk bangunan bertingkat diperlukan untuk mengatasi masalah tersebut, yang seterusnya akan memberikan peningkatan dalam gaya hidup moden. Sebilangan besar sistem pengurusan tempat letak kereta yang ada menggunakan pintu automatik dan tiket tempat letak kereta. Namun, terdapat sedikit maklumat mengenai ketersediaan slot tempat letak kereta yang disediakan, biasanya menggunakan paparan LED di pintu masuk tempat letak kereta. Integrasi antara sistem tempat letak kereta konvensional dengan teknologi Internet of Things (IoT) adalah penyelesaian yang baik untuk menyediakan sistem pengurusan tempat letak kereta yang lebih cekap dan fleksibel. Projek ini bertujuan untuk membangunkan sistem tempat letak kenderaan pintar yang menyediakan penggunaan tempat letak kereta yang cekap menggunakan teknologi IoT. Sistem yang dibangunkan akan terdiri daripada dua komponen utama iaitu peranti di lokasi dan aplikasi mudah alih. Peranti di lokasi mengemas kini maklumat mengenai ketersediaan tempat letak kereta dan lokasinya di pelayan awan. Data dapat diakses oleh pengguna melalui aplikasi mobile. Sistem ini memberitahu ketersediaan slot tempat letak kenderaan di bangunan tersebut dengan tahap yang ditentukan. Ketepatan untuk Sistem Parkir Pintar berasaskan IoT akan dianalisis melalui satu siri ujian masa nyata. Dengan membandingkan keadaan sebenar peranti di lokasi dan hasil yang ditunjukkan dalam aplikasi mudah alih Blynk, peratusan ketepatan Sistem Parkir Pintar berasaskan IoT dikira. Semua hasil sebenar peranti di lokasi diselaraskan dengan hasil dalam aplikasi mudah alih Blynk. Sistem ini membolehkan sistem parkir pintar dan pengguna berinteraksi. Yang akan membolehkan pengguna memeriksa slot tempat letak kereta kosong di tangan mereka.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, madam Zahariah Binti Manap for her precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parent for the financial support which enables me to accomplish the project. Not forgetting my fellow course mate for the willingness of sharing his thoughts and ideas regarding the project.

My highest appreciation goes to my parents and family members for their love and prayer during the period of my study.

Finally, I would like to thank all the staffs at the UTeM and classmates as well as other individuals who are not listed here for being co-operative and helpful.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

V	-	Voltage
mA	-	Current
KB	-	Kilobyte
MHz	-	Megahertz
mm	-	Millimetre
g	-	Gram
vcc	-	Voltage Common Collector

LIST OF ABBREVIATIONS

V	-	Voltage
IoT	-	Internet of things
i.e.	-	That is

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Many different types of vehicles are produced and used by people in this century of modernism, especially in urban areas. The increased number of vehicles can have a significant serious effect on the environment. Particularly because of the increased need for public parking infrastructure at multi-story building. For example, find vacant parking in a shopping mall or a hospital facility.

Only an automatic gate and a parking ticket are used in a conventional parking lot system and the availability of the parking lot is not presented to the user. They have located it on their own in order to park their vehicles. In this situation, finding a parking spot and a vacant parking lot takes time for the user. Besides, they had no idea whether the parking lots were occupied or still vacant. The parking lot system needs to be refined to make it more systematic, efficient, and reliable for users. To overcome the following difficulties while also meeting demand for more parking spaces and improved services, parking management organizations are competing to create solutions that will result in a more efficient parking experience.

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 car park available to a user in a given level. Such

systems require the 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

When it comes to parking lots especially in multi-story buildings like hospital, Shopping centers. There is a slew of difficulties to consider. In a traditional parking lot system, only an automatic gate and a parking ticket are provided and the user is not informed about the parking lot's availability. Finding a vacant parking lot by each level takes time for the user in this case. Furthermore, they had no clue if the parking lots were full or empty.

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 by each level availability in multi-story building.

