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An IOT Based Parking System to Prevent Unauthorized Vehicles

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Abstract - *There is an increasing need for effective parking management systems traceable to the growing number of automobile and urbanization. Conventional parking systems frequently have trouble keeping illegal cars out of allocated spots, which causes traffic jams and security issues. In order to improve security and stop unwanted access to parking spaces, this article suggests a novel Internet of Things (IoT)-based parking system. In order to monitor and manage parking lot in real-time, the suggested system combines cutting-edge sensor technologies, communication protocols, and a centralized control unit. Every parking spot has intelligent sensors installed that can identify vehicle is there. A secure Internet of things network connects these sensors to a central control unit, facilitating easy data sharing and communication The Iot based parking system can make parking easier and more convenient for all users by using IoT sensors to locate parking lots, detect and monitor security, and reserve spaces. This illustrates how a wide range of people can use the IoT to make life easier and more convenient on a daily basis. Using inexpensive technology, parking is made easier and traffic is reduced. By reducing the amount of traffic and the amount of time needed for parking spots can be reserved and marked, and online data about the parking area is collected. The main gate and LCD panel display the tags that the RFID tag reader has scanned from the cars in the parking lot's allocated area. There is a designated parking space set aside for the car. The Arduino IDE software on an Arduino Nano based on automated parking system control using codes. The main advantages are the time and money savings as certainty management.*

***Key Words*: IOT, RFID, LCD display, Arduino, Mobile application**

1.INTRODUCTION

Urban parking management problems can be expertly solved using an Internet of Things (IoT)-based parking system that forbids unapproved vehicles. This inventive solution turns conventional parking lots into safe and effective areas by utilizing sensor technology, wireless networking, and data analytics. Properly positioned occupancy sensors in every parking spot keep an eye on things at all times, and Radio‐Frequency Identification cameras record and verify the presence of cars coming and going from the property. The system makes use of cloud connectivity for scalable storage and sophisticated analytics, as well as wireless networks for smooth communication that enable real-time data sharing only approved vehicles are allowed admission with the help of access control systems that are integrated with authentication servers and make use of mobile apps or RFID cards. Monitoring is made easier by a centralized control panel that offers information on entry/exit records, automated enforcement systems, and parking space availability. This all-encompassing strategy represents a major breakthrough in contemporary parking solutions since it not only stops illicit parking but also improves general security, effectiveness, and user experience. In addition to preventing illegal vehicles, the Internet of Things (IoT)-based parking system transforms the conventional parking environment with a wide range of functions. By directing cars to open spots, real-time parking information eases traffic and boosts productivity. Pre-booking and reservation options are very convenient, since they enable users to reserve parking spaces ahead of time. Integrating navigation apps with parking makes parking easier and provides drivers with a smoother driving experience. In addition to making transactions easier, automated payment processing also makes the revenue collecting system more effective. The system's capacity to gather and examine past data makes it easier to optimize parking facilities through evidence-based decision‐making. An additional layer of sustainability is added by environmental impact monitoring, which makes it possible to evaluate how a facility affects traffic and air quality. These systems' scalability and adaptability make them appropriate for a variety of settings, from large public buildings to little lots. Alerts and notifications increase user engagement by providing timely information about reservations and parking condition changes. Proactive system health management is made possible by maintenance and diagnostics features, while emergency response integration strengthens safety precautions. Beyond access management, the Internet of Things (IoT)-based parking system essentially turns urban parking into a smart, connected, and user-centric experience that is in line with the larger goals of smart city efforts. To maintain a secure and smooth traffic flow, drivers in India should follow these rules when operating a vehicle. Any breach, transgression, or disregard for any of these rules is regarded as a serious infraction under city-specific traffic laws. Due to its low cost and wide availability, vehicle observation using Radio Frequency Identification has become more and more common in recent years. RFID tags are typically placed inside of cars, while RFID readers are typically placed outside of them. It is possible to collect traffic data using RFID tags. This information will be used to hold lawbreakers accountable. The methodology presented

in this case might be applied in a city attempting to install RFID-based vehicle and traffic monitoring systems. Using RFID, a contactless and wireless technology, radio waves may automatically identify traffic police rules and the Indian Motor Vehicle Act.

