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Real-Time Parking Assistance using Arduino and Sensors

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Abstract: Automated Parking System can fulfil parking operations quickly and safely without wastage of time and energy. This study describes a scale model of an automated parking system with an LCD screen that can regulate and manage the number of vehicles that can be parked in a certain area at any given time based on the availability of parking spaces. The employment of sensors during car entry and exit is known as automatic parking. Most current systems aren't fully automated and require some amount of human interference or interaction in or with the system, according to our analysis of a few of the existing systems. We have examined some of the existing systems, and the results indicate that most of them aren't fully automated and need some amount of human involvement.

Keywords: Automated Parking, LCD Display, Parking Space

I. INTRODUCTION

In our proposal, an automated parking system model, which limits the number of vehicles that may be parked in a certain location at any given moment depending on the parking availability of space. This project aims to automate the parking lot so that automobiles can enter and park. On an LCD, information on the maximum vehicles that are to be parked and the amount of parking space available are displayed. When it reaches the entrance, the car will come to a stop over a path leading to the parking lot. A automobile will wait on the white line outside the parking area when it approaches the gate and is looking for a free space. The automobile will continue on its way to a free parking spot after being assigned a free slot. The data on the LCD will be updated automatically after a successful parking attempt. Interfacing of Microcontroller with LCD has been employed as the fundamental module in this model's implementation. To get to the parking gate, the automobile follows the trail. The parking unit and the car's microcontrollers connect at the gate, when a vacant parking space is verified for availability. If a vacant spot is discovered, it is assigned, and the automobile follows the designated path to park there. Data on LCD is simultaneously refreshed. The system's goal is to offer a productive parking system with a minimum of human involvement.

II. RELATED WORKS

Several techniques are frequently used to construct autonomous or intelligent parking systems. Some systems, according to research, need some level of human interaction to function.

Image processing has been used to suggest one of the intelligent parking systems [1]. This device takes a brown, circular image of the parking space with a camera, which is afterwards examined to determine which parking place is open. Details regarding the parking places that are currently available are displayed on the 7-segment display. First, a brown-rounded picture of parking spaces is captured. To make binary pictures, the image is divided. This image's noise has been eliminated, and the borders of the objects have been located. By calculating each object's area and perimeter, the image detection module ascertains whether items are spherical. As a result, the free parking spot is assigned.

A vision-based parking system has been developed that utilises both positive and negative images to locate available parking spaces. This approach uses an object classifier to find the necessary item in the input. Cars can be seen at a variety of perspectives in positive photographs. There are no automobiles to be seen in negative photos. To identify the presence of automobiles in the area, the given parking lot co-ordinates are utilized as input. Nevertheless, this technique may have restrictions depending on the kind of camera being utilized. Also, the utilized coordinate system chooses certain parking spaces; as a result, the camera must be in a fixed position. The system could be constrained by a small number of both positive and negative pictures.

The number plate recognition approach [3]for using an image processing foundation, an automated car parking system processes licence plates. This technique takes a picture of the car's licence plate. Furthermore, it is divided to provide distinct characters from the licence plate. Ultrasonic sensors are used to find vacant parking spaces. The photos of licence plates are then taken and scrutinised. To calculate the parking fines, the current time is also noted.

The following message is displayed on the LCD, "FULL". In order to give the indication that there are no available parking places. Nevertheless, the technique has significant drawbacks, such as backdrop color being required to be black and character color being required to be white. Moreover, analysis is restricted to license plates with a single row.

An image processing facility and mechanical model were presented by the smart parking system [4]. Lifts would be used to park the automobiles on various levels. In order to prevent unauthorized entrance, imag-processing is also done to capture the license plate and save it in the database for comparison.

The author of [5] explains the creation and use of a wireless-sensor network based smart parking system, which helps drivers of motor vehicles find available parking places. The plan's core components include WSNs, embedded-web servers, central web-servers, and mobile applications. The driver could use a mobile device to examine the state of the parking place thanks to sensor nodes in each one that track its condition and feed data to an integrated web server. The information is then relayed in real time over Wi-Fi networks to a central web server.

The goal of [6] is to use an ARM8 microcontroller to build an embedded system capable of intelligent parking guidance and information system. With the ability to instantaneously check the status of the parking space described above via the internet is another vital feature the author includes. The open parking spaces are visible on the webcam. It can simultaneously capture slots and display them on an LCD touch screen. A red colour box will show up on the LCD if there is an automobile in the slot. The LCD will display the empty slot number if the slot is open. To book a space, SMS the slot number to the recipient.

Big city drivers wasted time looking for parking spots, which added to traffic and pollution. Yee H.C. & colleagues [7] have suggested using GSM technology to create a smart, secure parking reservation system to deal with this problem. This system is composed of the security reservation module and the parking lot monitoring module. The work's contribution is the use of passwords when logging in and out. The Pic-Microcontroller, Visual Basic and LCD to notify the driver whether or not the password is incorrect, motor -driver to open the barrier gate when the password's correct, and GSM to serve as the user-PC interface are the system's main software and hardware components.