1.3 Project Objective

The aim of this project is to develop a parking guidance and information system for multi-story building. Specifically, the objectives are as follows:

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

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

c) To evaluate the performance of the developed system.

1.4 Scope of Project

My project's scope is to develop a parking guidance and information system for multi-story building that can access the on-site device that had installed. 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 this parking system, it will have 3 floor and each floor has 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 end-users. The central server Blynk serves as a directory to hold all information and end-users connected to the parking area who have access to the network. So that, the apps show number of available parking spaces by each level to the users. The data stored on the cloud is backed up and updated continuously to make sure that the information is the latest for the users.

1.5 Project Significance

In terms of commercialization, this project aspires to provide a parking guidance and information system for multi-story buildings that are in great demand. The commercial potential is enticing because this system has minimal equipment costs, minimal maintenance costs, and a simple infrastructure. The project gives users a lot of benefits to avoid wasting a lot of precious time finding the parking spaces for each level manually especially in terms of locating parking spaces in multi-story buildings such as shopping malls, hospitals, hotels, and other similar structures and allows users to instantly locate the best available parking spot because of the information provided by the mobile application.

In addition, users can avoid going to the level that already fully occupied car parks so that the traffic congestion rate can be reduced. As a result, rather than searching manually, this system can provide available parking. This can help save time and improve quality of life.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The daily urbanization of developed countries has led to a rise in the demand for automobiles. This has in turn culminated in the emerging of new vehicles into the market. There has been a spike in the number of cars, but there has been no proportional increase in the amount of parking space available. As a result, traditional parking systems may suffer from a number of negative consequences, including traffic congestion, noise, fuel usage, and time consumption. Furthermore, anyone looking for a parking spot must circle the parking lot multiple times and wasting valuable time. As a result, malls and other public places need the most effective solution to this issue. The online parking information system is critical to improving the parking system. This lead the demand for automated parking systems, online parking slot reservations, multi-story parking buildings, and other alternatives are increased. This chapter reviews articles and works from previous research on parking guidance and information systems in multi-story buildings.

2.2 Overview of parking guidance and information system

A detail survey on the development of parking guidance and information system has been found in [1], [2], [3]. The authors outlined the many technologies, methodologies, and algorithms that have been used to create a parking guidance and information system. GPS, GSM module, Wi-Fi, Bluetooth, RFID, Arduino, Raspberry Pi, and sensors like Pi camera, photodiode sensor, magnetometer sensor (MAG3110), Xbee, Ultrasonic, and Infrared (IR) Sensor are some of the most common and regularly used technologies

discussed in the articles. Parking guidance and information system technologies can certainly be a well identified innovation because based on the various technologies that support the parking guidance and information system. Although there are a massive range of technologies that have been used this day, there are a few commonly used technologies. In this section, parking guidance and information system applications in different sensors technologies are reviewed.

2.2.1 Infrared sensors Technologies

An infrared sensor is an electronic device that emits infrared rays to detect certain features of the environment. An infrared sensor can detect motion as well as measure the heat of an object. This sensor exclusively detects infrared radiation emitted by an object. These kinds of thermal radiations are often invisible to the naked eye, but they can be detected by an infrared sensor. Figure 2.1 show basic principle of IR sensor. The primary operating idea is when an infrared LED emits light, the photodiode senses it.

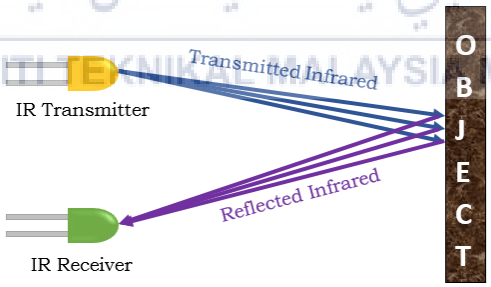

Figure 2.1 Basic working principle of IR sensor

The authors in [4] defined that Real-time sensor reading seem to be the most promising way to inform about the status of car parking (busy or free). The implementation of the prototype of car parking system has been done in this work. The real-time readings of the infra-red sensors are sent wirelessly to the gateway server where they will be saved and analyzed.

