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Campus Parking Availability System

Prof. Mrs. Prajakta A More[1], Ms. Mayuri Khalase[2],Ms. Khushi Kulkarni[3], Mr. Prathamesh Naik[4] , Mr. Sanket Shinde[5]
[1]*Professor,* [2, 3, 4, 5]*Student, E&TC, Zeal College of Engineering & Research, Pune*

Abstract: In past decades, IoT was not clearly visible to people, but nowadays - IoT has increasingly organizations in a variety of industries are using IoT to operate more efficiently delivered enhanced customer services, improve decision making and increases the value of businesses.

It consists of smart devices which are used to collect, send and act on data which is required for the system. Nowadays IoT plays an important role in the parking systems. IoT is a heart of embedded systems due to which every embedded system is more efficient and user-friendly. This IoT application we are using in our project to enhance the nowadays parking systems by using different components such as sensors, scanners, web-services, motors, authentication components etc which will be interfaced with each other by using IoT.

Keywords: IoT, Smart parking, Cloud, RFID, ESP32

I. INTRODUCTION

In the previous years, we have seen that in many college campuses, we have noticed that the parking slots provided by the campus management is not utilized properly which leads to congested parking due to which parking in the campus is more complex. To resolve those problems, we have built this project – Campus Parking Availability System.

Throughout this project, we have concluded that parking system should be in a constant way, the available parking slots will be displayed throughout the mobile application which should be installed in our mobile devices. Only students from the same college are allowed by scanning the authorized ID card provided by the college.

II. RELATED WORK

The present parking systems in urban areas can be frustrating and time consuming hence we proposed smart parking system which will work efficiently with the help of technological advancement. The evolution of parking systems is from simple sensors to complex data driven solutions. There are many different parking systems which were previously established, so we are concluding all the previous parking systems and improve the pitfalls of the systems.

Alirezahassani et.al has proposed the parking system which was implemented using the mobile application that is connected to the cloud. In this system, the user is able to set the time to allocate the slot. If he didn't use that the slot, the alarm will be given to the user.

This all functioning is shown by the mobile application which includes the number of used and empty spaces in the parking slots. The disadvantage is that if another user try to use the slot, he's unable to use that slot. Therefore, that slot is a waste of space if the first user cancels the slot which leads to waste of time and money. [1]

DharminiKanteti et.al has developed a smart parking in which IP cameras were used to capture the vehicle registration number. These components were used for pre-registration of the user for slot booking and the amount will be deducted by the e-wallets. The disadvantage of the system is that if the parking request is more than 80 slots, it couldn't accommodate more vehicles as parking is full. [2]

Rosario Salpietro et.al implements automatic detection of parking system through smartphone embedded sensor and blue tooth connectivity. In this system once the parking event is completed the detection of adaptive strategy allows the disseminating the information of the user using the combination of remote server and device-to-device connection through wi-fi links. [3]