This work has [8], an automated parking system using RFID (Radio-frequency identification) technology is designed and operated in detail. This unique smart car parking system model makes it simpler to locate available places, turn vehicles, and maintain security. This parking system's main objective is to prevent cars from entering and departing in as little time as possible while avoiding monitoring, which is bad in a traditional car parking system. The automated system's single entrance and exit point, which does away with the necessity for cars to make any turns, minimises the space. With only one semi-circular channel needed for the car's entrance and exit, slots with rail-mounted support can travel horizontally at an angle. There are RFID tags in every slot.

Because of a growth in the amount of vehicles on the road and poor parking space management in urban areas, traffic congestion has grown. [9]. As a result, it is essential to develop an automated smart-parking management-system that would help the motorist find a parking place that is suitable for their vehicle rapidly. The bulk of studies on development of smart parking system have not addressed the problems of in-the-moment incorrect parking detection and automatic parking charge collection, disregarding the fact that there are numerous research on the subject in the literature. This paper suggests a working prototype for an electric parking system based on the (IoT) Internet of Things. The planned E-parking system's integrated parking metre component takes care of the problem.

The (IoT) Internet of Things may connect a very large number of devices and services anywhere at any given time through a number of applications. The IoT is a new technology. The topic of smart automobile parking [10]is one of the most important current research discussion topics on the Internet of Things. In a contemporary big city, there are over a million cars on the roadways, but there is not enough parking. Furthermore, the vast majority of contemporary academics support cloud-based data management. However, this system may have issues with timely raw data transmission from dispersed sensors to the parking lot through the cloud and subsequent receipt of it once it has been processed. This approach is thought to be expensive when it comes to data.

Automated valet parking (AVP) systems [11] are viewed as having a great deal of potential to help with the parking issues in the futuristic smart cities, since they will be able to provide on-demand parking service, which have a number of benefits including time and energy savings for vehicles. In order for vehicles to perform automatic parking in accordance to the reserved parking information, parking reservations are a requirement for an AVP system. However, the Users should be exceedingly concerned because the requests of the reservations may not only reveal the identity of the driver but also her or his private destinations, such as the most well-known tourist attractions.

It is critical to comprehend how drivers select their parking spot in order to evaluate parking price policies, parking information systems, and reservation systems. How drivers act in the face of uncertainty regarding search times and finding an open parking space is an important factor. In light of these uncertainties, this study [12]offers the findings from a stated preference experiment on the decision-making behaviour of drivers. The attribute set was chosen based on a review of the literature, and the probabilities of discovering a free parking space upon arrival and after 8 minutes (and initially also after 4 minutes, but subsequently dropped to decrease the survey complexity) were added. The survey was designed using Efficient Designs, and previous coefficients were estimated using two rounds of pilot investigations.

In order to park the automobile effectively and efficiently, they [13] provided an algorithm that uses hybrid parking methods. This increases parking efficiency while lowering maintenance and power consumption costs. Here, they used CMOS sensors to identify licence plates, speed sensors to determine speed, ultrasonic sensors to identify vehicles, OCR software, an Arduino micro-controller, and a Raspberry-Pi to connect the parts. The study focuses on efficient and effective smart working ways in addition to user safety recommendations.

With the help of this technology [14], parking times should be shortened and drivers will be given assistance in remembering their exact parking spots. During peak hours, drivers frequently allot a sizable amount of time to parking their cars in the lots. While picking up the car, they might also forget exactly where their car was parked. In order to solve this problem, an automated car parking system is developed to assist drivers in finding a location for their vehicles more rapidly. The system displays details about available parking spaces. By letting drivers know about available spaces before they join the system, the time they must wait to park their car can be cut down. The technology detects the empty space This automatic display system can be installed at the main gate's entrance so that when a driver pulls into the parking area, they can locate their spot without assistance.

The effective parking solution discussed in this [15] work uses an ultrasonic sensor, an atmega series processor, a wireless signal module, and a cloud server to cut down on the time needed to find parking places. A new parking platform built on the Internet of Things makes it feasible to link, automate, and analyse data collected from devices and implement smart parking. In addition to reducing personnel, the suggested solution also eases traffic congestion and facilitates a secure parking system inside a constrained space.

The proposed smart parking system makes use of an on site IoT module. [16] To use mobile applications to identify and assess the availability of parking spaces. The suggested smart parking system tracks parking space availability and notifies users via mobile applications when a spot becomes available using an on-site loT module. Keep track of the parking spaces that are available in this region and distribute them to the users. If there’s one nearby the user's location, it shows one. Due to the lack of parking spaces, it reduces traffic congestion on roads, in shopping centres, and in multi-store complexes. Users of the Mobile Telnet application may look for parking availability and, if required, make a reservation.

The fare collecting device [17] , which, before handing the customer their parking ticket, accepts money, prints a QR code for a relative's car, and designates the car a parking space in the complex. According to the needs of the mall, the user's concerns, and the complex's parking space availability, the parking spot is assigned. The admin database is updated to reflect that the allotted parking space is occupied as soon as the user pulls into it. Prior to leaving, the designated user pays for the use by scanning a QR code with a QR code reader and the fare collecting equipment at the departure gate. Additionally, it ensures that he left the slot so that it may be given to the following user. parking lot for that time period. The database keeps track of all of this data, which is then shown to the administrator on a screen.

There are numerous issues with the parking system at [18] large theatres, shopping centres, auditorium areas, and other well-known tourist places with heavy traffic demand an enhanced solution. Smart parking systems collect data on open spots, saving time, energy, and gasoline. They might also contribute to clearing up the parking situation's existing misunderstanding.

