

Smart Car Parking System

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ABSTRACT

Due to population explosion, especially in India and China as population is increasing simultaneously number of vehicles on road also increasing. Therefore congestion is the main problem nowadays, during parking the vehicles finding available parking slots is tedious job it is better to identify the available parking slot before living the current location. By identifying and reserving the parking slot in destination place or nearby it is the good job. This study is aimed at analyzing available parking slots. This system allocates available parking space to a needed driver to park their vehicles. Renews the availability of the parking space when vehicles leaves and computes the charges, due to implementing this system will increase parking utilization. The system does this by providing more efficient and effective parking enforcement. In this system keypad, cloud, sensors, motors are used. Sensors are used to detect space is available or occupied, Cloud is used to store data of parking details, keypad is provided for the manual entry of OTP number by users. With sensors, LED Lights like Red, Green and Yellow etc are used to slot status.

Keywords: Arduino, Cloud, Sensor, Smart parking.

I. INTRODUCTION

There are two types of parking management system first is a normal parking system and another one is an automatic parking system. What we are using nowadays to park the vehicle is normal parking system. In normal parking system, problem faced by people due to lack to car parking management is shown in figure.1. An automatic parking system is used to make the whole process of car parking more efficient and less complex for both drivers and supervisor. This can be done through sensors, microcontroller, LEDs as indicator, LCD display, keypad, and stepper-motor. By storing the data related to parking area in cloud can be accessed from anywhere. To access the data from cloud internet is required.

The main objective of this paper is to develop an intelligent, user friendly automated car parking system which reduce the human intervention and traffic congestion and to offer safe and secure parking slots within limited area.

The main problem nowadays people facing is it is tedious job to find the vacant spaces during weekends or public holidays. Insufficient car park space leads to traffic congestion and driver frustration.



Figure 1. Improper parking system..

II. METHODS AND MATERIAL

We are designing a less complex system, thus the components required is also less. There will less man power involved for installation operation and maintenance. Hence system requires small space for installation and less power consumption. It allows pre-booking. It restricts user entry, as only user with more than threshold balance can enter parking slot. System allows user to give individual parking preference. It automatically deducts amount from user's wallet. De-allocates the parking slot once the car leaves. System notifies user of allocated slot through SMS during booking, deducted charges and remaining balance during exit. If user not able reach the parking slot within the buffer time then reservation will be auto cancelled (buffer time means like 15min, 30min). Then user need to reserve slot once again if required.

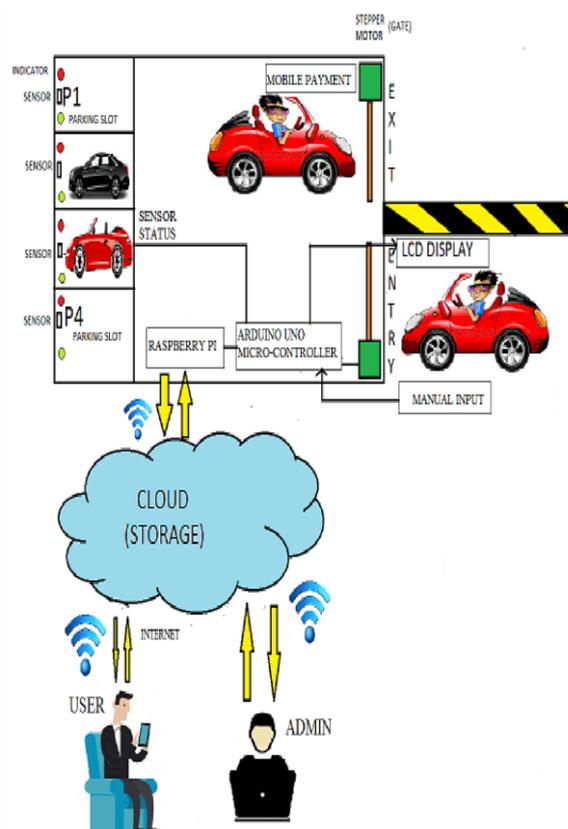


Figure.2. System Architecture of Smart Car Parking System.

The smart parking system encompasses numerous sensor nodes, GSM, micro-controller, cloud, barrier gate, LCD display and keypad as illustrated in Figure.2. Active IR sensor installed on every slot in parking area in order to collect information from them [12] [13]. Data collected from sensor is transferred to cloud through Raspberry-pi [10]. The cloud stores these data and presents them as useful information for drivers on the screen. The sensor stay in sleep condition most of the time to preserve the battery's power and starts it's reading from the active IR sensor at the appropriate time interval and then updated to cloud. The cloud manages the availability or occupancy states of all the parking slots and also offer the status of parking slot information to driver through browser and also at the entrance of the parking area in LCD display. Smart parking system has different functionalities that are managing user, parking slots, payment and messages. User can check the status of parking slot through android application and reserve specified parking slot if available. After successful reservation,

confirmation message is send to the user with OTP or reference ID. User as to enter received OTP or reference ID at entrance of parking area .If those numbers are matched the barrier gate opens. User will park the vehicle in reserved slot. During exit time user needs to make payment by scanning QR code (like Paytm). To make payment smart phone is required [11]. After successful payment it allows user to exit from that point.

A. Hardware Description

The required hardware component are Arduino UNO microcontroller, Raspberry pi, Router, LCD, Active IR sensor, stepper motor, power supply, Key pad and LEDs.

1) *Arduino Uno*: The Arduino Uno is a microcontroller board based on the ATmega328 (data sheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), analog inputs, a 16MHz ceramic resonator, a USB connection, a power jack, and a reset button. This contains all the required support needed for microcontroller.

2) *Sensor*: Sensor is placed in each slot to know the status of each parking slots. It sends signal to microcontroller, here active IR sensor are used.