III. BLOCK DIAGRAM OF SYSTEM

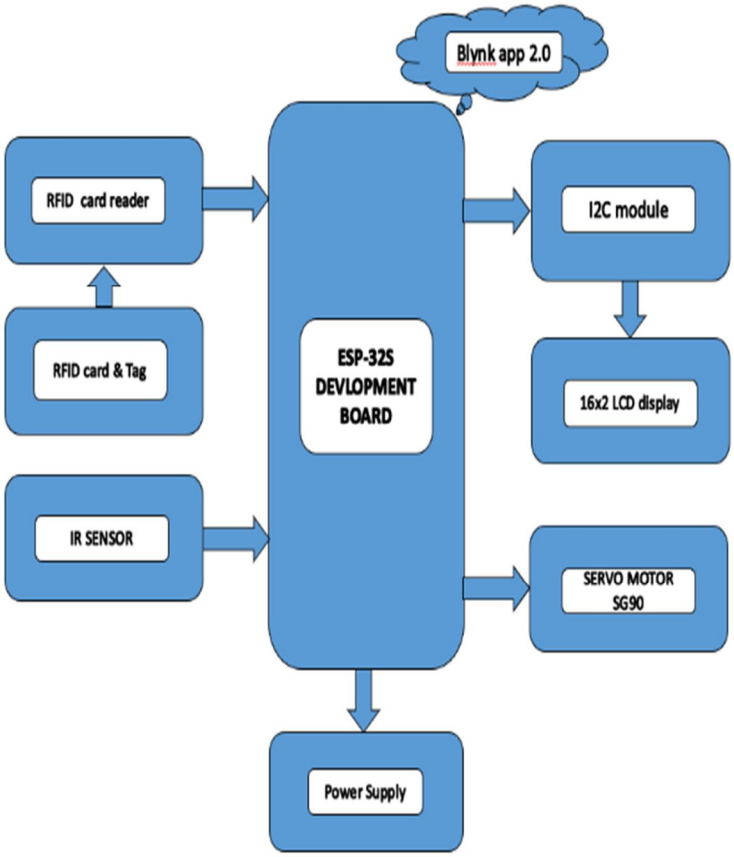

Fig. I Proposed block diagram

A. RFID Card Reader

As shown in fig.1 RFID Card reader is connected to the ESP-325 development board. This technology uses radio waves to identify people or objects. It has one or more antennas that emit radio waves and receive signals from the RFID tag.

B. RFID Card and tag

RFID tag uses the radio frequencies for searching, identifying and tracking and also communicate with people and specific components.

C. IR Sensor

The IR sensor is a device that can measure the heat of an object as well as detect the motion. It operates in the infrared spectrum.

D. Servo motor

The servo motor allows precise control of angular position. It is mainly used on angular or linear position and for specific velocity and acceleration.

E. 16x2 LCD Display

The 16x2 Liquid Crystal Display that can show 16 characters in 2 rows. So, total of 32 characters are shown on the display.

F. I2C module

It is a useful module to interface serial connection to parallel data, specially used for LCD display.

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IV. SYSTEM DESCRIPTION

The following figure shows the typical layout of the system in which IR sensors are shown in limitations but we can increase the number of IR sensors as per system requirement or user requirements.

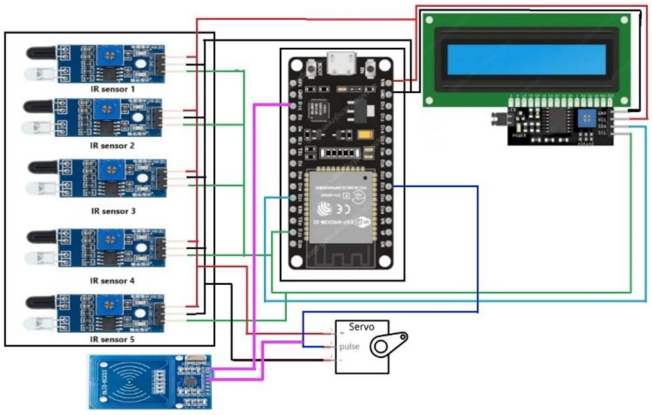

Fig. II System layout

In the above layout, we have shown five IR sensors which indicate that the system has five parking slots, the number of parking slots is limited in this system for clear understanding of the system. When the vehicle is on the campus gate, the user is responsible for scanning the RFID tag present in the ID card with the help of RFID reader. If the student is from the college the, ESP32 will check for that student in the database. If student details are present the ESP32 will allow the student to enter in the campus through the servo motor. The rotation of motor is 180˚. Now the vehicle is going to arrive on the parking locations, in our system. We have shown five IR sensors which indicate five parking slots. The slots are recognized as it is vacant or not is shown with the help of LCD Display. This display is placed on the campus gate. For communication between LCD Display and ESP32 is controlled by I2C module which provide serial communication path.

ESP32 is the heart of our project which is responsible for each and every function of the components. In this we have used two RFID Tags, in which one is authorized and another is unauthorized. This is because to show that the authorized tag is with student ID card and unauthorized tag is with unauthorized person. If the unauthorized person tries to enter in the campus by using fake tag, then he/she will not be allowed to enter campus as gate will not open. This makes system reliable and more secure. This whole operation can be controlled through the internet via Blynk 2.0 application. For that each and every authorized person is required to download Blynk 2.0 application. Through this application the user is able to see available parking slots, intime, out time etc. For that user is required to register his/her details with campus database and this database is fetched with ESP32.

