

Smart Parking System

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Abstract — The project entitled “THE SMART PARKING SYSTEM” presents an IOT based smart parking system which provides an optimal solution for the parking problem in metropolitan cities. Due to rapid increase in vehicle density especially during the peak hours of the day it is difficult task for the users to find the parking space to park their vehicles. This study proposes a smart parking system based on Raspberry components. This project deals with an effective way of finding empty spaces and managing the number of vehicles moving in and out in complex multi storeyed parking structures by detecting a vehicle using IR sensors and thus providing a feedback.

It is also providing which allows an end user to check the availability of parking space and book a parking slot accordingly. Smart parking can increase the economy by reducing fuel consumption and pollution in urban cities.

Keywords - *Smart parking system, IR sensors, Parking lot, Reservation*

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects devices, vehicles, buildings and other items—embedded with electronics, software, ultrasonic sensors, and network connectivity that enables these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through it is embedded computing system but is able to interoperate within the existing Internet infrastructure.

In the present scenario around us we see excess vehicles and the ineffectiveness to manage them in the correct order. As the population increases day by day the rate of utilization also increases and coping up with the numbers becomes a task. An omnipresent problem around the world is finding a parking space to park your vehicle. This task looks simple on side roads and interior lanes but the actual problem arises when parking in malls, multistorey parking structures, IT hubs and parking facilities where several hundred cars are parked and it becomes arduous to find a spot. The general approach to finding a parking space is to go around and drive aimlessly until a free space is found. Finding a parking space could be the easiest task or could be the most tedious one when it involves wide acres of distributed space across one level or multiple levels. The time and fuel are consumed

unnecessarily because the destination is unknown. The easiest way of approach is to provide a destination specific driving within the parking structure. Smart parking can be considered as one of the Internet of Things applications, a technology which appeared firstly in 1999. More specifically, IoT can be regarded as concept under which a group of things/objects that can be connected via wireless and wired connections, Things can interact with each other for the creation of new services or even applications. With the growth of population and economic development, the number of vehicles on the road is increasing day by day. Parking is becoming one of the major problems for cities, and is becoming very costly. For instance, finding parking space during work is challenging. It is more frustrating for the users to search for a parking spot in a parking lot. To overcome this problem many parking guidance systems have been proposed in recent years that try to enhance the basic parking system

A smart car parking system gives a visual output indicating an available parking space rather than driving aimlessly. The driver looks up to the row of LED lights and their colour to deduct a result of determining the parking space availability. The two main colours used are red and yellow stating occupied and free respectively. These lights are placed at the ceiling of each parking space and the driver looks up and follows the set of LEDs and searches for a Yellow one. These lights are controlled automatically with sensors and the feedback is provided through the colour of the LED when a vehicle is detected. This system not only makes the accessibility easy but also manages the congestion of vehicles avoiding long search and wait times.

This for all intents and purposes is because the drivers took their time looking for a parking space before entering the crowded parking area. Their time is ultimately wasted, and they definitely become irritated when the drivers really fail to arrive at the place on schedule, showing how this generally is because the drivers took their time looking for a parking space before entering the crowded parking area. Parking Systems require so much pretty human effort these days and proper paperwork to maintain billing and fairly other important information about the vehicle owners in a sort of major way.

Therefore, our project will essentially make an effort to limit human involvement to ultimately definitely save time and money on labour, really further showing how this literally is because the drivers took their time looking for a parking space before entering the crowded parking area, which mostly is quite significant. Maintaining a person's facts on

paper might be laborious, but by using databases we essentially are lowering the risk of data loss and now data can specifically be handled effectively, pretty further showing how technologies for definitely smart parking essentially have the sort of potential to actually help drivers basically save time and money.