The problem of parking is a major one that cannot be solved simply. However, with the help of this study [19], people can begin to make little changes. notably in urban areas. It will also be fantastic for our environment and streets. After being notified, the car will drive to the designated parking spot. After a successful parking, the slot information is instantly updated in the administrators' database. Now is the moment to start looking for a free parking spot. The majority of the responsibility for assisting users in finding available parking spaces and keeping track of the overall number of free spaces nearby rests with the Intelligent Parking System (IPS). As a result, the user is spared the time and trouble of seeking for a parking space using our proposed technique.

The project's objective [20] is by controlling vehicle entry and exit and making sure that the drivers are aware of parking situations before coming, is to achieve automatic car parking. The project consists of, a controller, sensors, motors for exit and entry, and other actuators to identify permitted people. This method helps to alleviate parking troubles in crowded markets, malls, and large cities.

The Xbee modules are configured in a star network, with the initial node serving as both a transmitter and a receiver and the subsequent nodes serving as transmitters. Multiple access time division was employed in this project [21].The transmitter node provides the data after a certain amount of time, and the receiver node receives it, all without there being any data collision between two transmitting nodes. The central processing unit (CPU) of each node is an Arduino. The Bluetooth protocol is used by the HC-06 RF module to establish a wireless connection with the graphical user interface. The major goal is to create an entirely wireless parking system that is not dependent on wired networks. The WSN-based parking system is the one that will be used.

This paper [22] discusses how reducing our reliance on the internet can be accomplished by using the Arduino Uno as our only means of communication. It has been established using Radio Frequency Identification (RFID) technology whether or not the person requesting a parking place is an employee of a certain business. Additionally, GPS technology has been developed, which is useful in regions with a broad geographic reach or where it is difficult to locate specific parking sites. The GPS sensor makes parking even simpler by providing the users with precise longitude and latitude of the parking area. The entire system is simulated on Proteus Software.

The technology [23] uses IR sensors to identify when a car door is opening. IR sensors are also used by the system to recognise when a vehicle touches base at a halting gate and to automatically open the doors when the vehicle lands. The overall functionality of the system is supported by the microcontroller. An Android app can also be used to find these lots by displaying the quantity of available parking spots at close-by alternative parking lots. Users can also reserve a parking place up to 15 minutes in advance; otherwise, if the user doesn't arrive by that time, the reservation will be cancelled.

The device's [24] objective is to offer ease and find more practical answers to core problems like traffic congestion. There are, however, specifications that must be complied with, including minimum display width and computing power. Because there are currently no smart city solutions in place in heavily crowded areas or places where it is difficult to obtain parking spaces, the suggested system qualifies as a "Originality". For every user action, from locating a parking space to making a confirmed reservation, a user-friendly app is made available. The circuitry employed throughout the process is easy to construct and inexpensive for businesses to use.

In urban areas, finding a parking spot can be challenging, especially during rush hour. The issue arises due to not knowing where the availability of parking spots might be at the time, even if one did know, several cars might seek out the few open spaces, jamming the roadways. The technology [25] locates the closest available parking spot by monitoring the number of open spots. By using fewer sensors while maintaining reliability, costs are reduced. The reservation-based parking policy of this system holds the promise of streamlining parking system operations and reducing traffic jams brought on by parking-related searches.

Using the Internet of Things, an innovative and useful method is used to automate the administration of the parking system at a usable parking location. [26]. The system is wirelessly accessible thanks to the (IoT) Internet of Things, which enables users to continually check for parking space availability. The primary problem resulting from the increase of vehicles in metropolitan areas is traffic congestion. The objective of this essay is to resolve this issue. Typically, the user wastes time and effort looking for an available spot in a designated parking lot. A notification with parking details is sent to the user. As a result, the user spends less time waiting while looking for a parking space.

The project's goal [27] aims to develop a functional prototype that can monitor open parking places using the Blynk app. An ultrasonic-sensor was used to find the car in the parking space. While the car is not parked in the lot, the LED will turn on green, and the LED will turn on red when it is. The Blynk app user will then receive a notification that there is no parking available. The Blynk programme additionally gives the user control over the servo motor when entering and exiting parking. Finally, users will be informed when parking spaces become available via the Blynk app..

The suggested [28] smart car parking systems can reduce the wasted fuel and time required to search for an open parking place and making it simpler for drivers to find parking spaces automatically. The objectives of this project were to create a smart parking system for automobiles, have it automatically locate parking spaces, send the information about parking status to the cloud and display it on a smartphone using an Android application, and compare the data now available with the newly created system. Compared to the previous system, which took a long time and used a lot of petrol to seek for parking places, the new car parking system consumes less time and less fuel.

Members who have been given authorization to use the planned [29] system would be the only ones who can use it. The suggested system incorporates Node MCU, an open-source Internet-of-Things (IoT) platform, and gives it a key role to play in the data transmission process. The Node MCU notifies the Arduino micro-controller of any free slots when the RFID scanner reads a vehicle's tag. The user is then given a slot by the microcontroller, and the information is shown on the LCD panel. The vehicle's tag is read by the RFID scanner. The school can lessen the possibility of a car being broken into by utilising this arrangement.

