

# An Efficient System for Monitoring Vehicle Parking using Raspberry Pi and Image Processing

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**Abstract:-** The IoT based Vehicle parking system utilizing Raspberry Pi and image processing is designed to efficiently manage parking spaces. The system comprises Raspberry Pi boards connected to cameras installed in parking lots. These cameras capture images of parking spaces, which are then processed using image processing algorithms. Image processing algorithms are implemented to check the existence of vehicles in parking spaces.

**This is achieved by analyzing the images captured by the cameras and identifying the presence of vehicles based on predefined criteria such as size, shape, and color.**

**The system determines the occupancy status of each parking space based on the presence or absence of vehicles. This information is used to update the parking lots occupancy status in real time. Users can access the parking system through a web application.**

**The Parking system connectivity provides actual information about parking space availability, location, and directions to the nearest available space. The IoT based**

**vehicle parking system offers several benefits, including efficient utilization parking spaces, reduced traffic congestion, and improved user experience.**

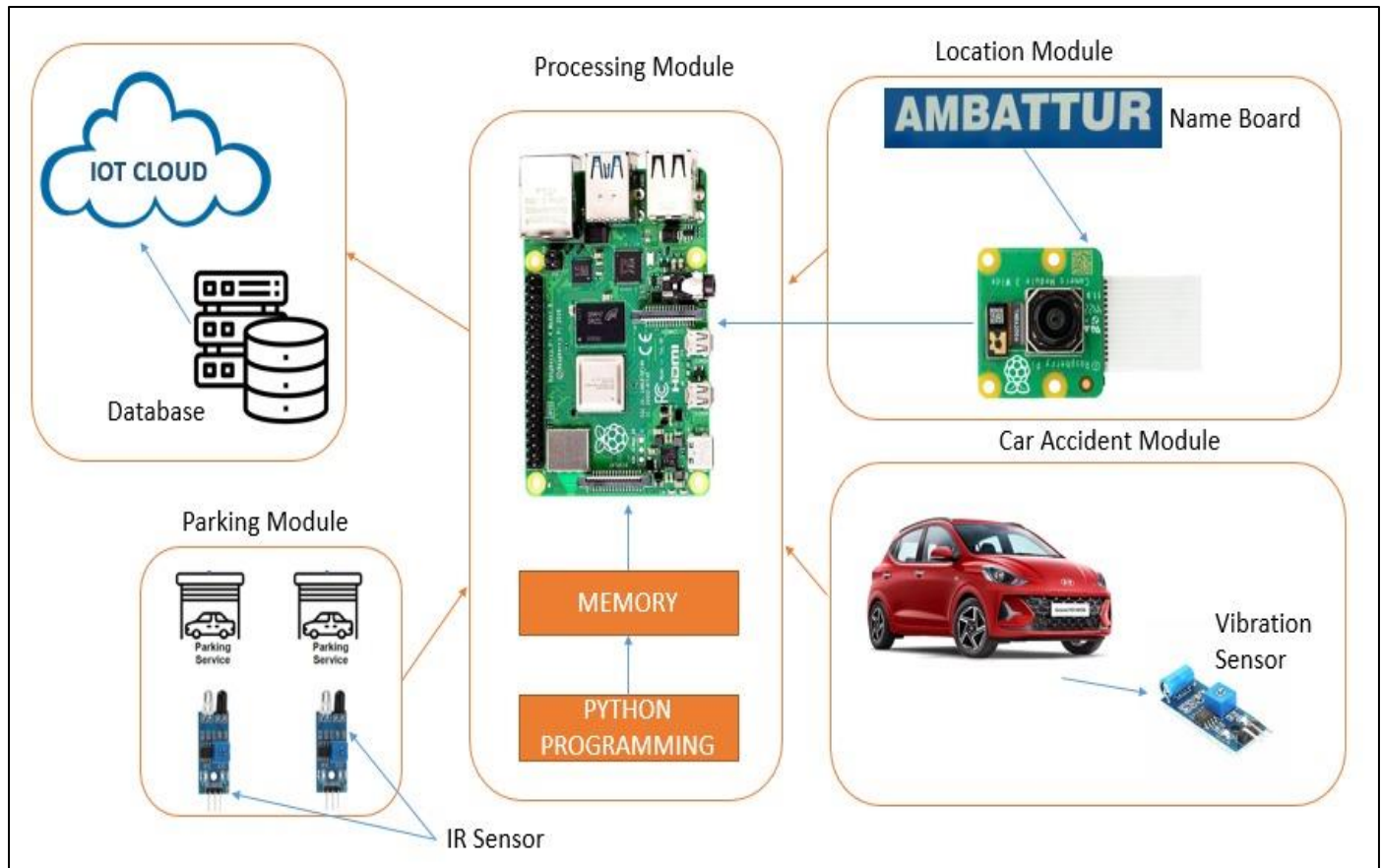
## I. INTRODUCTION

The aim of this project is to create an IoT-based vehicle parking system using Raspberry Pi that can efficiently manage and monitor parking spots. Users can able to check the availability of parking spots in real time using a web or mobile app, which will communicate with the Raspberry Pi server. The system will also log parking spot occupancy data for analysis and optimization of parking space utilization.

This project is to develop a low cost and efficient IoT-based vehicle parking system using Raspberry Pi. The system will use ultrasonic sensors to check the availability of vehicles in parking spots and LEDs to indicate the status of each spot. A web or mobile app will allow users to check the availability of parking spots in real time. The system aims to improve parking space utilization and provide a convenient parking experience for users.

## II. SYSTEM DESIGN

### ❖ System Architecture



**Fig 1 System Architecture**

#### ➤ Monitoring Unit

The monitoring unit is implemented at each parking slot and consists of a smart IoT device. This smart device unit will check the availability of a vehicle, take a picture, and transmit it to the processing unit.

