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Smart Parking System

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ABSTRACT -Due to the increase in the population of the city and the increase in vehicles, parking in the city has become a big problem. In this article, we present an autonomous parking system using IoT and ESP32.One of the main benefits of automatic parking systems is that they help drivers find a parking space quickly, saving time and fuel they would otherwise spend searching for a parking space. It can also help reduce traffic congestion in crowded cities. Smart parking can also maximize parking by adjusting prices as needed or directing traffic to vacant spaces. We offer cost-effective IoT smart parking systems to monitor urban parking spaces and provide drivers with the latest parking information. Cameras and machine vision technology can also be used to determine where a car is parked, rather than using onboard tools to detect cars in the parking lot.

I. INTRODUCTION

The Internet of Things connects various devices to the Internet to ensure people's safety and comfort. A branch of artificial intelligence (AI) called computer vision allows computers to extract information from images, videos, and other objects.

Proven end-to-end integration using smart parking technology, it delivers a higher standard and transforms the entire parking experience. Efficient and effective city parking management will reduce city traffic and pollution, and automatic parking is the best option. In this rapidly developing economy, the diversity of vehicle users is increasing and more parking spaces are needed.In this article, we describe an automated parking lot that uses the cloud and the Internet of Things. This is cheap stuff Besides normal parking, you can also use normal parking, convenient parking, etc. Use the Toolkit to find it. It can also help drivers find parking by giving an alert when the vehicle leaves the parking space, so they can reserve the space. Automatic parking eliminates the need for drivers to search for a parking space or park manually. Instead, the driver stops the vehicle at a designated point and lets the automated system do the rest. It can also stop and remove vehicles faster than the driver, thus reducing waiting time and increasing productivity.

This is especially important in busy cities where parking is limited and time is of the essence. Automated parking systems can help reduce the environmental impact of transportation by reducing the need for large parking spaces and reducing the time and fuel required to search for a parking space.

This can reduce congestion, improve air quality, and improve traffic. Overall, autonomous parking has many advantages over traditional parking and has the potential to change the way we park in the future. Smart parking was implemented using cloud computing with ESP32 camera module and Google Firebase, as the backend achieved good results in parking space search and timekeeping.

II. PROPOSED SYSTEM

The increasing number of vehicles on the road has led to a significant increase in traffic congestion, especially in urban areas.

This has resulted in a waste of time and fuel for drivers, as well as an increase in air pollution. In addition, finding a parking spot in busy areas can be a frustrating and time-consuming experience for drivers.

To address this problem, we propose the development of a smart parking system that will allow drivers to quickly and easily locate available parking spots.

The system will use sensors to detect the presence of vehicles in parking spots and transmit this information to a central server.

Drivers will be able to access this information through a mobile application, which will display the location of available parking spots in real-time.

III. LITERATURE REVIEW

[1]K.Sushma, P. Raveendra Babu, J. Nageshwara Reddy "Reservation based vehicle parking system using GSM and RFID technology", K.Sushma et al. Int. Journal of Engineering Research and Applications Vol. 3, Issue 5, Sep-Oct 2013, pp.495-498 :In this paper this system is to develop a Reservation based vehicle parking reservation system to overcome the problem of unnecessary time consumption in finding parking spot in populated areas. In this proposed system, we reserve the parking by using short message service (SMS). Slot reservation is done by sending a message to GSM modem placed at the parking end. If the parking slot is available then GSM modem gives slot number and a password. IR sensor is used for the indication of empty slot are denoted by green LED. User can park the vehicle at the allotted zone, and this is valid up to a certain period of time only after that the priority will be given to next user. RFID technology is used for entering and exiting parking area and payment transaction is done through RFID tag. Advantages of this system are GSM technology is used, IR sensors and RFID are used for accuracy, SMS based system, Barrier gate are used for security. Disadvantages are Network failure may occur, Expensive due to RFID, IR sensor, GSM card and Barrier gate, Complex circuit.