This idea [30] recommends a parking notification system that makes use of intelligent sensors, an LCD display board, and a system that is driven by piezoelectricity. The motorist may check for open parking places on the LCD display, which will save them a lot of time. LED lights will be turned on in the empty spaces, making parking easier to locate. Additionally, the admission and exit times are noted. The parking lot's base is made of piezoelectric sensors, which generate power when pressure from driving cars is applied to them. After that, the produced electricity can be stored and used to illuminate the parking lot.

The design and architecture of an Arduino based car parking system are described in this paper [31]. Having the user's or driver's permission is the basic rule for parking an automobile in a parking area. Each user will receive an authorization card including the vehicle's number or other information. The parking gate will open if the user is authorised and there is room in the lot; otherwise, even if the user is authorised, they are not permitted to park their car there. A parking notification will be sent to the user's smartphone if the automobile is permitted to park. It protects a car, forbids unauthorised use, and resolves the parking problem in urban areas.

This paper [32] investigates the problems of traditional parking lots. Also, it covers the negative consequences brought on by the inefficiency of traditional parking places. The authors of this work suggest and create a smart parking system that uses IoT technology and allows users to find available parking spaces in a specific area. Additionally, it avoids wasting time moving through packed parking lots. The authors of this study describe a novel parking system that makes use of Wi-Fi and RFID in the Internet of Things. The authors suggest that the key components of an IoT-based solution to the issue includes an application for smartphones, IR sensors, RFID, and an Arduino. With this solution, users can rapidly search for nearby parking lots as well as the current availability in each parking lot. The recommended system [33] implemented using the Arduino-Uno board, and the suggested technique is implemented by connecting the parking lot to the internet or other online resources using Node-MCU. To collect information about available parking spots, the recommended method places an infrared sensor in each slot. After the user makes a long-ahead parking spot reservation, the server already has all the information it needs. The password and username are unique to each user. The system will notify the accountable person if there is any abuse.

According to ongoing studies on urban regions, population growth causes a high vehicle density on the roads. As a result [34] finding a parking spot becomes an unpleasant issue for the drivers, making it harder for them to depart their vehicles. In this study, a web-based automatic smart parking system for autos is introduced. In this study, we have proposed a system that can easily manage parking systems using networks of different sensors. Finding a parking space and confirming whether or not the user parked the automobile are both made easier by this technology.

In order to prevent trafficking at the entrances [35] to manage parking spaces and make it simpler for people to park their cars, a simple parking automation system with IR sensors placed at the parking space to detect the presence of parked cars, an LED notification board to show specific empty parking spaces, and a display to direct people can be used. In order to control parking garage trafficking and advise drivers about available spots, the suggested research project creates and implements a prototype system model. A gate with a servomotor that manages vehicle restriction and access has also been erected.

The objective of this paper [36] is to fix this problem. In a parking lot, the user frequently wastes time and energy seeking for a spot. A LCD panel at the parking entrance gives the user information about parking. Traffic congestions and air pollution are caused by the parking problem. Due to the existing circumstance, people frequently struggle to locate parking spaces. By 2035, there are to be more than 1.6 billion vehicles on the road worldwide, according to a recent forecast.

As a result of their research [37], there are many models available that integrate cloud and mobile applications and have sensors added to them. As a result, a smart parking system is created that decreases carbon footprint by conserving resources such as time, electricity, petrol and others. Systems have been found to ignore the requirements of people with disabilities, and there isn't a single, all-encompassing parking solution at the moment. The rapid advancement in processor miniaturisation, resilience, and coupling with machine learning has raised the possibilities for a smart, single worldwide solution to manage parking difficulties in both indoor and outdoor parking lots. This study offers [38] a parking spot allocation and management system that is Internet-of-Things (IoT) equipped to solve parking system's issues. Smart parking makes use of an ultrasonic sensor, an Arduino-Uno, and a cloud server. Users can access this system and keep track of the available parking spaces using an Android app. This enables communication between the user and the smart parking system. It advocates implementing a parking system based on reservations. To fill their own assigned space, each user has a unique OTP. The system is primarily concerned with the idea [39] of an Internet-of-Things based parking detection system that uses sensors. In other words, it sends the website the parking status. Then, users may check where to park and which parking spaces are available. The ESP8266 WiFi module is used to transfer sensor data to an open-source, user-friendly IoT platform, which then uses HTTP to display the data. These kinds of technology makes it easier for users to find parking spots.

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III. EXISTING SYSTEMS

The environmental perception part of the Automatic Parking System controller [40] collects data about parking spaces and barriers using a variety of sensors, such as cameras, wheel speed sensors, and steering angle sensors. In addition to real-time visual information, the sensors record the vehicle's speed, steering angle, and the distance between it and objects. Multisensory data fusion will be used to assess if the parking space is available.

Despite the fact that there are many systems available, they still have a number of drawbacks, such as the need for additional study, sensitivity to unfavourable circumstances, insufficient parking speeds, and faulty sensors.

IV. PROPOSED SYSTEM

In order to maximise resource utilisation and address the current problem—human interaction in many automatic parking systems—automated parking systems are put into place. With the help of IoT concepts, this can be reduced and utilised more effectively.

Such systems require regular maintenance to ensure sure everything is functioning properly, which is a laborious operation. For instance, maintenance may alter certain code segments to guarantee that the programme is functional and that everything is speed- and efficiency-optimized. This might entail updating specific code segments or streamlining the programme to improve performance in terms of speed, reliability, and efficiency. Regular parking system upkeep requires both resources—time and money. Consequently, it can be viewed as a drawback to implement a parking management system.