#### ➤ Processing Unit

This unit consists of a low-cost computer Raspberry Pi 4 that can receive the images taken by the monitoring units, process and retrieve the required information from the images and it immediately transfers data to the cloud-side unit and it easily available for the user application.

#### ➤ Cloud-side Unit

This unit collects the extracted information from the images received from the IoT device, records the final details in the database, and performs the user alerting function.

#### ➤ User Application

This application has been designed to enable users to perform various functions, such as availability and modifying the parking slots.

#### ➤ Modules Description:

- Processing
- Parking IoT
- Accident Detection
- Location Checking
- IoT

## III. PROCESSING

The Processing Module is responsible for handling the data processing tasks within the smart parking system. It integrates data from various sensors and modules, including IR sensors for car detection, vibration sensors for accident detection, and camera input for location identification.

This module processes the incoming data, performs necessary computations, and ensures seamless communication between different components of the system.

#### IV. PARKING LOT

The Parking Lot Module focuses on the functionality related to parking space management. It utilizes IR sensors to find the presence or absence of cars in specific parking slots.

This real time data allows users to check the availability of parking spaces using a mobile app or other interfaces connected to the system.

When a car is detected, the module communicates this information to the Processing Module, updating the status of the corresponding parking slot.

#### V. ACCIDENT DETECTION

The Accident Detection Module employs vibration sensors to identify potential accidents or collisions within the parking area.

If a significant impact or vibration is detected, the module triggers an alert, notifying the Processing Module about the possible accident.

This feature enhances safety and security by providing immediate notifications in case of unexpected events.

#### VI. LOCATION CHECKING

The Location Checking Module utilizes the camera system to capture images of the surroundings, particularly focusing on identifying location names or codes associated with specific areas.

The captured images are processed by the module to extract location information.

The recognized location data is communicated to the processing module, allowing the system to associate parking and accident data with specific locations.

#### VII. IOT

The IoT Module is responsible for the communication and data storage aspects of the system. It connects the Raspberry Pi to the internet, enabling the transmission of processed data to a cloud-based IoT platform or server.