[2]Jihoon Yang, Jorge Portilla and Teresa Riesgo "Smart Parking Service based on Wireless Sensor Networks":This paper is based on the design and implementation of a system of Smart Parking Services based on Wireless Sensor Networks (WSNs).The proposed system consists of wireless sensor networks, web-server, central web-server and mobile phone application. In the system, wireless sensors are deployed into each parking slot equipped with one sensor node. The status of the slot is detected by sensor and is reported periodically to web-server via the wireless sensor networks. This information is sent to central web-server using Wi-Fi networks, and also the vehicle driver can find vacant parking lots using standard mobile devices. Advantages are using wireless sensor there is accuracy of parking slot, Real time update is fast due to WI-FI usage at web server. Disadvantages are Wireless sensor is used to update the status of parking slot which is expensive, Web page is use to know the information of the parking place and slot,Reservation cannot be done through web page, Sever failure can be happen due to load on server.

[3]Renuka R. and S. Dhanalakshmi "Android based smart parking system using slot allocation & reservations" , Journal of Engineering and Applied Sciences VOL. 10, NO. 7, APRIL 2015 ISSN 1819-6608: In this paper it shows the design and implementation of an android application, which is parking system, based on Reservation that allows drivers to easily find and reserve the vacant parking slots in the specific zone with the help of Internet with slot allocation method and performs automated billing process. In this system the billing process is also done using the RFID technology which has the details of the user bank Account. RFID's mainly use is primarily for tracking, this technology has quickly created an extremely number of areas including easy gas payment and credit card. Advantages of the system are Using slot allocation we can book and block our own reservation, IR sensors and RFID are used for accuracy, RFID tags are used for automated billing process. Disadvantages are Hardware failure may occur, Expensive due to RFID and IR sensor, Complex circuit.

[4]Waheed, A., Krishna, P. V., Gitanjali, J., Sadoun, B., & Obaidat, M. (2021). "Learning automata and reservation based secure smart parking system: Methodology and simulation analysis. Simulation Modelling Practice and Theory", 106, 102205: This paper in based on Time and energy saving green solution for IoT based smart parking system. It uses minimal onsite resources and uses cloud resources to process data. The theoretical mathematical model is used to

model the attraction, which ensures the high performance of the proposal. It also determines the parking lot that companies and families can use to park their cars and/or rental cars when they are not using it

[5]Said, A. M., Kamal, A. E., & Afifi, H. (2021). "An intelligent parking sharing system for green and smart cities basedbIoT". Computer Communications, 172, 10-18:This paper is on IoT-based Smart Parking (SP) solution designed to provide information about parking conditions in on-street parking lots.Real-time map of the number of people in the city's parking area. The vehicle control panel is used to control whether

there are vehicles in the parking lot. To achieve this, a three-axis magnetometer sensor is used here. The presence of the Bluetooth beacon in the vehicle is detected by the onboard station's Bluetooth receiver.

[6]Floris, A., Porcu, S., Atzori, L., & Girau, R. (2022)."A Social IoT-based platform for the deployment of a smart parking solution". Computer Networks, 205, 108756:This paper is on Virtualization technology is used to store data and provide an energy saving environment by using virtual machines.Authentication and verification of parking and driver information using RSU-based blockchain security layer network to reduce security and privacy concerns

[7]Singh, S. K., Pan, Y., & Park, J. H. (2022). "Blockchain-enabled secure framework for energy-efficient smart parking in sustainable city environment". Sustainable Cities and Society, 76, 103364: In This paper Smart Parking System uses IoT Raspberry Pi as a parking management system, which can easily find free parking spaces through GPS management. It uses computer vision to capture images in real time to identify parking spots via the Pi's camera. Ultrasonic sensors and LEDs are used to detect the parking lot with Pi camera support to provide accurate data.The received data is processed and can be accessed by the application from the cloud server.

[8]Jabbar, W. A., Wei, C. W., Azmi, N. A. A. M., & Haironnazli, N. A. (2021). "An IoT Raspberry Pi-based parking management system for smart campus". Internet of Things, 14, 100387: This Paper is based on study demonstrates the development of smart park through hardware design and mobile application development. The system allows users to search for free parking and users can pre-book parking at their homes. This system saves users time and effort to find free parking spaces.