Security is one benefit of a parking management system. For instance, a store's or an event's barrier and reservation system regulates which automobiles are permitted to enter and exit a location. One may put an end to their concerns about theft, vandalism, illegal dumping, and strangers leaving valuables in their cars by following these simple steps. As a consequence, your parking lot might become completely secure. The whereabouts of a car may be tracked by its owner even after they've given it over to a third party for inspection thanks to a CCTV (security camera), which can record both licence plate numbers and moving vehicles. Therefore, parking management systems are essential for parking Iots.

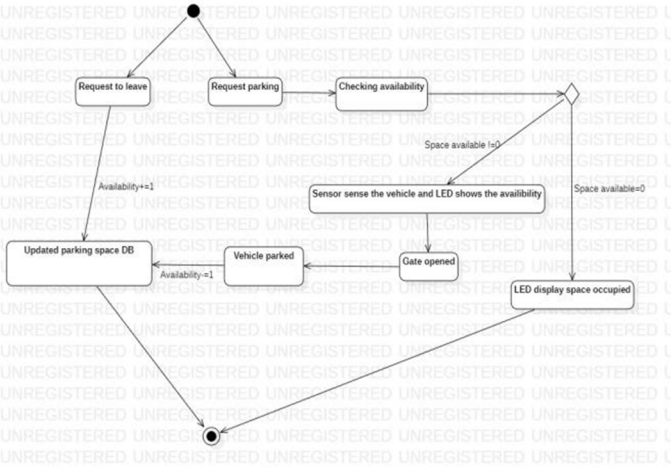


Fig 1- Activity Chart For Parking System

1) It makes a parking request based on the space's availability.then it appears on the LED screen.
2) Showed if the spot was taken or not.
3) If the slot is unoccupied, the gate opens automatically and closes in a similar manner when it leaves.
4) The LED screen changes to show that the empty spot has been occupied as the driver parks the car there.
5) Similarly, when the vehicle leaves the slot the LED screen is updated as vacant.

V. RESULT ANALYSIS

The automatic parking system using IoT can provide numerous benefits to both drivers and parking operators, including increased efficiency, improved safety, enhanced user experience, cost savings, and environmental benefits. However, issues like the calibre and dependability of the sensors and communication network, the correctness of the parking information, and user adoption and acceptance of the system will all affect how effective the system is.

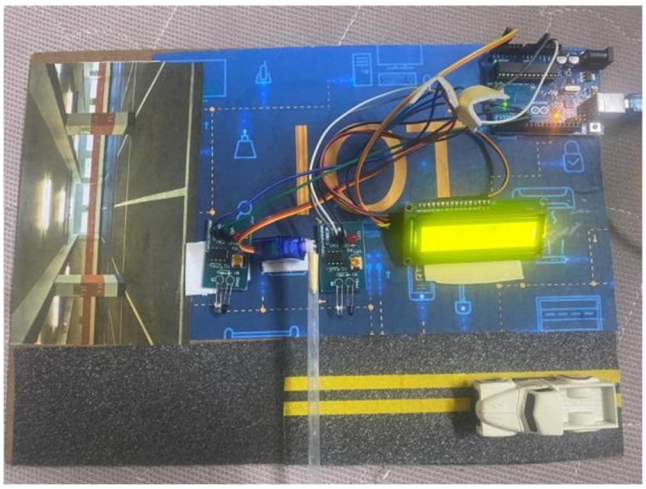


Fig 2- Parking System Model

Fig 3- LED Screen

The figure depicts the LED implemented in the project. The LED screen reflects the parking slots, it shows the availability of the slots whether it is vacant or occupied.

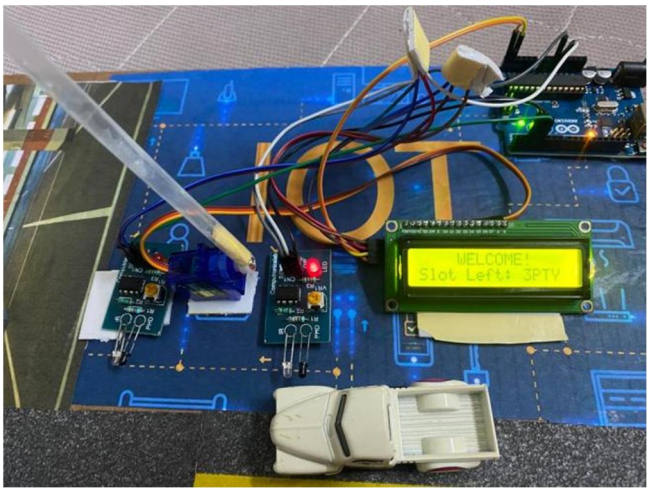


Fig 4- Slot Availability and Automatic Gate

As the figure depicts the availability of the slots. When the vehicle passes the gate opens automatically and the LED screen updates result for the slot availability for vehicles.