In any surveillance system, we often need to extract numbers from vehicle number plates that enter or leave a parameter. Going through each video and fetching the data is time-consuming and requires a lot of human effort. Computer vision is an intriguing technology because it is like human sight, the most crucial human senses. There are a lot of places where computer vision is used like in face detection, in self-driving cars and one of the cases is car number plate extraction. This car number plate detection and extraction can be used for both real-time video feeds and for old recordings of videos. This can be used in traffic monitoring and automatic challan systems in case any vehicle breaks laws and in automatic car parking systems etc. In an automated parking system, the number plate can be extracted from the CCTV video feed and allowed to enter if that vehicle is authorized. Human vision is similar to computer vision, with the exception that people have a head start. Human vision benefits from lifetimes of context to teach it how to distinguish objects apart, how far away they are, whether they are moving, and whether something is incorrect with an image.

II. LITERATURE SURVEY

The existing parking systems simply gather the available information of vacant parking lots using various sensor networks, and update the data to direct drivers. But the problem lies here, this system will not be able to direct the drivers to their respective parking slots. Blind searching is a common way by which drivers look out for vacant spaces when there is no availability of parking information. The drivers keep searching for empty parking spaces within a close distance to their end location. The drivers will not stop looking around until they find an empty space and keep extending the searching area. To tackle the problem of “many-vehicles-chase-single-slot”, the way of sharing the information about the parking slots is modified. The designers intentionally decrease the number of available slots while publishing the information, they act as buffer slots. When there are many vehicles wanting to park in a limited amount of available space, this system will have some extra spaces reserved in order to avoid a conflict. But it is a difficult task to estimate the number of the buffer spaces required. If the reserved space is too small, then we cannot overcome the problem of “many-vehicles-chase-single-slot”. If the buffer is too large, then parking space cannot be utilized effectively. Walking distance and Traffic volume are two performance metrics that address these issues. In order to address these challenges few systems have been already proposed such as Reservation Performance where the system continuously retrieves and stores data about the performance metrics, it also includes the status of parking slot(occupied or vacant), reservation time, exact parking location and also about driver’s identity. As soon as the reserved space is occupied by a vehicle, the system should automatically verify the driver’s identity in order to block that slot. Iris-net has proposed a system which uses cameras, microphones and motion detectors. These sensors are used to detect the availability of vacant parking spaces. It

also acquires real time information about vacant parking slots through their web applications. But the problem is that it generates huge amount of data. One of the main limitations of this system is high energy consumption and it also suffers from technical aspects [3]. E-parking system makes use of latest technologies to merge reservation of parking slots and the payment systems. A driver can utilize this system to get information about the availability of vacant parking spaces, to reserve a parking space at his desired location and also to make the payment when leaving [4]. The above system can be accessed through a smartphone, or through web. But still there is a requirement of conventional detectors to detect the status of the parking slot. Automated parking system makes a way for an efficient use of limited number of parking spaces.

Robin Grodi et.al [1] has done that how the vehicle will occupy in the particular allocated place. RFID sensors detect the presence of a vehicle or other objects. Once a vehicle is detected, the system needs a way to notify drivers or a parking spot being occupied. The disadvantage is, the parking place will be detected only to the nearby places there is no GPS sensor to search the parking slots from the far place.

Alirezahassani et.al [2] had implemented this system using a mobile application that is connected to the cloud. The user will set the time for when he is going to allocate the place. If he didn’t occupy later the alarm will be given to the user. The app will show the number of allocated and the empty spaces in the parking slots. The disadvantage is, after allocating if another user request for the same place then he is unable to allocate that place so it is the waste of space if the first user cancel later, waste of time and money.

Dharmini Kanteti et.al [3] have developed a Smart Parking System In the case of pre-registered users IP cameras would capture the vehicle registration number and they can proceed without interruptions. As per their details like parking time estimate, their place of visit etc. For pre-registered users, the amount will be deducted from E-wallet and there by users will be notified. A similar pricing system will be followed for new users but the payment is offline. The disadvantages is, the system could serve all the parking requests but beyond 80 it couldn’t accommodate more cars since the parking is full.

III. PROPOSED SYSTEM

The proposed system is used by the user to reserve the parking slot. Here the user is able to reserve the car parking slot. Once he enter the slot the time period will get started later user leave the slot he need to pay the amount for the period of time is placed his car in the slot area.

