

REAL-TIME SMART CAR PARKING MODEL USING IOT

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Abstract—The Internet of Things plays a crucial role in attaching the nearby environmental objects to a system and create a simple model to examine those objects from any remote place. The person must upgrade with expanding automation. And most people are facing issues with the parking automobile in a parking spot in a town. This study proposes to plan an SPS (Smart Parking System) that permits the user to identify the nearby parking zone and offers parking spot availability in such corresponding parking zone. Thus this paper aims in decreasing the time in detecting the parking masses and as well evades the irrelevant traveling through filled parking masses in a parking zone. Hence, it decreases fuel waste which in turn decreases carbon footprints in an environment.

Index Terms—Android Implementation, Internet of Things, Parking slots, Raspberry Pi, Smart parking

1. INTRODUCTION

Internet of Things was initially initiated in 1999 on the auto-ID hub and was initially utilized by Kevin Ashton. While developing this modern burning automation, it promises to attach all our nearby things to the system and

communicating with every other with little human participation. Still, IoT is in starting phase and there is no ordinary architecture that is prevalent until today. There are ample implementations and researches which are presently moving in every respective place. So there are no boundaries or guidelines presents to explain the IoT definition [1]. Therefore based on the context, the IoT approach has various definitions. Presently, it is explained as things available in the substantial world or surroundings are attached with sensors or along with some embedded models and made connected to a system via wireless or wired connections. These attached frames are known as smart objects or smart devices. And it contains smart machines that transmit linking with the further environment, machines, objects, etc. Moreover, it includes fixing any pair of machines, machines to people and vice-versa, etc. this transmission is known as M-M transmission. As M-M transmission is growing through the different likeness bodies like ETSI, OMA, 3GPP, IEEE corporation have achieved few schemes on M-M transmission. It creates everyday life objects to furnish with sensors, transceivers, microcontrollers, and actuators, etc. to transmission [2]. Some main advantages of IoT

contain 1) increased circumstantial awareness; 2) tracking actions; 3) instantaneous response and control; 4) sensor-driven resolution analytics Etc. IoT technology enlarges in different areas of smart approaches but has yet not found border limitations of this automation. Certain smart approaches that it has executing presently like smart lighting, smart energy, smart city, smart grids, smart health, etc. It is mainly sorted into three varieties like processing, connectivity, and sensing [3]. Since sensing contains sensing the rate of automobiles, sensing of pressure, temperature, and peoples or any things (accelerometer), etc. And these are processed by applying certain processors like a hybrid mainframe MPU/ MCU, network mainframe, etc. And apparatus is attached by applying certain technologies named Wi-Fi, GPS, RFID, BTLE/ BT, etc.

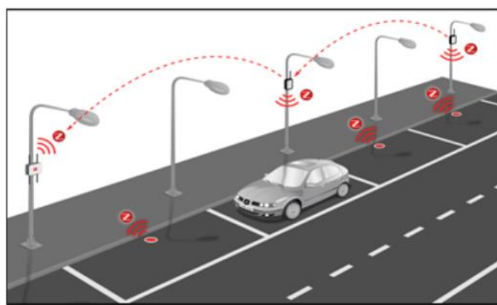


Fig.1 Smart Parking System

More than half of the world's humans are existing in the towns. Therefore the towns have achieved full tenancy. As people utilizing automobiles for transportation so there is a huge number of automobiles that prevails for human satisfaction. Most of the time people will spend their time seeking parking masses to park their automobiles. Figure 1 displays a smart parking system. Thus overcrowding happens in traffic jams it shows the hectic position to identify the parking area to leave their automobile. Most traffic happens only due to automobile overcrowding in town places thus humans are wasting time in seeking a parking place abnormally to leave their automobiles [4]. The method involves a Raspberry pi based parking detector. It consists of a Pi-camera to find the vacant parking areas and despatches this information to the server. This cached information is accessed by customers. This makes a customer examine the availability/status of parking areas before mounting their trip. Here, the challenge is to utilize the existing assets to the optimum extent to decrease the seeking time, traffic congestion in the town. Certain embedded models like Tsgate, raspberry pi, Tsmote, Auridino, etc. are applied to evolve IoT approaches [5]. Some surviving parking method uses detectors to gather the details. But applying detectors such as video detectors in the parking method is costly. Hence the proposed method focuses to evolve a structure with reduced cost as well as

increased performance. The paper includes related works in section 2, explains the systems in section 3. In Section 4 result with provisional findings is endorsed and the conclusion in part 5.

