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Smart Parking System with RFID Technology

[1]Prof. S. S. Bharadwaj, [2]Angshuman Mandal, [3]Karan Kumar, [4]Pratham Singh

[1,2,3,4]Department of Electronics and Telecommunications, Sinhgad Institute of Technology, Lonavala, Maharashtra, India

***Abstract* - Throughout the project, an Arduino Uno, an RFID card, an RFID reader, an IR LED, and an IR receiver are implemented, all in addition to a motor for the gate, a motor pressure sensor, and a keypad are included. However, other items apart from the other items may also be required. Another example is an RFID card that is used to ensure that an individual is who they claim to be when they are logging on and off. An IR LED, which functions as a light source or as a transmitter for signals, and an IR receiver work together to transfer signals to the Arduino Uno to control the motor. An LCD screen, which is a part of the touchscreen, can display the total number of spaces that are available along with the number of people that each space can accommodate. Two infrared (IR) sensors are employed in this project to distinguish between occupied and empty spaces. To alert that the RFID card has been contaminated, a buzzer is used.**

Keywords: Smart Parking System, RFID, RFID Technology, RFID card, Pressure sensor, Arduino Uno.

I. INTRODUCTION

Parking attendants stationed at entrances to parking lots often cause delays and congestion. Discarded paper tickets outside these areas also contribute to litter and potential hazards. RFID and IoT-based paid parking systems offer a solution to these problems. These systems utilize a rechargeable RFID card that's scanned upon entry. When the card is read at the entrance, the system's microcontroller verifies the card's validity and updates its balance. If the card is invalid, an alarm sounds, and the gate remains closed. If valid, the gate opens, allowing the vehicle to enter, and a signal is sent to the driver.

II. PROPOSED SYSTEM

The ESP12 Node MCU microcontroller in this system is its main processor, paired with an RFID reader and tags attached to the cars. A display module is integrated into the circuit board with an I2C interface for communication and another LCD screen that gives system feedback. Each RFID tag has details about the vehicle like its registration number, the owner's name, and contact information in case of parking accounts. This scan of the tag is performed when the reader inspects the vehicle during the entry or exit from the parking area. LCD screens show the current parking condition which includes spaces available and spaces taken. With Wi-Fi connectivity, the Node MCU can update its website with the current parking information in real-time.

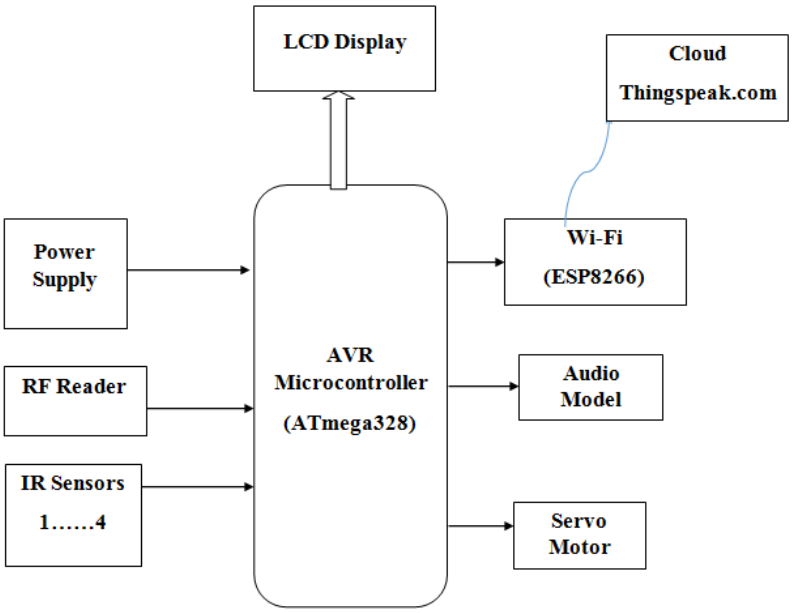

Figure 1: Block Diagram of smart parking system with RFID technology

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Each registered user receives an RFID tag for their vehicle, containing information like the vehicle's identification number, owner, contact number, and available balance. A card reader scans the tag upon entry and exit, recording these details. An LCD screen provides messages to the driver. The system uses an ESP12 Node MCU with built-in Wi-Fi for internet connectivity and real-time updates to a website. The LCD also displays the number of available parking spaces. The system's circuit includes the Node MCU development board, utilizing I2C pins to connect various sensors and devices, supporting both I2C master and slave modes. The software verifies I2C functionality. The I2C clock signal operates at 100 kHz. Other components include an LCD screen, a servomotor, infrared sensors, and an RFID reader.