1.1 Literature Survey

[1] A cloud-based network and sensor-based smart parking system are used for smart city applications. Authors: Lokesh Sharma, Dinesh Yadav, Vaani Rajvanshi, and Swasti Chaturvedi. Published in 2019 A synopsis of this work: This suggested smart parking system architecture will shorten the time it takes to find a spot and lower the number of occasions where cars are parked incorrectly. Additionally, it lowers labor costs and physical work, requiring less money to be saved and negating the need for manpower investment. [2] Smart Parking with Wireless Sensor with Network System. Authors: Evelina, Ade Silvia, Anggi Sahfutri, Nyayu Latifah Husni, M. Nawawawi, Iskandar Lutfi, and Ekawati Prihatini Published in 2018 A synopsis of this work: Since the gadget can send and receive data, communication between the parking lot and the monitor area is one aspect of this research that contributes to the device's success. This research provides an easy approach for users to discover parking lots by monitoring and providing information before drivers enter.

[3] An Intelligent Wireless Parking System Authors: G.P. Hancke, B. Silvia Silva, and O. Orrie. Published in 2015 A synopsis of this work As this article shows, the system is a workable design that, if put into a commercial setting, might work effectively for parking lots with a lot of traffic. In crowded regions, the system can shorten the time it takes to find a parking space through including the appropriate security elements.

[4] Sturdy Automatic Parallel Parking using Fuzzy logic in small areas Authors: Collins, E. G., and Zhao, Y. Published in 2005 A synopsis of this work: This study established and evaluated an autonomous parking algorithm for small spaces. Furthermore, offers a way to adapt the algorithm developed to various car platforms.

[5] Using Parking Lots Sensors Networks to Implement a Smart Parking Guidance System. Authors: Yongjie Pan, Dong Zhang, and Wenyu Cai Originally Published in 2015 A synopsis of this work: This study illustrates how, despite the system's non-existence, its concepts are novel and potentially useful in everyday situations. Enhancement This study concerns the Dijkstra algorithm, which has a higher efficiency and is easier to compute than the classic Dijkstra algorithm. There is some use for this approach in intelligent parking fields.

[6] A Mechanical Parking System, Authors Feng Yuan Wang and Yi Liu Originally Published in 2017 A synopsis of this work: a rotational mechanism that allowed any carto move in rotated movement. All of the automobiles rotated as they were loaded and unloaded. Eight to twelve autos were better off using this approach. The fact that it was simple to use and that parking the car was easy were advantages. Its complicated structure, high initial cost, and requirement for all cars to be rotated in order to reach one car were major drawbacks.

[7] Smart Parking System for Commercial Stretch in Cities. Authors: Dharmini Kanteti, D V S Srikar, and T K Ramesh Published in 2017. A synopsis of this work: They created an intelligent parking system. They would proceed without any delays since, in their model, preregistered IP cameras would record the car registration number. Their information would be kept on file, including their visitation location and estimated parking duration. The sum would be taken out of the e-wallet for pre-registered users, who would subsequently receive notification. For new users, a comparable pricing structure would be used, but offline payment would be required. One of the drawbacks was that although the system could handle every parking request, it was unable to handle any more cars beyond 80 because the parking lot was already full. of other groups, which significantly affects the precision.

[8] Parking-related navigation system with ZigBee wireless sensor network Authors: Yuki Hirakata, Akira Nakamura, Kohei Ohno, and Makoto Itami wrote this. Published in 2012 A synopsis of this work: A ZigBee-based navigation system for the spacious parking lot is suggested. One of the sensor network systems is the ZigBee, which may be used to create a low-cost multi-hop network with several terminals. ZigBee technology enables the simultaneous connection of multiple devices, hence facilitating the formation of a network in a larger parking area.

[9] Applications, technology, and smart parking sensors for open parking lots Authors: Roger G. Nyberg, Hasan Fleyeh, Johan Håkansson, and Vijay Paidi Published in 2018 A synopsis of this work: The use of smart parking sensors, technology, and applications for open parking lots is identified as a research gap in this study. Because of the extreme weather and high cost, none of the smart parking apps and technologies now in use are appropriate for open parking lots. Giving smart parking services in an open parking lot has no immediate financial benefits.