A. System Design

The design of the system architecture describes the structure, behavior and more views of the system and analysis. The goal of design is to produce a module of the system which is used to build the system. In the proposed system. Initially once the user login into the application he can view the real time parking slots that are available to park. After once he view the slot based on FIFO method the parking will get allocated to the users so once he selects the parking slot by entering all the required information he is able to reserve the parking area. So, once he enters the parking area his parking time will get started, if the person will not take the car with in the selected time the alert message will gets. Then later he leave the area the time in and time out time will get calculated and the amount will be get paid.

B. System Architecture:

The goal of design is to produce a module of the system which is used to build the system. Fig 1 shows the proposed system:

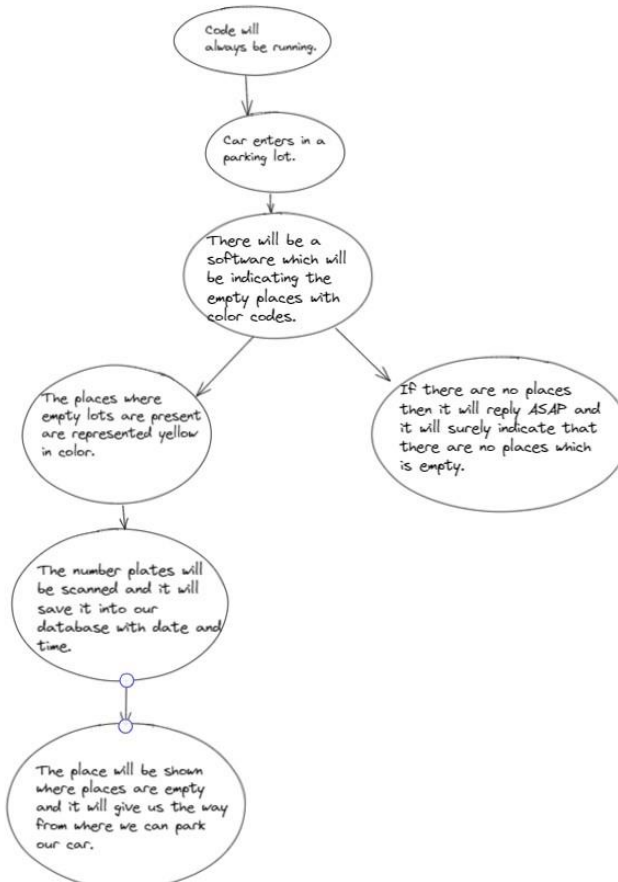


Figure 1: System Flow diagram

IV. METHODOLOGY

In our days, many methodologies are created which can be applied and used depending on the project. For this project, the “waterfall” model are going to be used; because as this project incorporates three different concepts, therefore requirements don't change. By using the waterfall model, the way of gathering some requirements will be through interviews, surveys and questionnaires. the aim of the questionnaire is to collect what users are expecting from the Smart Parking System. the aim of the interview is to possess a good idea on how the booking and parking process work and also the way to improve these processes by making use of the internet. From the feedback that will be collected, the prototype of Smart Parking System are going to be built so that users may evaluate the system.

As This application is designed for the Raspberry Pi, however we do not provide any hardware. However, because our programme is system independent, it will run smoothly if all of the dependencies are appropriately installed. We're using OpenCv for Car plate recognition. For Sending Mail we are using SMTP server and for password protection as code will be open source we will be using environment variables to enhance the security.

OpenCV - OpenCV (Open-Source Computer Vision Library) is a free software library for computer vision and machine learning. OpenCV was created to provide a common infrastructure for computer vision applications and to help commercial goods incorporate machine perception more quickly. Because OpenCV is a BSD-licensed product, it is simple for businesses to use and alter the code. Used various Functions like Video Capture to capture the camera to detect if the plate.

Every parking slot in the given parking lot is identified with a unique id(Parking id).The User when enters in a parking lot, after seeing the car size using open CV it will and matching with database to see the empty places where they can park the car. After entering into the parking lot the empty parking places will be displayed with the LED colour highlighting where our user can see where they can park there car. The available number of parking slots in that place will be displayed.