V. EXPERIMENTAL SETUP

The following figure shows the complete experimental setup: -

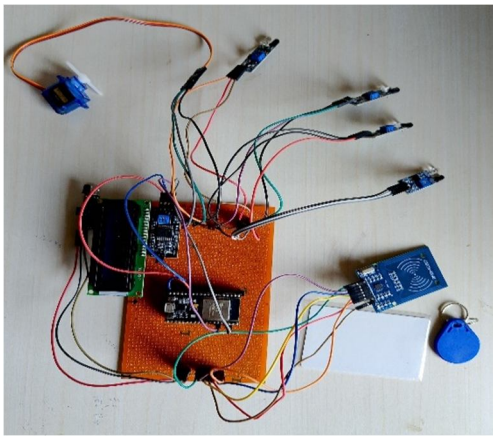

Fig. III Complete Experimental Setup

Fig. III shows all the connections of components with ESP32.

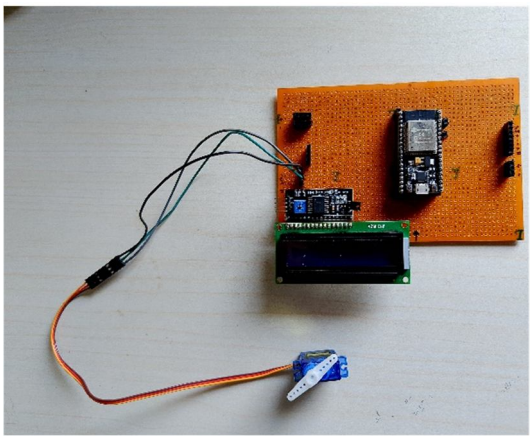

Fig. IV Interfacing with Servo motor

Fig. IV shows the interfacing of servo motor with ESP32.

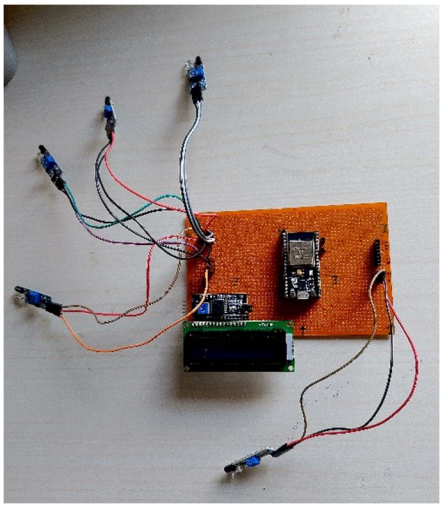

Fig. V Interfacing with IR sensor

Fig. V shows the interfacing of IR sensor with ESP32.

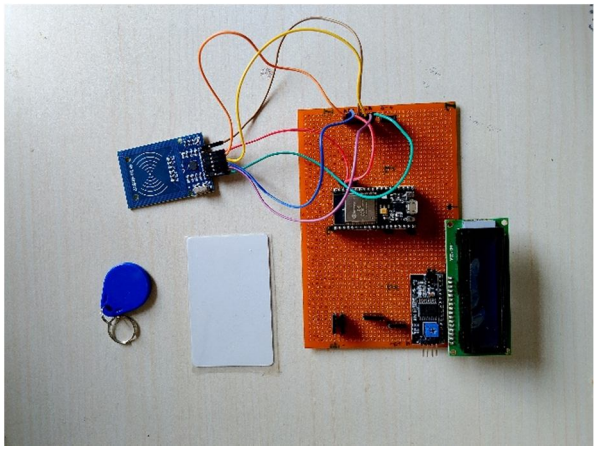

Fig. VI Interfacing with RFID tag and Reader

Fig. VI shows the interfacing of RFID tag and Reader ESP32.