[9]Usman, M. T., Hassan, A., Akbar, A., Waleed, A., & Hasham,A. (2021, November). "Development of Time and Energy Efficient, Smart Parking System". In 2021 International Conference on Innovative Computing (ICIC) (pp. 1-6). IEEE: This paper is Based on Smart parking is based on automatic driver's license search and provides web support so that the driver can book an appointment anytime and anywhere. Vehicle identification is completed with plate image. It eliminates the need for drivers to search for long parking spaces or to force them to park illegally.

[10]Khanna, A.; Anand, R.," IoT based Smart Parking System", proc., in 2016 International Conference on Internet of Things and Applications (IOTA), Pune, India, 22–24 January 2016; pp. 266–270: This paper is based on delivers parking facilities in real-time and users are ready to book places and make payments before incoming at the car park's lot.

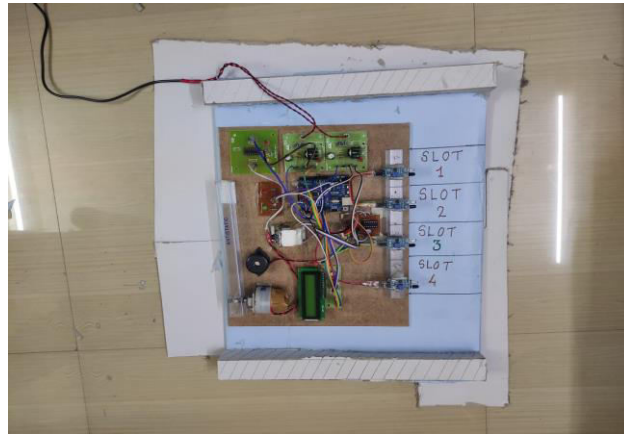3. Block Diagram

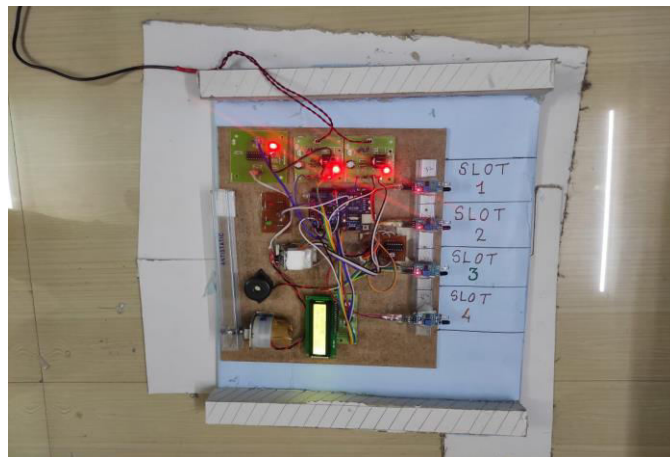BLOCK DIAGRAM

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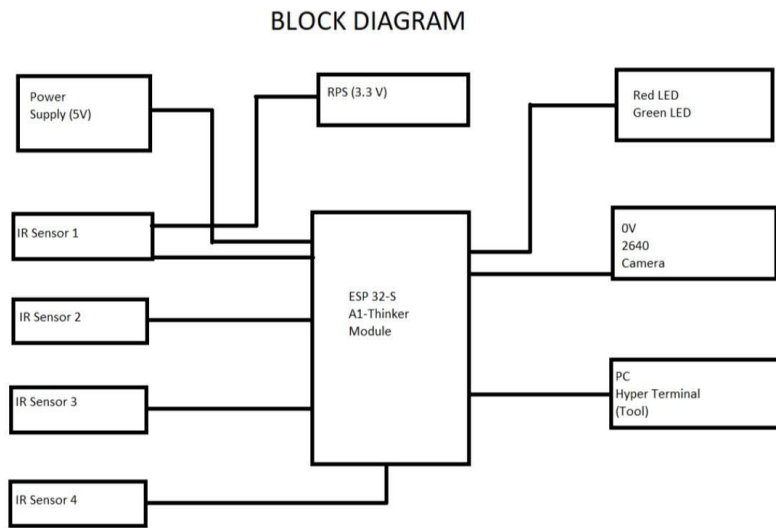
IV. RESULT