2. RELATED WORKS

An effective method in the literature describes the cloud computing automation and the IoT have been associated with the infrastructure of town to create the context-aware and further intelligent town for using its great resources. Automation possesses sample potential to resolve the urban region's challenges around the world to ease the people. A framework method such permits the sensor's information integration and data analysis in the condition of smart parking is presented [6]. This automation utilizes sensors and gadgets employed around the town parking regions despatching real-time information by the border computers to the primary cloud server. To resolve the town parking issues in towns a detailed survey of fuzzy logic present systems is evolved.

The internet of things links billions of things and people in real-world circumstances. Among utmost researches, the present research is mainly on the smart car parking method. The increasing numeral of the automobiles on the roadway and abusing of unoccupied parking places leads to traffic and congestion issues. The author presents the concept of utilizing cloud-based automation and RFID in car parking resources in town [7]. This method gives a solution applying the RFID idea with IoT attached with the cloud model.

Another method in literature focused on intelligent smart parking methods applying IoT and computer vision. The proposed method begins by obtaining a dataset [8]. The database contains figures of different vehicles, such as composed of the section of a science car park on the Port Harcourt, Rivers State University, Nigeria. The two techniques namely CNN and Mask R-CNN are proposed for parking/ vehicle spot detection.

The concept of a smart town [9] is presented in this literature. An IoT associated with the smart parking administration method applying RFID automation is executed. The IR detectors are laid before the parking spot and a buzzer is utilized for indication. While the parking spot is vacant then the LED will flash and the parking spot is the entire LED will be turned OFF. If the automobile is left the RFID will study the data and cut the specific amount and by utilizing IoT position will be despatched by a message to the owner utilizing GPS and GSM technologies.

In current scenarios, the issue of automobile congestion increases over car parking gradually. The execution of an android application executed for a user appeal to host technique. The RFID tag is attached to every automobile [10]. If the car arrives

somedistance later RFID tags monitor or detect by the RFID reader to find which regions are free for parking the automobile. After finding the detail of the parking spot that data will move to a Raspberry pi mainframe. Based on automobile density for discovering the empty and later it will alert to a customer for parking the vehicle by similar application.

Another method [11] introduces the idea of utilizing RFID tags and IoT depending on automation in-vehicle parking aids in town. The author builds the older parking method smarter through leveraging the IoT facility and embedding it with the latest novelty of electronic detectors, computers. The present method assists users to mechanically examine and unoccupied car parking areas in a little quantity of time.

The usage of the smart town rises rapidly with the quick progress of the IoT approach. It has been elaborated in the literature [12]. The smart town concept inherently getting town life; also raises the ability of municipal occupations and benefits plus form the feasible economic advance of the town. The offered vehicle parking network envelops an IoT structure sent close by for getting arranged the surviving parking places such as faster contrasted associated with the various frameworks.

An effective method is proposed in the literature [13]. It involves a microcontroller, a combination of low-cost IR detectors, and IoT. The IoT depends on the intelligent car parking method assists to make a smart circumstance and link the objects to the web and also makes it easier to access those objects from a remote position.

Another method [14] proposes a model which integrates the restriction of sharp IoT gadgets with supremacy shape entryways utilizing progressing trial response to secured control works in the halting region. A reasonable most short route estimation is utilized to identify the base detachment in the middle of the consumer and every halting zone in the structure. The structure will assist consumers to detect a free parking place at any rate cost.