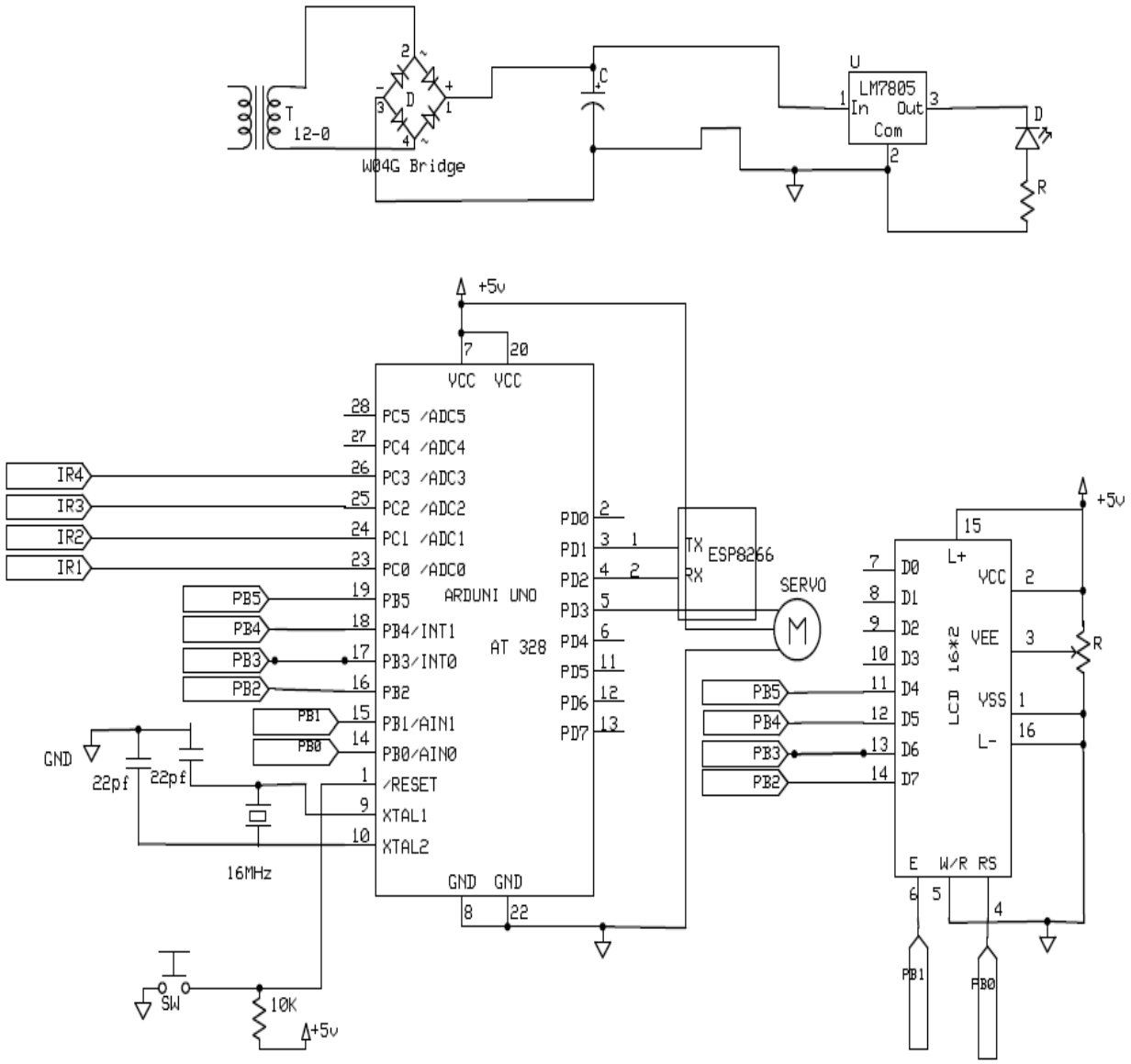

Figure 2: Circuit Diagram

III. FLOW CHART FOR VEHICLE ALLOCATION

The Arduino Uno microcontroller features 14 digital input/output pins and 6 analog pins. Sensor communication and integration are managed through the Arduino IDE software. The flowchart illustrates the vehicle assignment process. To assign a vehicle, the system verifies slot availability. If a slot is open, the RFID tag is scanned. Following the scan, the slot is allocated, the server database is updated, and the total number of available slots is reduced by one.