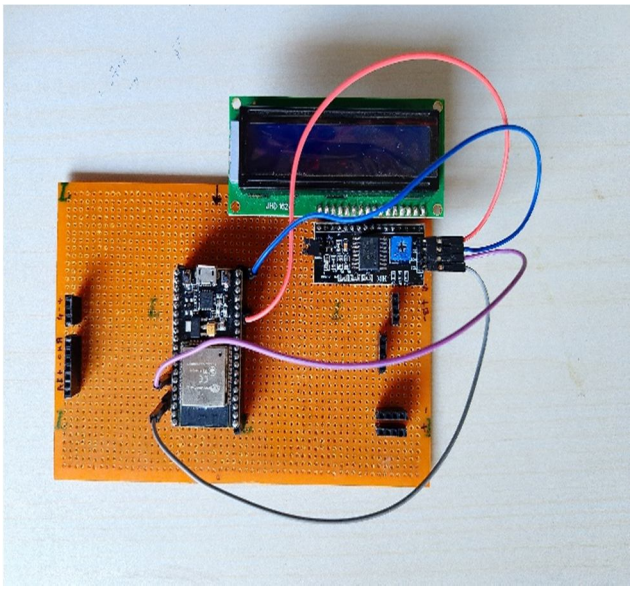

Fig. VII Interfacing with I2C module

Fig. VII shows the interfacing of I2C module with ESP32.

VI. SOFTWARE TESTING

The following figure shows the software testing details in which first we have to install Arduino IDE environment using official website of Arduino boards. After downloading the software, we have to follow some essential installation steps in which we have to manage libraries and other tools for complete setup of software. After installation of software, when we open it, we have to check code declaration with respect to boards. We have to select accurate board for debugging the program.

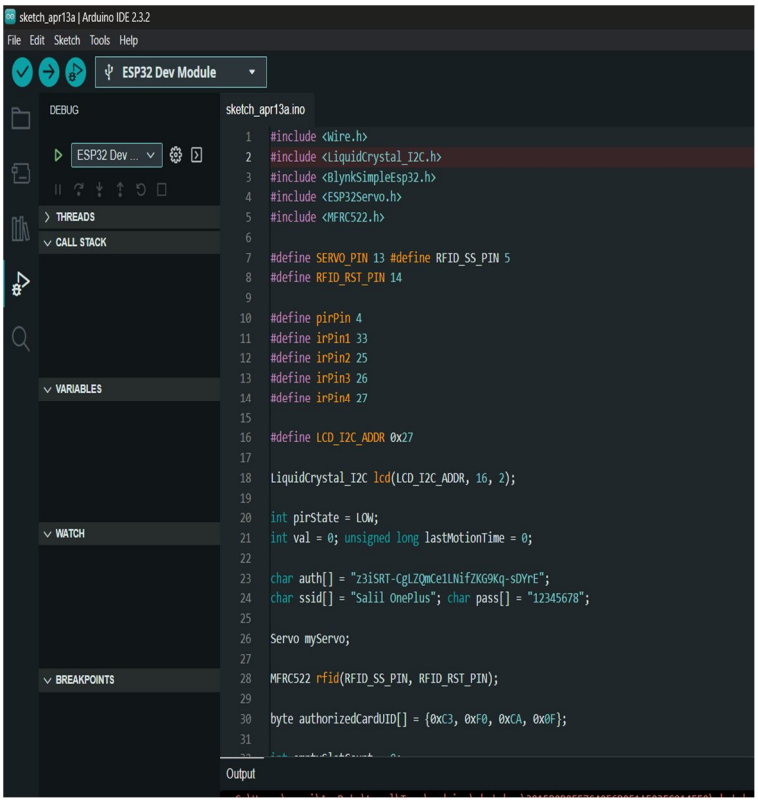

Fig. VIII Code on Arduino IDE

Fig. IX Blynk 2.0 Application UI

Fig. IX shows the UI of the Blynk 2.0 app which shows the 4 parking slots and if they are empty or not.

VII. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) Reduce the traffic in college campus
2) Security
3) Optimized parking spaces
4) Users save a lot of time in finding available parking slots
5) Shows available and non-available parking slots

B. Disadvantages

1) Cost of implementation is high
2) It is fully automatic and does not require any manual operation
3) Internet availability is required
4) Increased throughput

VIII. CONCLUSION

The Campus Parking Availability System provides us smart parking in the campus. It shows available and non-available parking slots and identifies students using the RFID card. It reduces traffic and congestion in the college campus. It gives us an organized parking system that allows constant parking method.