The aim is to provide a good solution to the annoying issue car parking is proposed in the literature. A try has been done to create an IoT authorized parking network, thus decreasing the time, human efforts, cost to look for a vacant spot, and as well the fuel utilization of the automobile [15] – [18]. While evolving this network, some existing models depending on IoT were studied. And, there is a provision to cache the customer entries and their car number plate in the dataset. The author incorporates the figures of working websites showing the availability of places in green and red and as well entries in the dataset alongside the customer number plate [19-20].

3. PROPOSED WORK

The proposed smart parking spot booking method is planned through a mixture of software and hardware. As per the software portion is concerned, it

is made in the Android implementation that is applied for evolving a mobile application that will possess access to the details given through Raspberry Pi. The Raspberry Pi is the hardware core and most main element of the hardware portion. DC power supply is utilized for allowing supply to a circuit. An Ultrasonic detector is employed at every parking spot and it will inform if its parking spot is empty or not. A motor operator circuit and the DC gear motor are attached with a microcontroller which is applied to manage a fence at the parking entrance. At an entry barrier user will confirm the reservation information through a QR code scanner and later the obstacle will be unlocked or locked through an authenticated person. LCD is attached to a microcontroller that shows numerous devices which have been parked and the buzzer honks while the parking area is jammed. The detail about the empty or filled spot is despatched to a microcontroller and another despatched this detail to the cloud server sector which is attached to it. A cloud server sector despatches the details to an application through IoT and the order about unlocking or locking the gate is a despatch from an application by a cloud server sector to a microcontroller, that by a DC gear motor and a motor driver circuit manages the barrier functioning. In the software portion, the user will outlook the tracking parking area through Google map, reservation history, QR code production, and also supplies the email information of the reservation details. Initially, online reservation by utilizing an android application is made. In town places detecting parking areas is hard in surge hours. So in the android application, the person used to reserve the parking spots in advance like movie tickets. Thus, a parking spot is booked by utilizing the mobile app. cloud database supplies parking available details; if there are any empty spots available, later people will reserve the interesting spot and the payments are completed by e-wallet. Figure 2 shows an architectural diagram of the proposed system.

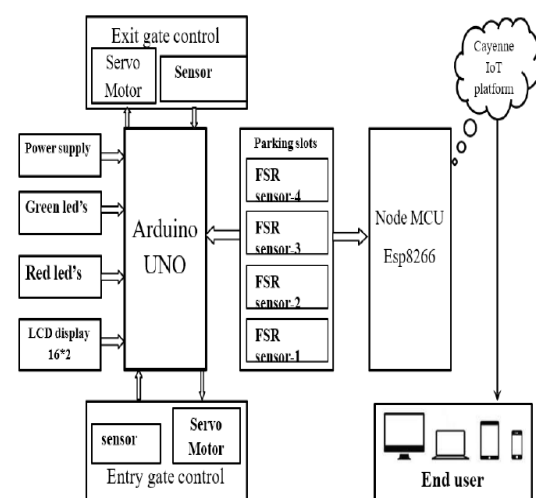


Fig.2 Architectural diagram of the present system

The flow process of the proposed model is depicted in figure 3.