[10] An all-inclusive smart parking system powered by IoT, featuring real-time monitoring and navigation. Authors: Mohamed Elhoseny, Mohamed Fathy, and Sherif Abdelkader Published in 2021 A synopsis of this work: The most recent information on parking spaces that are available is provided via sensors and image processing algorithm Navigation of parking spaces: uses in-app and visual directions to quickly lead cars to open spots. disadvantage Large-scale implementations could need for sophisticated infrastructure and data management solutions.

[11] An Eco-Friendly Internet of Things a Smart Parking System Integrating the Renewable Energy and Optimizing an Charging. Authors: Wei Huang, Jingyu He, and Huaiyu Zhu Published in 2023 A synopsis of this work: Sensors provide accurate information on vacant parking spaces and charging stations, including their power availability. The system connects to solar panels or wind turbines, utilizing surplus energy for EV charging and powering the system itself. In order to promote electric mobility, integrate renewable energy sources, and manage resources efficiently, this study illustrates how IoT-based smart parking systems may support sustainable urban development. Main drawback the need for initial investment in renewable energy infrastructure and advanced charging technologies. on resolving issues with cost, scalability, and user adoption.

2. DESIGN AND METHODOLOGY

Here we are trying to build a suitable computerized Smart Parking System to prevent unauthorized vehicles entering the parking lot. The project implemented using IoT with IR sensors which is used to entry and exit. It is also used to check whether the parking slot is free or not. RFID reader is used for vehicle authentication. LCD display to display parking slots. Servo motors, IR sensors to open the gate automatically when there is a vehicle. Blynk app contains the state of the parking slots.

A) Block Diagram

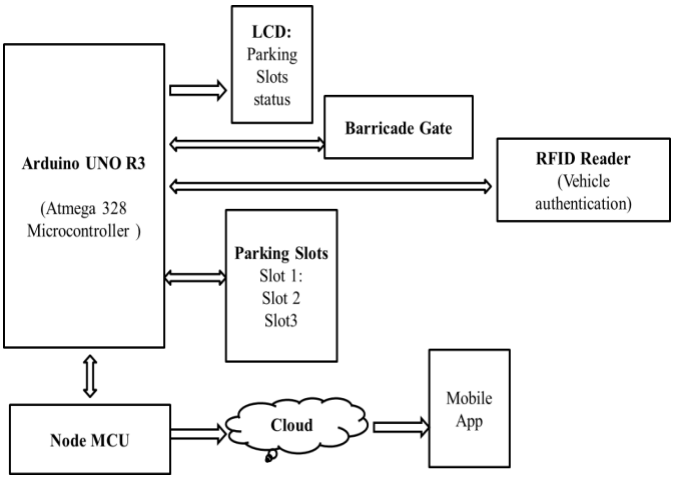

Fig 2.1: Block Diagram

B) Hard Requirements:

Arduino UNO R3:

The Arduino Uno R3 is a microcontroller board based on the ATmega328P chip. Arduino is a popular choice for beginners and experienced hobbyists alike due to its ease of use, affordability, and extensive of capabilities. The Arduino Uno R3 is a versatile and user-friendly microcontroller board that is a great choice for beginners and experienced hobbyists alike. With its wide range of features and capabilities, it can be used in many IoT project.

Fig 2.2: Arduino UNO R3

LCD:

An LCD, or Liquid Crystal Display, is a flat-panel display technology commonly used in various devices like televisions, computer monitors, smartphones, and many more.

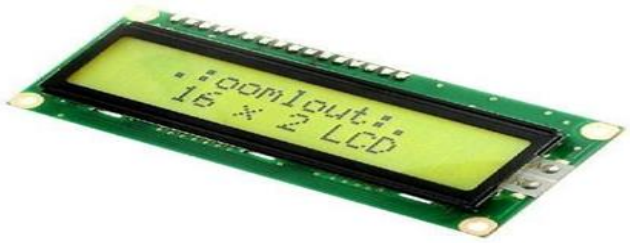

Fig 3.3 LCD

IR Sensors:

IR sensors, or infrared sensors, are optoelectronic components that detect and respond to infrared radiation. This invisible radiation, also called as heat radiation, is emitted by all objects with a temperature above absolute zero. As such, IR sensors have a wide range of applications in various fields

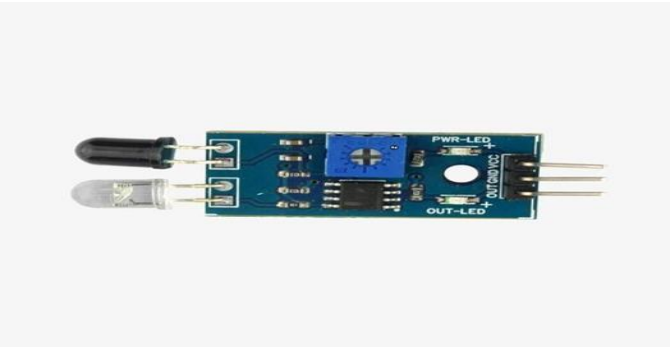

Fig 2.4: IR Sensors

RFID Reader:
An RFID reader, or Radio Frequency Identification reader, is a device that has one or more antennas that emits radio waves to interface with and gather data from RFID tags. These tags are small chips attached to objects and contain unique identifiers

Fig 2.5: RFID Reader

Servo Motor:
Servo motors are devices that provide precise control of angular or linear position, velocity, and acceleration. They are widely used in various applications where accurate and controlled movement is required. They are used as barricade system to allow and exit the cars.

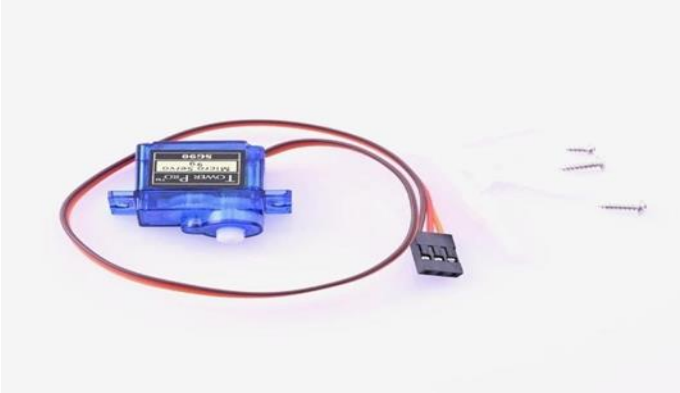

Fig 2.6: Servo Motor

Blynk Application: Blynk is a platform that enables the development of Internet of Things applications for controlling hardware remotely. It provides a mobile app (iOS and Android) and a cloud-based server that allows you to build projects and control devices over the internet.

C) Working:

When a car arrives, it opens the gate only when there are empty spaces left and also for authorized vehicles. If there is not any empty slot then the gate does not open and also non un authorized vehicles. The LCD in the system status of the parking slots, we are using IR sensors in order to indicate the occupancy parking slots. Through the internet cloud connectivity, the mobile app which we are developing will receive the update through microcontroller to cloud communication regarding the status of the parking slots. Vehicles will be identified through RFID communication system to check it is authorized or unauthorized vehicles. Based on the data of RFID and also the parking slot information the barricade gate which we have developed through the servo motors will work accordingly. We are developing this model using Arduino Atmega328 microcontroller, and esp8266 microcontroller. Atmega328 microcontroller takes care of the entire parking system and esp8266 microcontroller which connected serially to the Arduino board takes care data transmission to IoT cloud to update the details to the mobile app.

The smart parking system is completely automated once it is controlled by a web or mobile application. The Arduino IDE software carries out the functions of the Arduino NANO (ATMEGA328P) by using the embedded C program. On the internet, users can reserve parking spots and receive a parking badge via email. They can then use the website to locate the parking lot and park there. Utilizing the Arduino IDE program, you can use the integrated C software in the esp8266P Wi-Fi kit to program IR sensors and DC motors to create an Internet of Things gadget. The parking lot's main gate is powered by an electric motor and an RFID tag reader, which opens and closes the gate and confirms that the person who rented the space. We can observe how modern technology has affected our daily lives everywhere we turn. The right use of technology is required to build a future where everything can be done more swiftly and easily with its assistance. Because of the rapid population growth in our modern civilization, vehicle traffic has become a daily event. Furthermore, there are now more unauthorized cars on the road. Therefore, the system we've created aims to ensure that cars are appropriately managed to prevent illegal parking and traffic in public areas like workplaces and schools. Certain elements make it possible to identify between permitted and unauthorized vehicles at the main gate and to identify illegal vehicles parked in the parking lot.