3) *Indicators (LEDs)*: Neopixels are used and placed in each parking slot. Advantage of it is these are addressable LEDs and it require only 3 wires to connect 'n' number of LEDs. Each slot separate color can be assigned and Red indicates slot occupied and Green indicates available.

4) *Stepper motor*: It is used to open the barrier gate when user arrives at entry point and departure at exit point.

5) *LCD Display*: Display is placed in outside of parking area at entrance. It contains parking slots status like number of slots occupied and number of slots available.

6) *Raspberry pi*: A raspberry pi is a credit card sized computer originally designed for education. Raspbian comes preloaded with python, the official programming language of the Raspberry Pi and

IDLE3, a python integrated development Environment. It is used in education, industrial and home automation [10].

B. Software Requirements

1) *LINUX*: Linux is a family of free and open source software operating system built around the Linux kernel. Linux OS is a cross-platform operating system based on UNIX that can be installed on PCs, laptop and more.

2) *Arduino IDE*: Arduino consist of both a physical programmable circuit board (often referred to as a Microcontroller) and a piece of software, or IDE (integrated development environment) that runs on your computer, used to write and upload computer code to the physical board.

3) *php / html / JS*: JS is used for interface between hardware and software. HTML and PHP is used for developing front end.

C. Modules

Entire system is divided into three Modules:-

1) *Slot Reservation*: Initially user needs to register his details using smart phone in android application. After registration, logging to his profile user can check parking slot status. All information related to parking area will be stored in cloud. Data stored in cloud will be displayed to user in on android application. Based on the data displayed on android application user reserve the required slot. After selecting the slot an OTP will be sent to the user as a confirmation message.

2) *Authentication*: In case of registered user, the registered user arrives at the parking slot and the OTP number is entered with the help of keypad which user received during reservation as a confirmation message. After verification of the entered OTP number microcontroller send the signal to open the barrier gate. Then user is allowed park the vehicle in reserved slot.

In case of Un-Registered user, the unregistered user at the entrance of parking area LCD displays the status of parking area that is total number of occupied and free slots. If the Parking space are available then user need to enter some minimum details like vehicle number and phone number. Next user will get confirmation message with OTP, user needs to enter received OTP then barrier gate will open user is allowed to enter into parking area and park's the vehicle in allocated slot.

3) *Check Out:* User leaves parking slot and arrive at exit point. User has to make payment by scanning QR code (like paytm). After successful payment only barrier gate will open for user to exit. Allocated space is de-allocated and make available to another user to make use of it. All details (timings, payment, and user information) get updated in the cloud. Those details are accessible to the supervisor. Complete working flow of smart car-parking system is shown in activity diagram Fig.3.

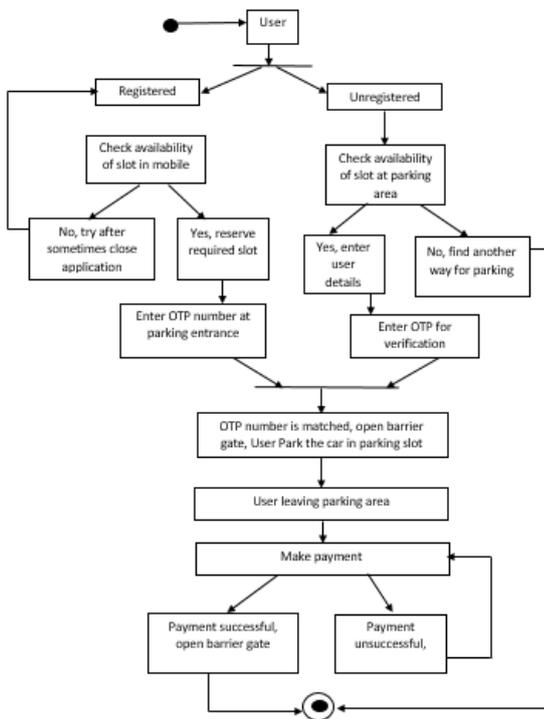


Figure 3. Activity diagram for smart car parking system

III. RESULTS AND DISCUSSION

When we saw how people park these , we came up with this idea that we certainly need a better parking system that exist today as there is no authorization and anyone can park their vehicle where they want.

At entrance it reads RFID Tag and checks it is authorized user or not. If authorized user than gate opens for entry to parking slot and park the vehicle, if slot is available and counter get updated. IR sensors are used to sense the car present in slot or not [1]. User need to get registered by entering their credentials. Those details are get updated to cloud. When user arrives at parking area captures car number plate and processed parking slip will be displayed on the owner's application upon verification. Also LED allotted to slot turn to Red indicating that slot allocated. As soon as user leaves parking area billing amount will be calculated according to the parking time and will be withdrawn from the linked payment wallet customer .cloud provide data storage and computing resource for the car parking service [2][5].

Admin application is used to define new parking area, specify number of parking lots, the parking cost per hour and other details. Parking application used to send vehicle plate number and reservation password to central server for verification when user checks in and issue bill to user on checkout. Application for user to register for service, find parking area from the list of area, and reserve an available parking slot and specify duration of reservation [3].

In some of the proposed system, using image processing concept number of slots available or not is predicted and updated to cloud [6][7]. And also to check arrived user at parking entrance is authorized user or not using OCR algorithm [8] [9].

IV. CONCLUSION

Due to advancement in technology, drivers are demanding easier and less time consuming parking facilities. There are various methodologies of smart parking that have been implemented to provide better service to end users and improve the overall management of the existing parking system. The real time monitoring of available parking lots and allotment of the suitable parking area by advanced reservation are some of the characteristics services provided to the customers through a user friendly interface like a browser or using SMS services.

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