IoT Based Smart Car Parking System

Vaishnavi Narkhede[1], Vaishnavi Wagh[2], Komal Uchade[3], Priti Thakare[4], Prof. S. A. Manekar[5]
[1,2,3,4]*Student, Entc Department, MGICOET, Shegaon, Maharashtra, India*
[5]*Assistant Prof., ENTC Department, MGICOET, Shegaon, Maharastra, India*

***Abstract*— In today's rapid urbanization world, reach and effective management of parking spaces have become an important issue. The project presents a smart parking system based on the Internet of Things (IoT), designed to automate and customize parking operations in small to moderate size functions. The system is built with an Arduino Uno microcontroller, ESP8266 ESP-01 WiFi module, infrared (IR) sensor, Saro Motors and I2C Brakes with 16 × 2 LCD, supported by a lead IoT mobile application for real-time monitoring. The system appoints the IR sensor to detect the presence of the vehicle in both entry/exit and individual parking spaces. When a vehicle reaches the entrance point, check the available parking spaces. If a track is free, the port automatically opens using an allo engine. The number of available and occupied tracks is updated on the LCD as well as on the Blynk app. The ESP8266 module provides a comfortable WiFi connection and shooting communication with the Blynk platform module. In addition, an LM2596 bank converter is used to regulate the voltage, which ensures safe operation of ESP8266 modules. The purpose of this smart parking solution is to reduce human intervention, improve parking efficiency and provide user -friendly interfaces for real -time monitoring.**

***Keywords*—Smart Parking, IoT, Arduino Uno, ESP8266, Blynk App, IR Sensor, Servo Motor, LCD Display, LM2596, Vehicle Detection, Real-Time Monitoring, Automation.**

I. INTRODUCTION

Rapid growth in urbanization and ownership of vehicles has made a significant increase in issues related to traffic fees and parking in cities around the world. Drivers often spend a lot of time looking for empty parking spaces, resulting in fuel waste, increasing emissions and general leading disappointment. Traditional parking systems are largely unable to meet the requirements for manual, disabled and modern cities. To solve this problem, there is an increasing requirement for automatic and intelligent parking management systems that can provide real -time information and reduce human intervention. The project introduces a smart parking system run by IoT (Internet of Things), and provides more efficient, safe and user -friendly alternatives for traditional parking methods. The origin of the system is designed using an Arduino Uno microcontroller, supported by many sensors and actuators, and an ESP8266 ESP-01 is connected to the Internet via WiFi module. Using the IR sensor, the system can detect the presence or absence of vehicles in both inputs/exit sports and individual parking spaces. This detection system enables accurate monitoring and control of the availability of parking.

To improve the purpose and access, the system is integrated with the Blynk Mobile application, so that users or administrators can be allowed to see the location of the parking lot in real time. The number of available parking spaces is also displayed locally using 16 × 2 I2C LCD screen. In addition, Sarvo engines are used to automatically control the input and exhaust gates based on the availability of the vehicle, making the entire parking process automated without the need for manual supervision. The system also involves an LM2596 DC-DC Bank Converter to ensure that the ESP8266 module receives a stable 3.3V supply, as the 3.3V output on the ship to the Arduino ship is insufficient for the power requirements of the WiFi module. A 12V 2A DC adapter strengthens the entire system, allowing it to function continuously and efficiently. This integration of hardware and IoT services ensures real-time communication between the physical parking area and the user interfaces, creating a completely automatic, low-cost solution.

This smart parking system shows a practical and scalable approach to modernize parking infrastructure. By reducing time spent in search of parking, improving resource use and enabling distance monitoring provides significant benefits when it comes to system systems, traffic reductions and environmental impact. It laid the foundation for future development in intelligent transport systems and smart city initiatives.

II. SYSTEM MODEL

The system model of this smart parking system is based on a microcontroller-centered architecture, integrated with IoT communication for sensors, actuators, a screen module and real-time interaction. Arduino UNO acts as a central processing unit, which is responsible for handling the sensor data, controls Sarvo Motors to operate and update LCD screens. The IR sensor is strategically located in the entrance, exhaust and each parking space to detect the presence or movement of vehicles. These sensors produce digital signals when an object is detected, used by Arduino to determine the track Ocupance and the vehicle input/exit.