This module facilitates the storage of parking occupancy, accident alerts, and location information in a centralized database, making it accessible for monitoring, analysis, and future reference.

Additionally, the IoT module enables remote access to the system, allowing users to check parking availability and receive real-time alerts.

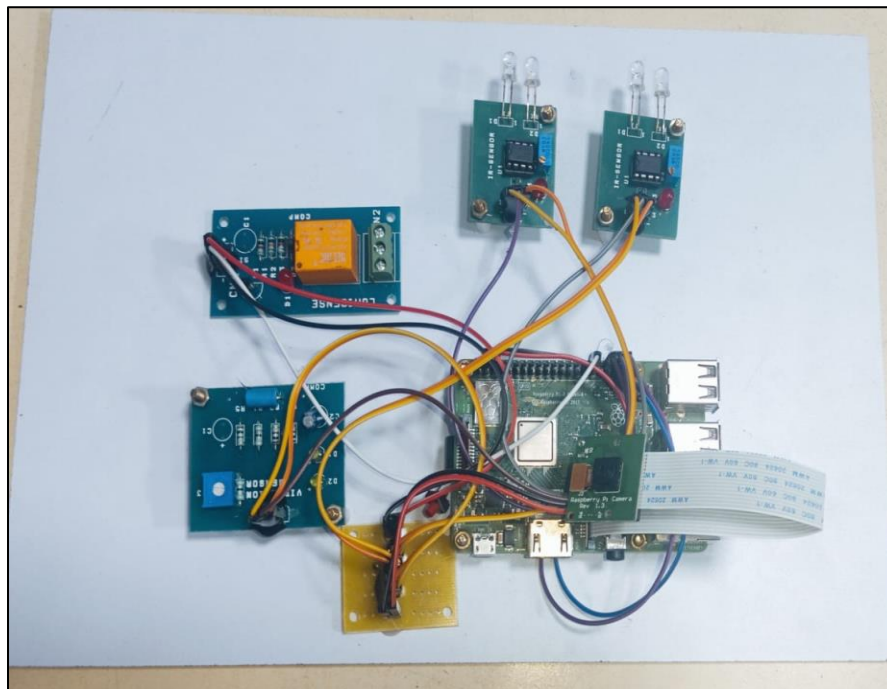
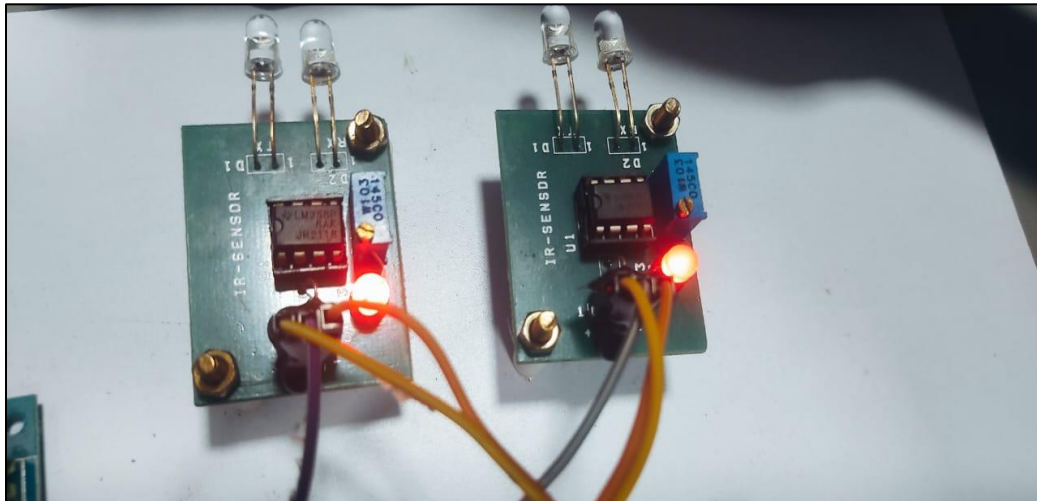
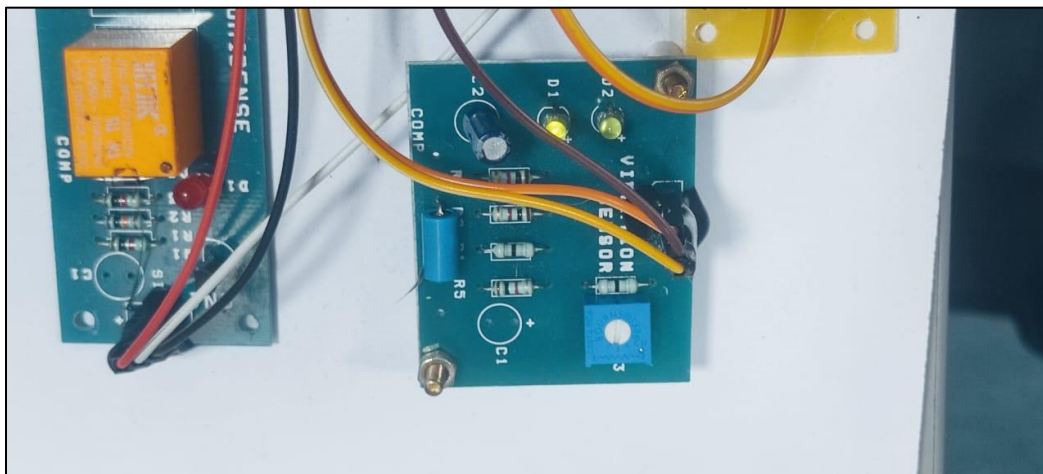