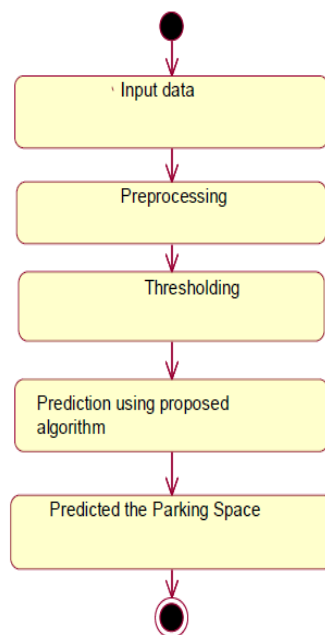


Fig.3 Structure Description

While the reservation is finished, the database is upgraded with present availability. Then, the parking entry method utilizes an IR detector, LCD, DC motor, and the QR code reader. The IR detector is applied to permit the car access, LCD is applied to exhibit the parking detail, DC motor is applied to unlock the barrier, and QR code reader is utilized to find car information such as owner name, car number, etc. After finding a car number, while a user reserved their parking area then the gate is unlocked and will move inside. An LCD exhibit allocated parking status and parking spot too. This allocated information is continuously upgraded to a database. After, the parking system management is done. This supplies regulations to owners to leave their car precisely. Every spot is allocated through a single Ultrasonic detector and the buzzer. Firstly, it will examine whether a spot is allocated or not. While it is allocated later, LED green becomes 'ON'. While any car entered a parking spot, then the Ultrasonic detector finds it out. LED red turns 'ON' and LED green turns 'OFF'. While the buzzer is 'ON', the user will recognize that people have parked their car unfairly. Later people will quit the spot and moves to the allocated spot. This data is also continuously updated in the database.

The present system contains android applications and hardware modules. In Android Application Module,

- User will open an application and the new user will sign up on this application (Registered details such as Name, contact number, upload a photo, car number, email id)

- Enrolled users will login into this application and get the needed services
- If Users forget passwords and they will retrieve their passwords by email.
- Users will reserve a parking spot as per their scheduling.
- Later the successful reservation as per their scheduling evaluates the pay and amount by e-wallet.
- After the payment verification message is sent to the user mail
- QR code is generated for users, who have reserved a parking spot.
- Android application UI will exhibit the Parking Spot, GPS tracing feature by utilizing Google maps, Settlement Gateway by e-wallet.

In Hardware Module, examine a QR code and IR detector by getting the main entrance access. Then, every parking spot has ultrasonic detectors. Whenever a car enters into a parking spot, the ultrasonic detector finds a car, and its information is dispatched to a cloud and reserves it.

4. RESULTS AND DISCUSSION

The experimentation was done by using a Pentium IV 2.4 GHz software, with 40 GB Hard disk capacity and 512 Mb Ram. The simulation was done by using embedded C coding language and Arduino IDE.

To get an appropriate understanding of the network, it is compulsory to survey all types of outcomes, which are accepting from the network. Through all that analysis, it is possible to hit desired outcomes. The earlier mentioned method for reserving an area is described with the help of the screenshots.

The implementation was done in the software, the login screen was created is displayed in figure 4.

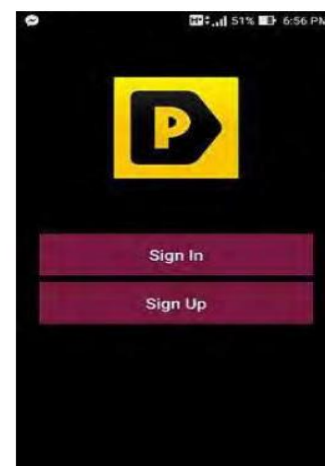


Fig.4 Login page

The registration activity is conducted using the following page as showed in following figure 5.



Fig.5 Registration page

The compilation was done in Arduino IDE and embedded C coding language. The snapshot of the compilation is shown in figure 6.

```
dependencies {
    compile fileTree(include: ['*.jar'], dir: 'libs')
    androidTestCompile('com.android.support.espresso:espresso-core:2.2.2', {
        exclude group: 'com.android.support', module: 'support-annotations'
    })
}

compile 'com.android.support:appcompat-v7:25.3.1'
compile 'com.android.support.constraint:constraint-layout:1.0.2'
compile 'com.google.firebase:firebase-database:10.0.1'
compile 'com.google.firebase:firebase-core:10.0.1'
compile 'com.google.firebase:firebase-auth:10.0.1'
compile 'com.google.firebase:firebase-storage:10.0.1'
compile 'com.android.support:mediarouter-v7:25.3.1'
compile 'com.google.android.gms:play-services-location:10.0.1'
compile 'com.android.support:design:25.3.1'
compile 'com.squareup.retrofit2:retrofit:2.1.0'
compile 'com.squareup.retrofit2:converter-gson:2.1.0'
compile 'com.intuit.sdp:sdp-android:1.0.3'
compile 'de.hdodenhof:circleimageview:2.1.0'
compile 'com.google.android.gms:play-services-location:10.0.1'
compile 'org.greenrobot:greendao:3.1.1'
compile 'com.scribble:android:1.0.0'
compile 'com.github.humpach:glide:1.3.0'
compile('com.crashlytics.sdk.android:crashlytics:2.6.0@aar') {
    transitive = true;
}
testCompile 'junit:junit:4.12'
apply plugin: 'com.google.gms.google-services'
```

Fig.6 Compilation result

In figure 7, the green parking spots displays such they are engaged, yellow parking spots are requested by the customer, but do notensueat the position yet if red parking spots areentirelyaccessible for the reservation.