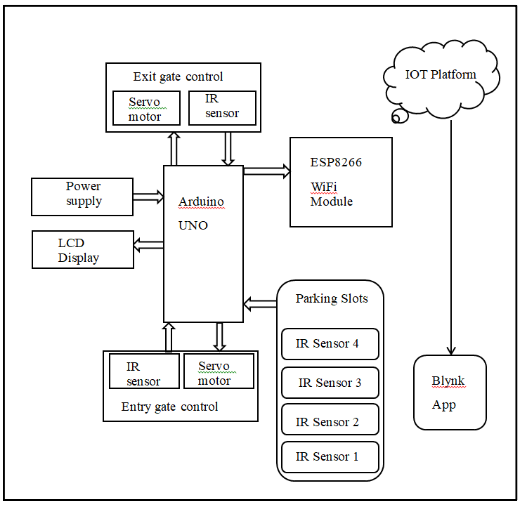

Fig.1 Block Diagram of Parking System

The system also includes the SG90 Saro Motors in entry and exit sports, which automatically functions based on vehicle detection and accessibility of tracks. The 16x2 LCD with the I2C module shows the parking status in real time, such as the number of available tracks. For IoT connection, ESP8266 ESP-01 WiFi module is used, so Arduino can transfer data to Blynk Mobile Application, where users can view the current status of parking accessibility from the father. To ensure the correct voltage level, an LM2596 Buck Converter 12V supply takes the ESP module safely to 3.3V safely.

This system model connects hardware and software components to create a effective, automatic and remove available parking management solutions. It supports real -time monitoring, automatic port control and external user access, which is very suitable for smart urban applications and modern urban environment.

a) Arduino Uno:

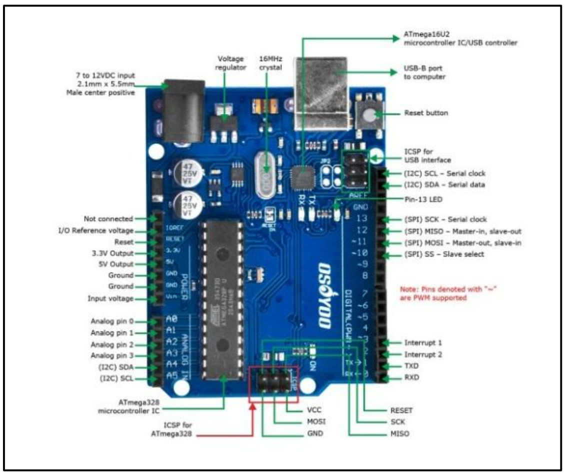

Fig.1 Arduino Uno

Arduino Uno is an open-source microcontroller based on the atmega328p microchip. It has 14 digital I/O stick means 6 can be used as PWM output, 6 analog i/p, a 16 MHz quartz crystal, a USB connection and a power connector. It is widely used for the production of electronics projects due to its simplicity and versatility. In this project, Arduino Uno works as the main control unit, processes the input signal from the IR sensor and controls SARO Motors and LCD screens. It also communicates with the ESP8266 module to send real -time data on the Blynk IoT platform.

b) ESP 8266 with Esp-01 Board

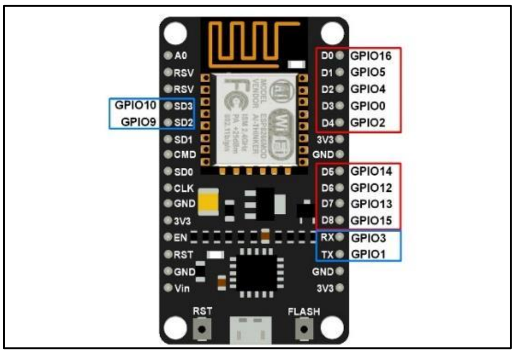

Fig 2. Esp8266

ESP-01 WiFi module to send sensor data on lead 2.0 server in your project-a compact and effective option for IoT applications. ESP8266 provides ESP-01, 2 GPIO PINs based on chip and supports 802.11 B/G/N Wi-Fi standards. To interface with lead 2.0, you must flash ESP-01 with suitable in the first firmware, if used as a wifi shield with another microcontroller. Alternatively, you can program direct ESP-01 by selecting the "Generic ESP8266 module" board and using the Blynk ESP8266 library using the Arduino idea. In Blynk 2.0, create a template in the Blynk IoT platform and notice the template -ID, device name and Autic Token.The module is connected to WiFi and sends data from sensors such as temperature or others, which is a virtual stick in lead. Provide stable 3.3V power supply for ESP-01, as it is sensitive to voltage fluctuations. With the correct setup, you can monitor and control your equipment from a distance through leading mobile or web dashboard.