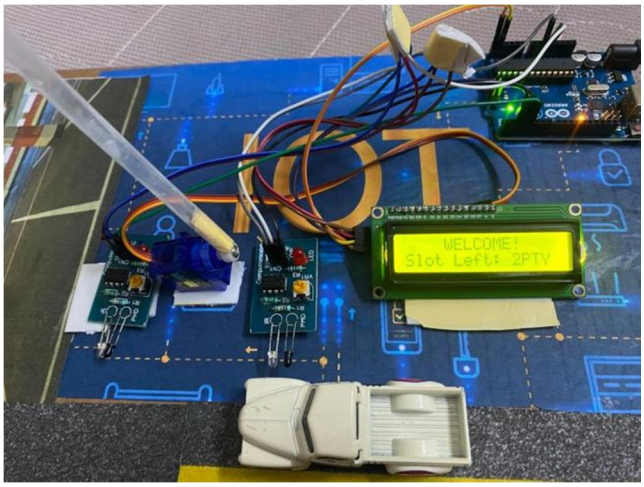


Fig 5- Decrease In Parking Slots

Similarly, the parking slots number decreases as the vehicle keeps moving and the gate could be seen opening automatically. The sensors detects the vehicle and gate functions accordingly.

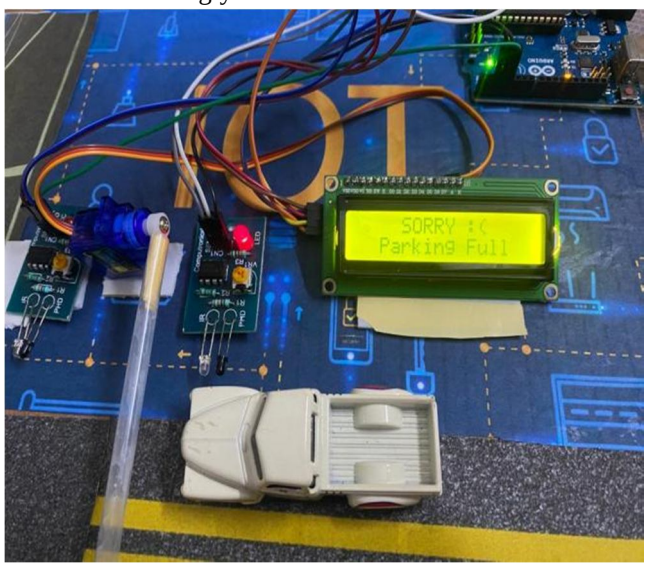


Fig 6- Zero availability Of Parking Slot

When all available parking spaces have been taken, i.e., when parking is not possible. The LED display automatically changes to Parking Full, as seen in the figure. The slots are full when the sensors identify the car, so it does not open. By minimising time spent in looking for a parking spot, making the best use of available spaces, and requiring fewer parking attendants, the created system can considerably increase the efficiency of parking operations.

VI. FUTURE SCOPE

1) The Automated Parking Systems (APS) market is projected to grow at a 12.4% CAGR.
2) It is expected to have a big influence on the development of smart parking due to the introduction of autonomous vehicles (AVs).
3) Parking lots will shrink dramatically with automated parking systems.
4) There won't be a need for as many because the ones that are already there will be utilized more effectively.
5) In turn, the carbon footprint benefits from automatic parking systems.