Figure 1: Smart Parking System hardware model

Figure 2: Smart Parking System hardware model after execution

Figure 3: Web-Page of IoT based Smart Car Parking System

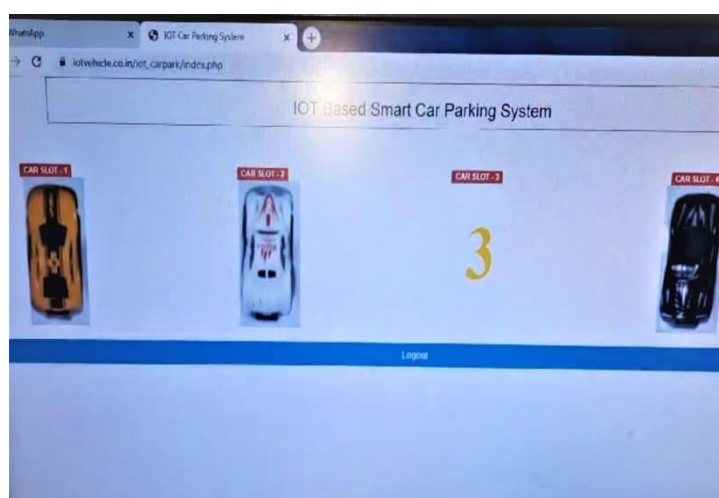Figure 4: Web-Page of IoT based Smart Car Parking System after login

Figure 5: Web-Page of IoT based Smart Car Parking System after car allocation

V. FUTURE SCOPE

Smart parking system using an ESP32-CAM module has the potential for several practical applications and future scope. Here are some possibilities:
1. Scalability.
2. Integration with mobile apps.
3. Payment integration, data analytics.
4. Security enhancements.
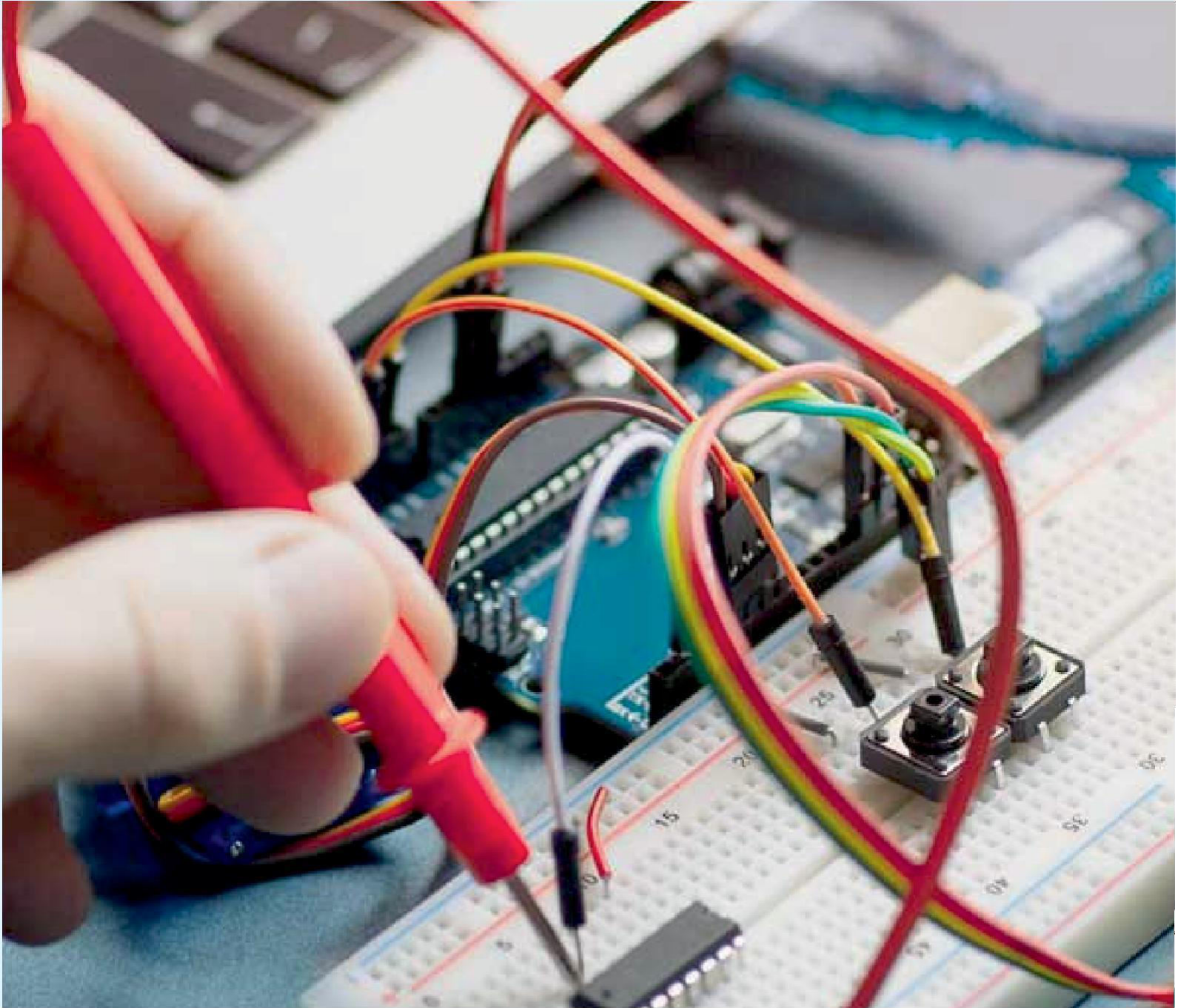5. User-friendly interfaces.
6. Emergency services.