The authors in [5] proposed the IR technology is used for vehicle detection. The IR sensor will be placed at the entry point to help eliminate multiple check-ins and parking lot traffic congestion. The infrared obstacle sensor, which is mounted at each floor's entry and exit and whose duty is to transfer data to the Arduino, which processes the sensor and sends data to the database, is shown in [6]. The database is utilized to record data and sensor values that will be displayed in a Web browser on a monitor on the ground floor to alert the driver of an empty parking spaces as to produce efficiency BBM and time efficiency.

In addition, the author in [7] created the main processing unit is an Arduino microcontroller. Which receives information from IR sensors to assist the user. When sensors detect a vehicle, the corresponding output is sent to the cloud, via protocol and various layers of the OSI model. So, the data can be accessed on a user's mobile device via an app or on a computer via an html page. Then user can view the parking lot of any geographical area to find an empty parking slot.

The authors in [1], designed an availability of parking lots based on the IR sensor linked with an online monitoring system. Those infrared sensors have established a wireless connection. Through the LCD counter display the parking system operator may regulate and monitor the state of each parking lot. This indoor parking assistance system will provide the driver with significant advantages.

In [8], the authors proposed when the application is not in use the RFID readers are utilized to control the entry and exit gates and the servo motors serve as the entry and exit gates. Then, like in-spot sensors IR reflective sensors monitor the condition of the spot (free or occupied by a parked car) with all the IR sensors connected to a single Interface kit. RFID, Servos and interface kit is directly connected to a laptop acting as a server that collects information about the car park infrastructure and occupancy.

2.2.2 Ultrasonic sensor Technology

An ultrasonic sensor is an electronic device that uses ultrasonic sound waves to detect the distance between a target item and converts the reflected sound into an electrical signal. Ultrasonic waves travel at a faster rate than audible sound waves (i.e., the sound that humans can hear). Figure 2.2 shows ultrasonic sensors include two primary components. A transmitter (which uses piezoelectric crystals to make sound) and a receiver (which encounters the sound after it has travelled to and from the target).

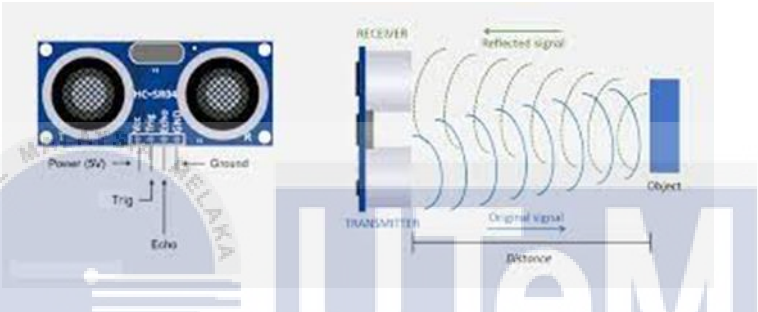

Figure 2.2 basic working principle of ultrasonic sensor

The author in [9] and [10] implemented Ultrasonic sensors are installed in the parking slots to detect cars entering and exiting the slots. Author in [9], an ultrasonic sensors to convey information about empty and full slots to the Arduino. When a car approaches the sensor, the sensor's trigger emits a high-frequency sound wave that is reversed. That signal is processed by the Arduino, which then displays a green or red LED. The LED will turn red if all slots are occupied. The LED at the parking entry will be green if it isn't.

In addition, the authors in [11] introduce HC-SR04 ultrasonic module to detect parking slot. When HC-SR04 ultrasonic module output is sent to the Arduino Nano, and data is transferred to the server using esp8266 Wi-Fi module. Further, the data is processed by the server, which then displays the information in the form of a parking area map on both web and desktop applications. This system will display available space on a website and on a computer with a few second delay and a simple wiring system.