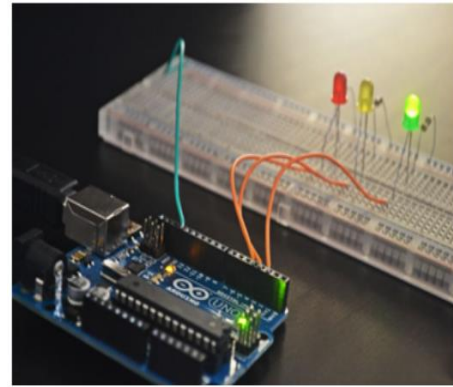


Fig. 7 Parking spots

Figure 8depictsthe live parking spot status at the controlboard.

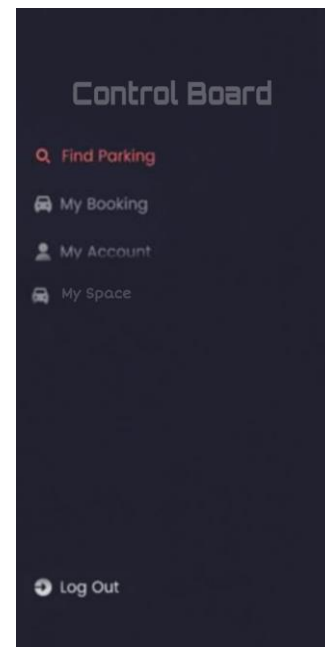


Fig.8Control board



Fig. 9 Bookedand Unbooked

Figure 9 displays the user's booked and unbooked at the control board and as well depicts the user's arrival and exit time based on the real-time network.

The design is implemented on PCB to attain hardware with MCUNODE 8266 i.e. IoT WI-FI element, LEDs, and IR sensors.

Arduino UNO has been used as a primary platform shown in figure 10.

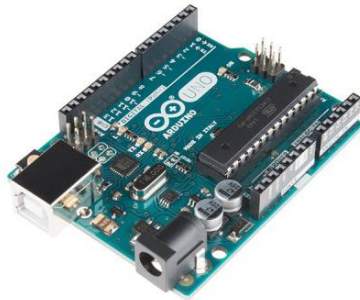


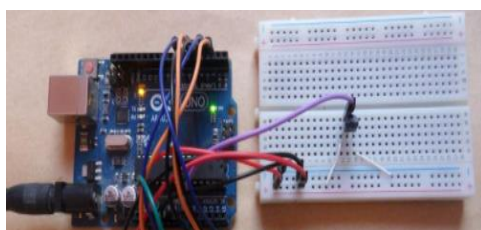
Fig.10 Arduino UNO

The hardware is designed with IR sensors, LED's, Wi-Fi elements immersed in it. It is operating on 5V DC. And, figure 11 denotes hardware with IR Sensors.



Fig.11 Hardware with IR Sensors

The final hardware implementation is shown in figure 12.



5. CONCLUSION

The concept of a smart town has faithfully been a rebellion for humankind. In the current years, substantial innovation has been done in creating keen town regions a reality. The evolution of the Internet of things has provided an ascent to novel potential results as far as intelligent town areas. A constant actual time smart parking method by using IoT discards the demand to scrutinize parking slots and to adequately select and pre-book the supreme parking area. The customer is thus viable to obtain a parking area according to its option at any time and as well from anywhere utilizing just the mobile implementation. The whole network works in actual time. Also, lots of issues such as fuel consumption, pollution, wastage of time, are reduced drastically.

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