VI. CONCLUSION

The Smart Parking System project presents a promising solution to the parking challenges faced by modern cities. By leveraging cutting-edge technology, real-time data, and user-friendly interfaces, the system aims to enhance the overall urban mobility experience for both drivers and city planners. As urbanization continues to grow, the implementation of such intelligent parking solutions becomes increasingly crucial for building smarter, more efficient, and eco-friendly cities.

REFERENCES

[1]K.Sushma, P. Raveendra Babu, J. Nageshwara Reddy "Reservation based vehicle parking system using GSM and RFID technology", K.Sushma et al. Int. Journal of Engineering Research and Applications Vol. 3, Issue 5, Sep-Oct 2013, pp.495-498.

[2]Jihoon Yang, Jorge Portilla and Teresa Riesgo "Smart Parking Service based on Wireless Sensor Networks".

[3]Renuka R. and S. Dhanalakshmi "Android based smart parking system using slot allocation & reservations" , Journal of Engineering and Applied Sciences VOL. 10, NO. 7, APRIL 2015 ISSN 1819-6608.

[4]Waheed, A., Krishna, P. V., Gitanjali, J., Sadoun, B., & Obaidat, M. (2021). "Learning automata and reservation based secure smart parking system: Methodology and simulation analysis. Simulation Modelling Practice and Theory", 106, 102205.

[5]Said, A. M., Kamal, A. E., & Afifi, H. (2021). "An intelligent parking sharing system for green and smart cities basedbIoT". Computer Communications, 172, 10-18.

[6]Floris, A., Porcu, S., Atzori, L., & Girau, R. (2022)."A Social IoT-based platform for the deployment of a smart parking solution". Computer Networks, 205, 108756.

[7]Singh, S. K., Pan, Y., & Park, J. H. (2022). "Blockchain-enabled secure framework for energy-efficient smart parking in sustainable city environment". Sustainable Cities and Society, 76, 103364.

[8]Jabbar, W. A., Wei, C. W., Azmi, N. A. A. M., & Haironnazli, N. A. (2021). "An IoT Raspberry Pi-based parking management system for smart campus". Internet of Things, 14, 100387.

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