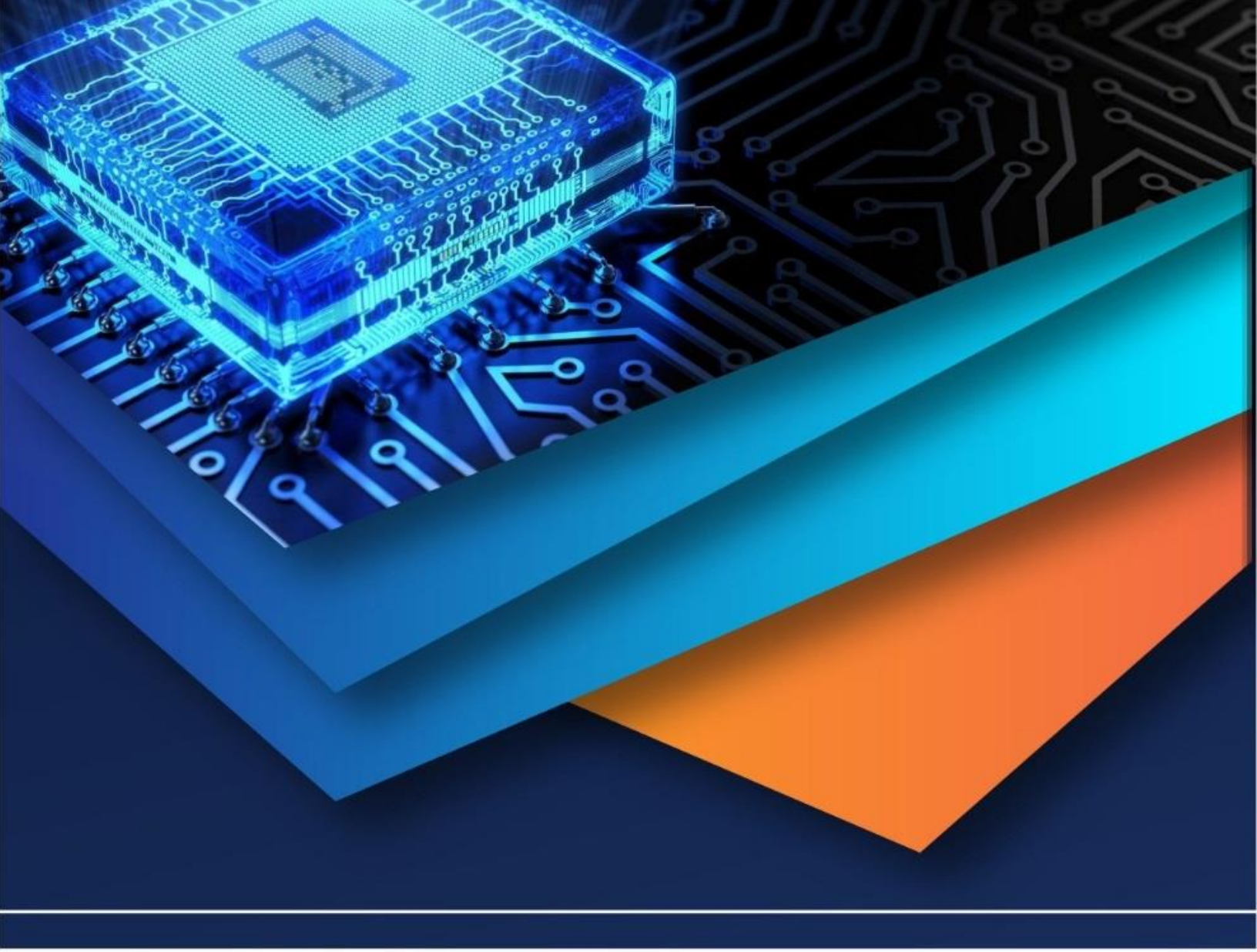
VII. LIMITATIONS

1) They may malfunction or break down, preventing cars from reaching their desired spot.
2) Additionally, they may not be able to handle huge consumer quantities, require frequent maintenance.
3) Parking management systems can be expensive to build and implement, thus they might not be practical with respect to the available resources in a locality.
4) Co-operation with the customers as they might not approve of it initially.

REFERENCES

[1] M.Ataur Rehman, M.M. Rashid, A.Musa, A.Farhana and N.Farhana,"Automatic parking management and parking fee collection based On Number Plate Recognition", International Journal of Machine Learning and Computing, vol. 2, no. 2, pp. 93-98, 2012.
[2] Patrick Sebastian, Hamada R.H. Al-Absi, Justin Dinesh Daniel Devraj and Yap Vooi Voon, "Vision based automated parking System", 10th International conference on Information Science, Signal Processing and their Applications (ISSPA 2010), no. 1, pp. 757-760, 2010.
[3] Norazwinawati Basharuddin, R. Yusnita, Fariza Norbaya,"Intelligent Parking space detection system based on image Processing", Internation Journal of Innovation, Management and Technology, vol. 3, no. 3, pp. 232-253, 2012.
[4] M.A.R. Sarkar, A.A. Rokoni, M.O. Reza, M.F. Ismail, "Smart Parking system with image processing facility", I.J. Intelligent Systems and Applications, 2012, vol. 3, pp. 41-47.
[5] Yang, J., Portilla, J., & Riesgo, T. (2012, October). Smart parking service based on wireless sensor networks. In IECON 2012-38th Annual Conference on IEEE Industrial Electronics Society (pp. 6029-6034). IEEE.
[6] P.DharmaReddy, A. RajeshwarRao, Dr. Syed Musthak Ahmed (2013). An Intelligent Parking Guidance and Information System by using image processing technique. International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 10, October 2013
[7] Rahayu, Y., & Mustapa, F. N. (2013). A secure parking reservation system using gsm technology. International Journal of Computer and Communication Engineering, 2(4), 518.
[8] Raxit, Sourav & Arman, S M & Banik, Sajal. (2021). Automated Car Parking System.
[9] Sadhukhan, Pampa. "An IoT-based E-parking system for smart cities." 2017 International conference on advances in computing, communications and informatics (ICACCI). IEEE, 2017.
[10] Alsafery, Wael, et al. "Smart car parking system solution for the internet of things in smart cities." 2018 1st International Conference on Computer Applications & Information Security (ICCAIS). IEEE, 2018.
[11] Huang, Cheng, et al. "Secure automated valet parking: A privacy-preserving reservation scheme for autonomous vehicles." IEEE Transactions on Vehicular Technology 67.11 (2018): 11169-11180.
[12] Chaniotakis, Emmanouil, and Adam J. Pel. "Drivers' parking location choice under uncertain parking availability and search times: A stated preference experiment." Transportation Research Part A: Policy and Practice 82 (2015): 228-239.
[13] Kanteti, Dharmini, D. V. S. Srikar, and T. K. Ramesh. "Intelligent smart parking algorithm." 2017 International Conference On Smart Technologies For Smart Nation (SmartTechCon). IEEE, 2017.
[14] Akshaya, D. S., Bhoomika, Y., Shashank, K. S., & Tulasi, A. S. SMART PARKING CONTROL SYSTEM WITH AUTO GATE.
[15] Dey, A., Dutta, A., Sen, M., Banerjee, D., Baidya, D., & KarGupta, A. (2020). Development of Intelligent Car-Parking System. International Journal of Innovative Research in Physics, 1(4), 52-57.
[16] Saravanan, S., Rishitha, A., Kalaiyarasi, M., Reddy, K. V. B., Chandrababu, P., & Kumar, D. G. (2022, December). Identification of parking space availability by using Arduino Uno for Smart City. In 2022 3rd International Conference on Communication, Computing and Industry 4.0 (C2I4) (pp. 1-5). IEEE.
[17] Sivapriya, J., Akaveeti, J., Kotha, K., & Sushmitha, M. (2018). Enhanced Smart Parking System using Sensor Technology. International Journal of Emerging Technologies in Engineering Research (IJETER), 6(10).
[18] SINGH, S., MORE, S., TARMALE, A., & WALIMBE, R. ARDUINO BASED SMART CAR PARKING SYSTEM.
[19] Divakar, D., Kumar Singh, S., & Dkhar, F. (2022). Automatic Car Parking Management System. Available at SSRN 4157591.
[20] Mustaffa, O. O. A. S. (2018). Automatic Car Parking System.
[21] Rasheed, K., Shahzad, L., Saad, S., Khan, H. A., Ahmed, W., & Sadiq, T. (2021, December). Parking guidance system using wireless sensor networks. In 2021 International Conference on Decision Aid Sciences and Application (DASA) (pp. 573-577). IEEE.
[22] Mittal, U., Shekher, T., Agarwal, K., Singh, S. K., & Chaudhary, H. (2021, November). Real-Time Smart Parking System. In 2021 IEEE 8th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON) (pp. 1-5). IEEE.
[23] Sharma, A., Bansal, S., Mishra, S., Kumar, P., & Choudhury, T. (2019, March). Automated Car Parking with empty slot detection using IoT. In International Conference on Advances in Engineering Science Management & Technology (ICAESMT)-2019, Uttaranchal University, Dehradun, India.
[24] Somani, A., Periwal, S., Patel, K., & Gaikwad, P. (2018, January). Cross platform smart reservation based parking system. In 2018 International Conference on Smart City and Emerging Technology (ICSCET) (pp. 1-5). IEEE.
[25] Mishra, B., Verma, A., Gupta, A., & Singh, S. (2018). Smart parking system. SYSTEM, 5(04).
[26] Chitra, D., & Arunprasath, C. (2019). AN OPTIMIZED METHOD FOR VEHICLE PARKING SYSTEM BASED ON IOT. Technology, 10(1), 379-382.
[27] Sabri, M. F. M., Zohari, M. H., & Zainal, M. S. (2021). Empty Parking Tracking System using Internet of Things (IoT). Journal of Electrical Power and Electronic Systems, 2(2).
[28] NYIRANSABIMANA, E. (2021). Smart car Parking System in Rwanda (Doctoral dissertation, College of Science and Technology).
[29] Archana, M., Raju, S. S., Preethi, D., Mydhili, S. K., & Vinothkumar, U. (2023, March). Smart Automated Parking System using IoT. In 2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS) (pp. 1580-1585). IEEE.
[30] Jain, A., & Shambavi, K. (2021). Energy Efficient Smart Parking System Using Peizoelectric Material And Sensors. International Research Journal of Modernization in Engineering Technology and Science, 3(05), 3148-3150.