c) IR Sensor:

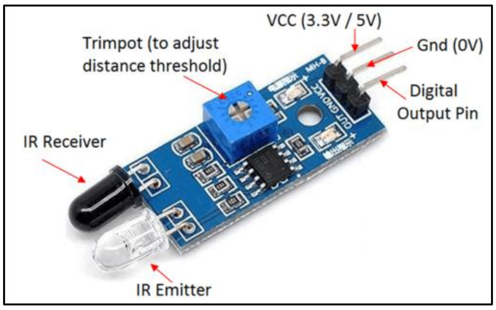

Fig.3 IR Sensor

An infrared IR sensor is an electronic device that detects subordinate radiation heat sent from objects in the area. It consists of an IR sector and a recipient that works together to detect the presence or absence of an object based on the reflection of IR light. When the object comes in front of the sensor, the IR light is reflected back to the receiver, leading to a change in the output voltage. the IR sensor plays an important role in detecting the vehicle. Two IR sensors are used to detect vehicle movement and first digits, while four extra sensors monitor coatings in individual parking spaces. When a car is present on a track, the sensor detects it and sends a signal to Arduino. This information is used to update the screen in real time to update LCD and enable effective parking control.

d) Servo Motor:

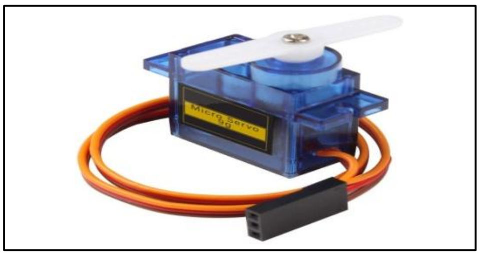

Fig.4 Servo Motor

The SG90 servomotor is a small and mild actuator used in hobby electronics and robotics. It operates from 4.8V to 6V and is able to rotate from 0 to 180 degrees. The engine includes a control circuit that accurately receives a PWM (pulse width modulation) signal to the shaft. Regularly unlike DC motors, the servos can capture their position, making them ideal for applications that require controlled movement.

In this smart parking system, two SG90 Sarvo engines are used to enter the entry and starting port. When a vehicle is discovered by the IR sensor and a parking space is available, Arduino sends a PWM signal to the services, inspiring it to rotate and open the gate. After entering or leaving the car, Saro rotates back to close the gate. This automation reduces human effort and increases the efficiency and safety of the parking system.

e) I2C 16x2 LCD Display:

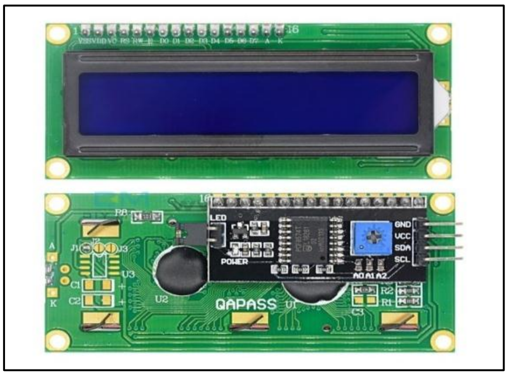

Fig.5 I2C 16x2 LCD display

The 16x2 LCD screen is a widely used module that can display two rows of each 16 characters. It is usually used in built -in systems to display real -time data or messages. When an I2C (Inter-E-Einent Circuit) is combined with a module, it becomes very easy to interface with a microcontroller like the Arduino screen. The I2C module reduces the number of necessary connection pins to just two data lines: SDA (data) and SCL (clock), simplifies cabling and preserves the valuable I/O stick.