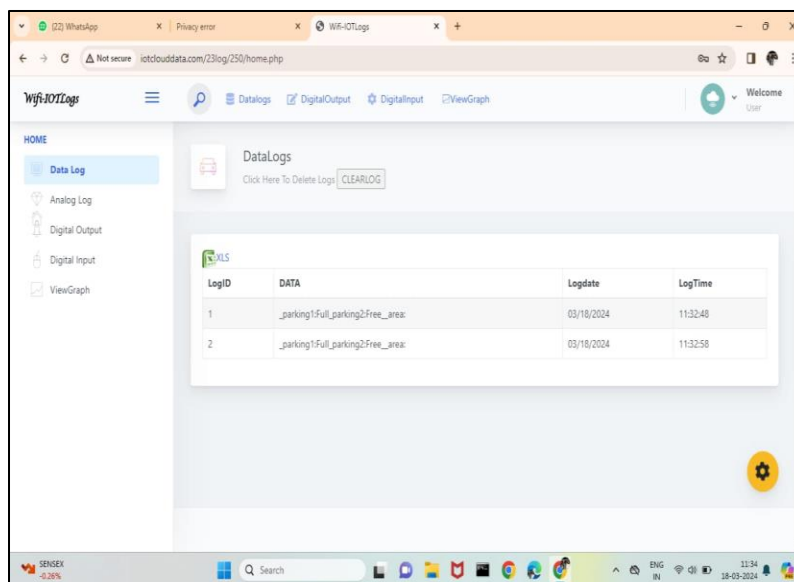
Fig 2: Overall View of Our project



**Fig 3: The Working of IR Sensor**

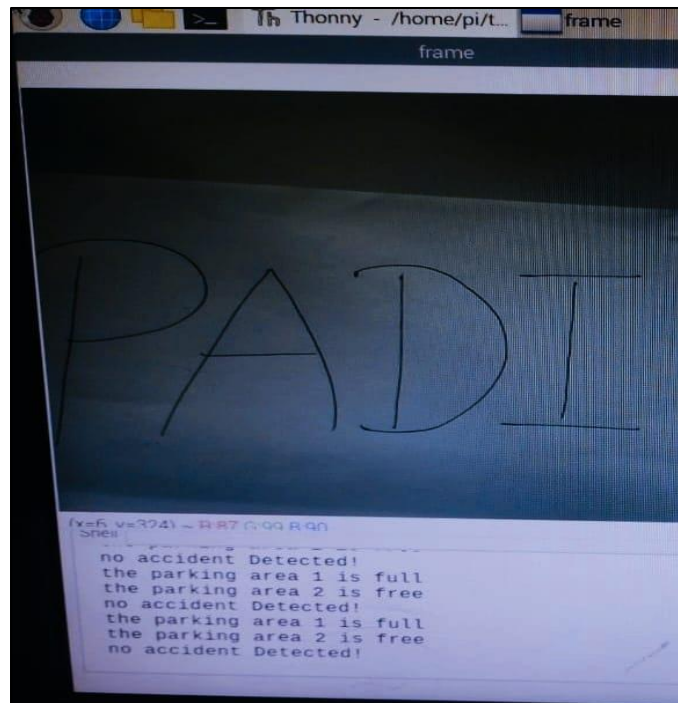


**Fig 4: It Indicates the Light When the Vibration Sensor is Vibrated**

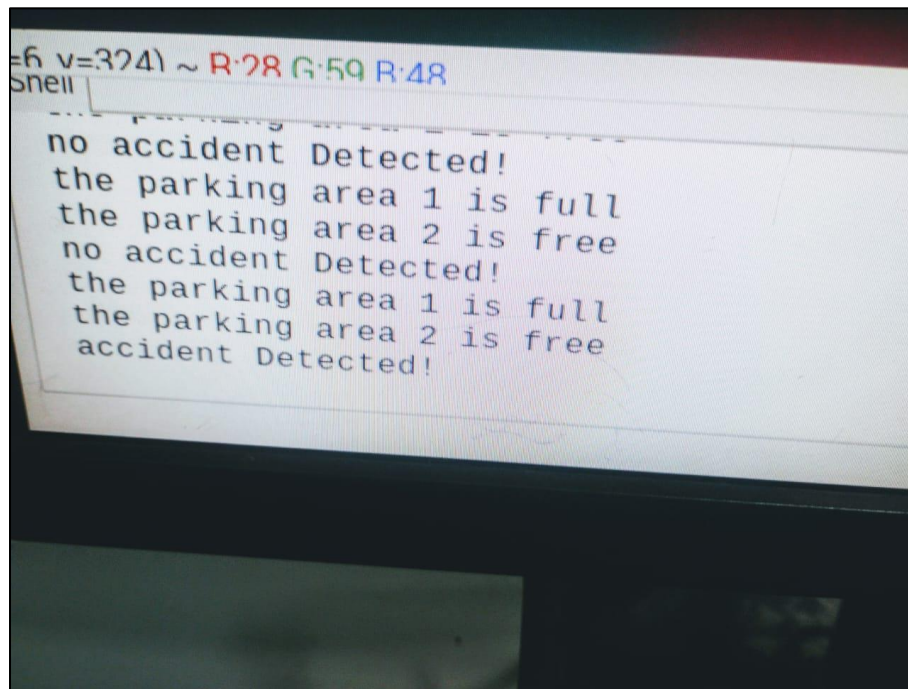


**Fig 5: Website Displays the Availability of Parking Spaces**





**Fig 6: It Detects the Name Board and Display the Parking Slot is Free or Full.**



**Fig 7: It Shows the Message Whether Accident Detected or Not**

## VIII. CONCLUSION

An Efficient Vehicle parking system using Raspberry Pi offers a comprehensive solution for efficient management of parking spaces. Through the integration of sensors, cameras, and Raspberry Pi, the system can exactly check the availability of parking spaces, provide exact information to users and automates the process. The system's ability to handle user-friendly interface, enhances the overall parking experience. Additionally, the system's scalability and adaptability make it suitable for various parking environments, ranging from small parking lots to large-scale parking facilities. Overall, the car parking system using Raspberry Pi demonstrates the effectiveness of IoT-based solutions in optimizing parking management, improving resource utilization, and enhancing user convenience.

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