D) Module Description: In an IoT-based parking system, various modules and components work together to create an intelligent and efficient solution. Here's a description of key modules typically found in such a system

i. Sensor Module: This module includes sensors placed in each parking space to detect the presence or absence of vehicles. Common types of sensors include ultrasonic sensors, infrared sensors, or magnetic sensors. Sensors continuously monitor the status of parking spaces and send signals to the central system when a vehicle is detected.

ii. User Authentication Module: responsible for authenticating users who want to access the parking facility. It may use RFID cards, mobile apps, license plate recognition, or other methods. Validates user identity against authorized data stored in the central server, allowing or denying access based on the authentication result

iii. Automated Barrier/Gate Control Module: Controls the physical barriers or gates that grant or restrict access to the parking area. Receives commands from the central server based on user authentication and real-time monitoring, controlling the opening and closing of barriers to allow or deny entry.

3. RESULTS AND DISCUSSIONS

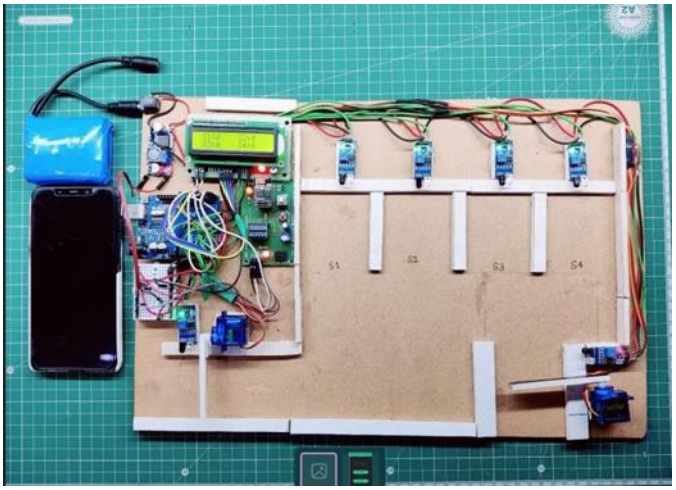

Fig 3.1: Prototype of The Project

Fig 3.2: LCD displaying vehicle Enter

Fig 3.3 Parking lot status on LCD showing that Slot 3 is empty.

Fig 3.4: RFID reader check whether the vehicle is authorized or not.

4. CONCLUSIONS

This paper concludes the full structure of how an IOT-based system will work in daily life, and an RFID-based parking system will provide many solutions to park vehicles and also to locate unauthorized vehicles in a clear manner. RFID is a sensor working system that collects information about a vehicle, communicates with other sensors, and transfers data so we can separate authorized and unauthorized vehicles in a simple manner. This system will work as a simple tool to find and prevent unauthorized vehicles in an easy way. As it is known that today, cars are getting more into smart technology and smart driving. If we use this RFID technology as a key to find unauthorized vehicles, it will be more helpful, and the driving will not be wasted on other things. And this system will help to reduce pollution and fuel by booking parking spaces for the person searching for vacant spaces. With this system, users can also gain access to the vacancy of parking lots through the local network or satellite-based system, so it will be time saving for drivers and real- time parking communication will be done. Parking will gain greatly as an outcome of this system's implementation. There are several benefits to using this system to advance the economic, social, and safety-related elements of society, as well as conserving the environment. Aiming to progress the well-being for the city's residents, efforts have been made to upgrade the city's parking infrastructure. For crowded regions, finding a parking spot may be time-consuming, thus the adoption of smart technology is important to aid drivers and drop the time it takes to locate a spot. We can reduce road congestion and enhance parking options in this manner. In the future scope, we add a camera for this project, using the camera we will monitor the live streaming of that vehicle's movements. By using this method, we will take/reserve permission for parking in that area

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