In this smart parking system, the I2C 16x2 LCD is used to display the number of available parking spaces and the location of each track (occupied or free). Arduino continuously updates performance based on the input from the IR sensor. This gives users a quick, clear view of the availability of direct parking in the parking area, increases the user's convenience and improves traffic flows at the entrance.

f) LM2596 DC DC Buck Converter:

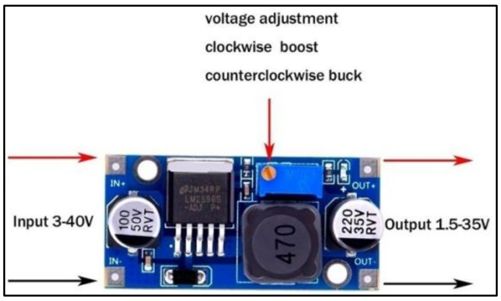

Fig.6 LM2596 DC DC Buck Converter

LM2596 DC-DC Buck Converter is a voltage control module used to take high voltage down to a stable lower voltage. It is based on the LM2596 switch regulator IC and it can turn voltage such as 12V or 9V to 5V, 3.3V or other adjustable levels. Unlike linear regulators, deer converters are very effective and produce low heat, making them ideal for battery -powered and compact electronic systems.

In this smart parking system, the LM2596 module is used to go down to 3.3V from DC adapter, which is necessary to safely operate the ESP8266 ESP-01 WiFi module. Since ESP-01 cannot handle more than 3.3V direct and the 3.3V output to Arduino is insufficient for stable operations, LM2596 ensures that ESP receives a reliable and safe power supply. This enables uninterrupted WiFi communication between hardware and lead IoT platform.

III. METHODOLOGY

The feature of this project involves designing an automated system for monitoring and management of parking spaces using IoT technology. The hardware setup includes an Arduino UNO as the main controller, which is connected to the IR sensor for detecting the vehicle, SG90 SARO Motors for port control and 16x2 I2C LCD screen to notify real -time. ESP8266 ESP-01 WiFi module is used to connect the system to the Internet, enabling communication with lead IoT's mobile application. Power is delivered via 12V 2A DC adapters, and an LM2596 Buck Converter took the voltage safely to Strøm ESP 8266 safely.

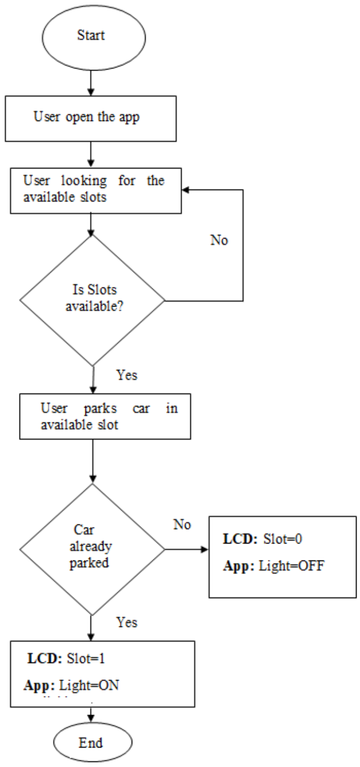

Fig.7 Flow Chart

The system works by continuously monitoring the parking lot using IR sensors. When a vehicle is detected at the entrance, Arduino examines whether a column is available. If a track is free, the entrance opens automatically by using Saro engine. When the car is parked, the same IR sensor detects the coating and updates the gap position. This information is displayed on the LCD and sent to the Blynk app in real time via the ESP8266 module, where users can check the availability before they reach.+

This approach reduces human participation, improves the use of parking spaces and user increases convenience. The system is scalable, so that several sensors and components can be added to large parking spaces. Overall, the function shows how microcontrollers, sensors and IoT platforms can be integrated to develop smart, efficient and real - time monitoring systems for urban infrastructure.

The floaw shows the operational argument for the smart parking system. The process begins when the user opens the Blynk app on the smartphone to check the available parking lot. The system shows the status of current availability using real -time data from IR sensors. If the tracks are not available, the user is motivated to wait or refresh the app until a track becomes free. When the system detects an available track, the user is allowed to park the vehicle. After the vehicle is parked, another check has been made to confirm whether the track is now occupied. This confirmation is based on the input from the IR sensor installed in each track. If the car is parked correctly, the system turns on a red indicator light and updates the Blynk app to mark the track as inaccessible. If a car is not detected, the green light remains and the track appears as available in the app. This automatic loop continues, ensures accurately and efficient control of the availability of parking space.