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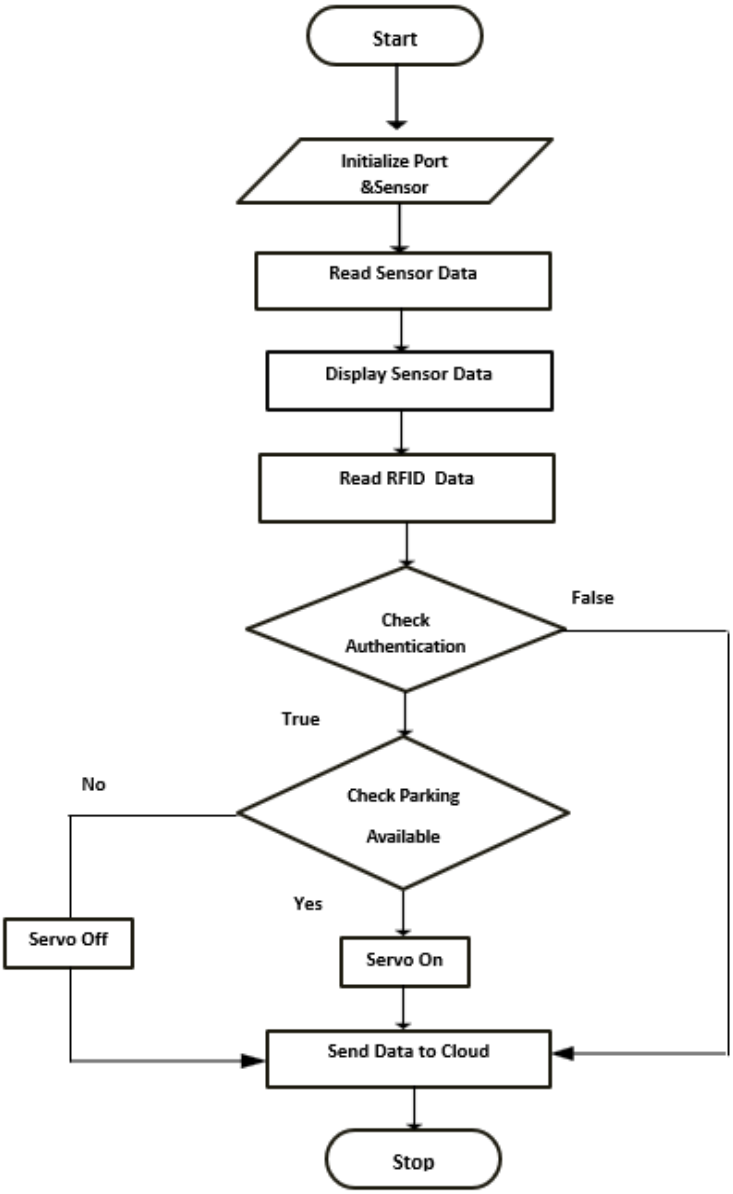

Figure 3: Flow Chart

IV. CONCLUSION

Currently, smart cities are testing a one-day parking system that will be effective in managing the flow of vehicles. Despite the long history and development of IoT and Cloud, they have achieved several milestones. For instance, this smart parking system employs an integrated IoT cloud-based system aimed at resolving parking problems. One of the major features of this interactive website is the real-time parking availability based on the availability of parking that has been booked by the users through the system. In a general sense, it has some positive influence on the consumers.

V. FUTURE SCOPE

There is a lot of scope in the future for the design of IoT-based smart vehicle parking systems using RFID. Smart city infrastructure integration could provide real-time updates, enhanced parking capabilities, and assist in optimizing traffic flow. Predictive parking: Advanced data analytics and machine-learning-powered predictions could inform drivers on upcoming park availability, cautiously assisting them to find parking spaces faster and emissions reduction. With sustainability a major consideration, these systems may be powered by renewable energy using sensors designed to consume less energy and emit less CO2 during the process. User data may also be better protected through stronger security, including encryption and blockchain.

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