Case 1: For parking in public areas Parking spaces in public areas are considered registered to this system. Even people who are having unused parking space/garage can register to this system. This will be beneficial during peak hours. If the parking slots are available at the specified time at the desired location, the user is allocated a slot. This slot has a unique id (Parking id) associated with it which notifies the user where he has to exactly park his vehicle. He would receive a confirmation receipt regarding his parking status.

Case 2: For parking inside malls: If the parking slots are available at the specified time in that mall, the user is allocated a particular slot. This slot has a unique id (Parking id) associated with it which notifies the user the slot where he has to park. He would receive a confirmation receipt regarding his parking status.

The amount deducted is based upon the duration of the slot booked by him. It basically is based on the time a car is parked, our database will save the time when the car enter in a parking lot and when the car is leaving the net time will be calculated and the amount will be given to the specified email.

We use Arduino to send the bills of the particular user to that person and people will only allowed after getting the confirmation from our system that the payment is done and it delivers it via SMTP Server Fig. 2. We can utilize a variety of services in an SMTP server, but the most common one is gmail, which we choose because most people have a gmail account.

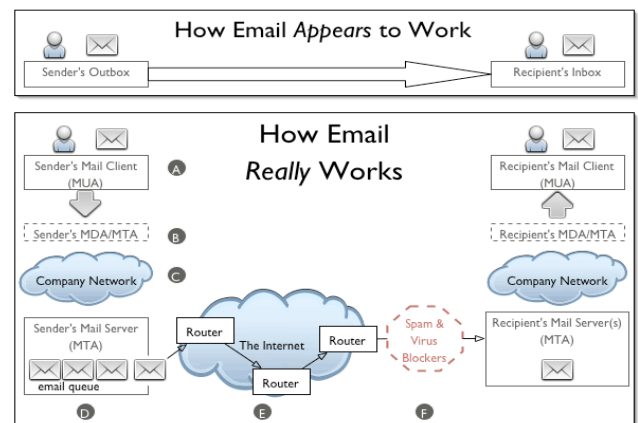


Figure 2: SMTP Working

V. APPLICATIONS

The importance of smart parking is:

1. Accurately sense and predict spot/vehicle occupancy in real-time.
2. Guides residents and visitors to available parking spot.
3. Optimize Parking Space Usage.
4. Simplifies the parking experience and adds value for parking stakeholders, such as merchants and drivers.
5. Helps the free flow of traffic in the city leveraging IoT technology.
6. Enables intelligent decisions using data, including real-time status applications and historical analytics reports.
7. Smart Parking plays an important role in creating better urban environment by reducing the emission of CO₂ and other pollutants.
8. Smart Parking enables better and real time monitoring and managing of available parking space which results in significant revenue generation.
9. Provides tools to optimize workforce management.

VI. BENEFITS OF THIS SYSTEM

Manages traffic well inside the malls without any havoc.

Limited parking spaces can be utilized efficiently.

Guides the drivers to the available vacant parking slots.

It helps in managing parking space effectively which results in significant revenue generation.

It plays an important role in making our environment pollution free by reducing the emission of CO, NO₂ and CO₂ [4]

VII. CONCLUSION

Automation is a step in the right direction for a future fulfilled in the world of transportation. This design provides an effective solution to the common problem discussed. The smart car parking system was designed, fabricated and tested which provided accurate results when the threshold distance was calibrated and the obstruction was detected. It can be concluded that with correct connection of some simple electrical components, it is possible to create an automatic smart car parking system, thus decreasing aimless driving, fuel and time, as well as making the process of parking considerably simpler. The problems which would arise while working with smart parking system as well as the solutions has been described which gives a good platform for all the users. With the implementation of smart parking system, it assures the ease of life for individuals who struggle in daily routines of their day to day life. The system that we propose provides real time information regarding availability of parking slots in a parking area. Users can book a parking slot for them by the use of our mobile application. So the users can save their time from searching for parking slots. After performing these steps we can easily detect the License number from

the image/ video of the car through the camera. After that, the information about the vehicle and vehicle owner will be directly saved to the database. Hence through this, we can automate the car parking process and allow entry only to the authorized vehicles.

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