IV. RESULTS

Fig.9 4th Slot is full

In the above image as we can see there is a car parking lot number 4 so the orange led in the blynk indicating that the slot no 4 is occupied by the car and remaining slots are free

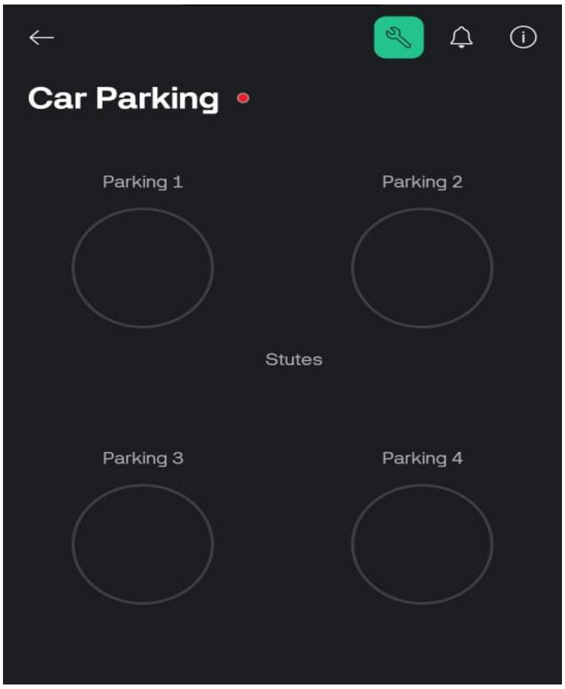

Fig.10 Blynk dashboard

In the above image as we can see there is no led blink means there is no car is parked in the parking.

V. CONCLUSION

The smart parking system developed in this project provides a reliable, efficient and low cost solution for modern parking challenges. Arduino Uno, ESP8266 WiFi module, IR -sensor, Sarvo Motors and Blynk IoT platform, by combining the power of the platform, the system automatically detects automatic automatic monitoring of vehicles, port control and real -time tracks. The integration of LM2596 Bank Converter ensures stable power supply, while the 16x2 I2C LCD screen provides local, user -friendly position updates.

This reduces the requirement for IoT-based solution for the solution, reduces overload at entry and exhaust points, and helps users identify the parking lot quickly available. The external monitoring system through the Blynk app improves the function of the user and supports future scalability. Overall, the project indicates how the use of built -in systems and IoTs can be used effectively to overcome real world's urban problems and provides basic work for more advanced smart urban applications in the future.

REFERENCES

[1] J. John and M. Thomas. (2021). IoT-based smart parking system. International Journal of Computer Applications, 178 (43), 22-27.
[2] R. Kumar and S. Patel. (2020). Automatic smart parking using IoT and lead platforms. International Research Journal of Engineering and Technology (Irjet), 7 (5), 1800-1804.
[3] A. Sharma and N. Gupta. (2019). The design and implementation of IoT-based smart parking system using Arduino and Blynk. International Journal of Innovative Research in Science, Engineering and Technology, 8 (12), 14522-14528.
[4] p. Verma and A. Lion (2020). Smart parking system using IR sensors and IoT. The International Journal of Scientific and Engineering Research (IJser), 11 (3), 348-352.
[5] K. Roy and M. Slave. (2021). IoT activated the smart parking management system using ESP8266. International Journal of Advanced Research in Electronics and Communication Engineering, 10 (4), 89-93.
[6] n. Mehta and D. Rana. (2022). Development of real -time parking system using lead and Arduino. The International Journal of

Computer Trends and Technology (ijcttt), 70 (7), 45-49.
[7] S. Day [1] J. John and M. Thomas. (2021). IoT-based smart parking system. International Journal of Computer Applications, 178 (43), 22-27.
[8] R. Kumar and S. Patel. (2020). Automatic smart parking using IoT and lead platforms. International Research Journal of Engineering and Technology (Irjet), 7 (5), 1800-1804.
[9] A. Sharma and N. Gupta. (2019). The design and implementation of an IoT-based smart parking system using Arduino and Blynk. International Journal of Innovative Research in Science, Engineering and Technology, 8 (12), 14522-14528.
[10] p. Verma and A. Lion (2020). Smart parking system using IR sensors and IoT. International Journal of Scientific and Engineer