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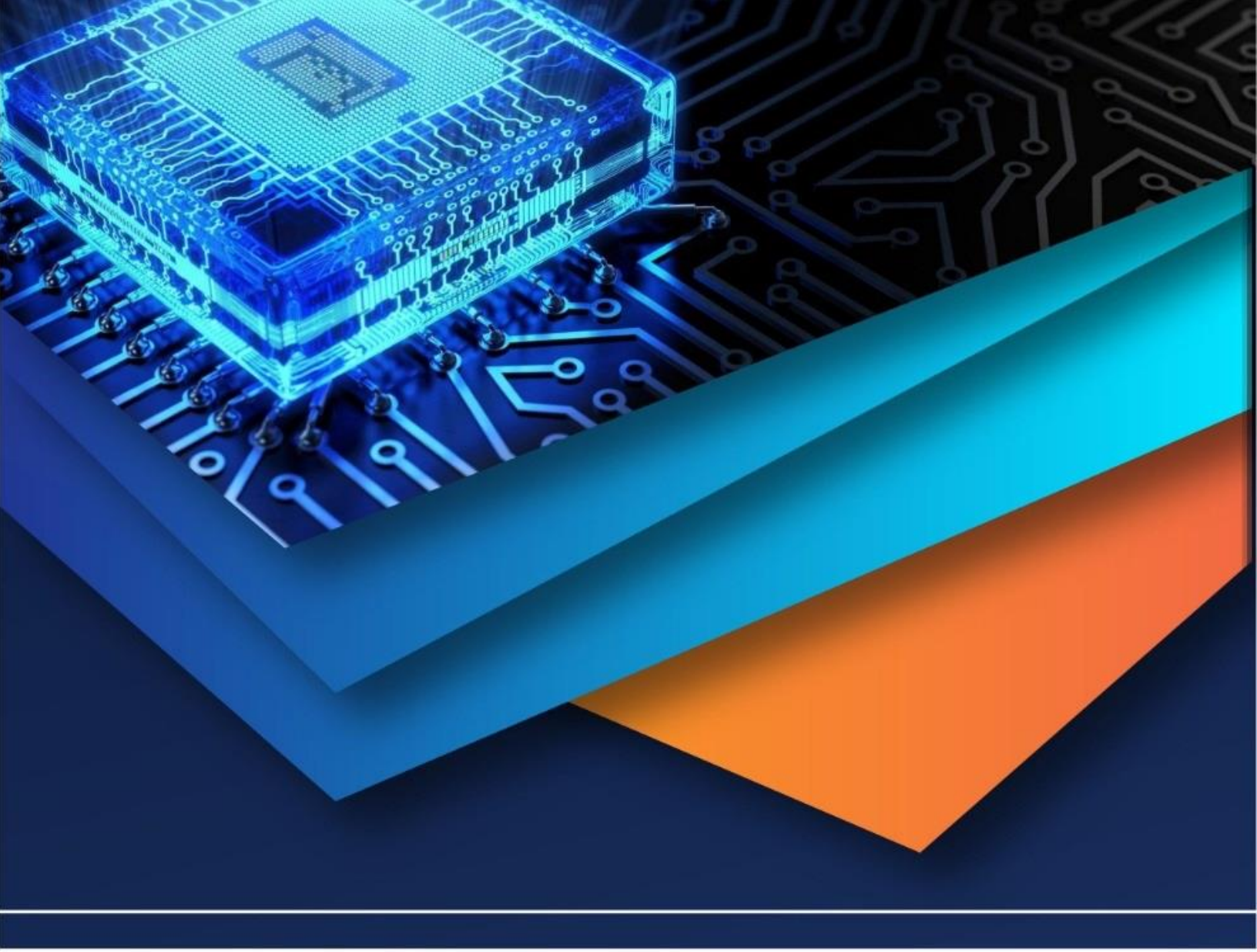

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