[31] Chaudhary, H., Bansal, P., & Valarmathi, B. (2017, January). Advanced CAR parking system using Arduino. In 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS) (pp. 1-5). IEEE.
[32] Agarwal, Y., Ratnani, P., Shah, U., & Jain, P. (2021, May). IoT based smart parking system. In 2021 5th international conference on intelligent computing and control systems (ICICCS) (pp. 464-470). IEEE.
[33] Patil, M., Chakole, V., & Chetepawad, K. (2020, December). IoT based economic smart vehicle parking system. In 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS) (pp. 1337-1340). IEEE.
[34] Dixit, M., Priya, A., Haldiya, G., Priya, A., & Kumar, B. (2023, February). Smart Car Parking System using Arduino. In 2023 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS) (pp. 1-6). IEEE.
[35] Dhanabalraj, P., Gopinath, L., Gowthaman, G. M., Sherin, J. J., & Kumar, K. (2021, March). Car Parking Allocation System using Arduino. In 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS) (pp. 1223-1227). IEEE.
[36] Shanmugapriya, P., Abishek, J., Chandhrasekaran, G., Khadarjilani, N., & Verma, G. K. (2022, December). IoT based Control and Management for Parking System. In 2022 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS) (pp. 1-3). IEEE.
[37] Saleem, A. A., Siddiqui, H. U. R., Shafique, R., Haider, A., & Ali, M. (2020). A review on smart IOT based parking system. In Recent Advances on Soft Computing and Data Mining: Proceedings of the Fourth International Conference on Soft Computing and Data Mining (SCDM 2020), Melaka, Malaysia, January 22– 23, 2020 (pp. 264-273). Springer International Publishing.
[38] Mudaliar, S., Agali, S., Mudhol, S., & Jambotkar, C. (2019). IoT based smart car parking system. Int J Sci Adv Res Technol, 5(1), 270-272.
[39] Venkatesh, V., & Sailaja, K. A. Iot Based Sensor Enabled Vehicle Parking System.
[40] Ye, Hao & Jiang, Haobin & Shidian, ma & Tang, Bin & Wahab, Lukuman. (2019). Linear model predictive control of automatic parking path tracking with soft constraints. International Journal of Advanced Robotic Systems.16.172988141985220.10.1177/172988141985221.



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