Controlling Of Smart Movable Road Divider and Clearance of Ambulance Path

Prof. Kavita Mahajan*1, Sakshi Kamble*2, Dhanshri Kenjale *3, Dnyneshwar suwarnkar*4

*2,3,4, Student, Zeal College of Engineering and Research Narhe, Pune, India.

*1 Faculty of Zeal College of Engineering and Research Narhe, Pune, India.

ABSTRACT

Road dividers are important for controlling traffic by creating lanes for incoming and outgoing traffic to make the movement of traffic smooth. But in the case of industrial areas or malls, traffic usage is different at different times of the day, and the lanes prove to be inefficiently utilized. In peak hours, one way could have heavy traffic congestion while the other lane is left empty, causing wastage of fuel and time. To solve this problem, a smart movable road divider system is suggested. The system dynamically changes lane allocation according to real-time traffic density through ESP32, ultrasonic sensors, IR sensors, and a motorized mechanism driven by an L298N motor driver. The sensors continuously observe traffic flow, enabling the divider to move towards the less crowded lane, thus maximizing road space utilization. Also, the system can advance emergency vehicles on a priority basis when needed, increasing traffic efficacy and response speed. This clever method reduces intervention by human operatives, optimizes traffic management, and gives timely feedback about traffic conditions.

Keywords: Smart Road Divider, ESP32, Ultrasonic Sensors, IR Sensors, Motorized mechanism , L298N Motor Driver.

INTRODUCTION

Traffic congestion on a one-lane road prompted the development of a two-lane road, and subsequently a four-lane road, but these efforts did not solve the problems because of growing vehicle numbers and poor infrastructure. Conventional IoT-based systems with sensors, designed to monitor traffic, were inaccurate and expensive to maintain. This created ongoing problems, including delays, road accidents, and environmental damage, particularly affecting emergency vehicles like ambulances, which often faced life-threatening delays stuck in traffic.

To meet these issues, the project offers a dynamic solution that comes in the form of a transportable road divider that dynamically adapts depending on current traffic patterns. The system uses IoT technology and computer vision to monitor inbound and outbound lanes of traffic. During high-traffic periods when there is congestion imbalance, the divider moves automatically to alleviate it. When a traffic congestion arises, the system detects it from signals of a camera vision module and adjusts the divider accordingly. The system further gives priority to the free movement of ambulances in the event of an emergency.

This project utilizes cloud computing to oversee a database of traffic data that has been captured using cameras along the road. The cameras take photos of the cars, and deep-learning algorithms examine the data in order to provide an accurate traffic density measurement. This solution aims to optimize traffic flow, road safety, lessen the impact on the environment, and provide easy passage for emergency vehicles.

RELATED WORK

In Reference [1], the article that minimized traffic congestion with the assistance of image processing. In this case, signal poles were installed with cameras and cameras can capture a picture then processed it. After obtaining the image effects processing timer was established by signal lights**.**

In Reference [2], explained how traffic density can be minimized. In this PIR sensors were utilized to sense traffic congestion. Depending on the results obtained time calculators for the red and the green light were set.

In Reference [3], survey has been conducted on the western express road close to Goregaon, Bombay. A 10-lane road was chosen with points of congestion. The west express highway is chosen to realize the existing long distance traffic status. Study is conducted 7.00am to 9.00pm, data gathered from the above study
was number of cars traversing a road and speed of cars. He concluded that the density of cars was reducing during peak hours.

In Reference [4], it proposes a method to minimize traffic congestion by employing two standard and extended dividers. The author proved the outcome in one traffic using ultrasonic sensors, but in actual time traffic congestion may be on more than one side.

In Reference [5], a case study was done encompassing the wagholi chowk traffic flow on the Pune-Nagar road and projecting a serious traffic issue in the region

In Reference [6], there is a review on cost-effectiveness utilizing a moving road divider. Congestion rate noted on the basis of working hours fuel combustion, pollution and losses incur every year when the 2018 annual data are given.

The algorithm was developed for the operation of the IoT Traffic Signing System Based on Traffic **Congestion [7],** but the worst part here was that traffic congestion information was not secured while transmitting traffic signal control information.

Reference [8], presents a proposal based on an IoT-based technique for analyzing traffic congestion. Pictures are captured using a common camera and analyzed using a cloud-based technique. The model was initiated using this method using raspberry pi and servo motors but the efficiency of this method is the prime concern above the cost of its implementation

References [9], have indicated the application of a smart temporary detector that folds in and out of the road. This strategy uses RFID-based ambulance detection and recovery identification unlocks emergency vehicle pathways. This mechanism appears highly attractive due to the real applications. However, the application is very challenging.

BLOCK DIAGRAM OF SYSTEM

The diagram illustrates the basic setup of smart movable road divider using PIC 18f4550

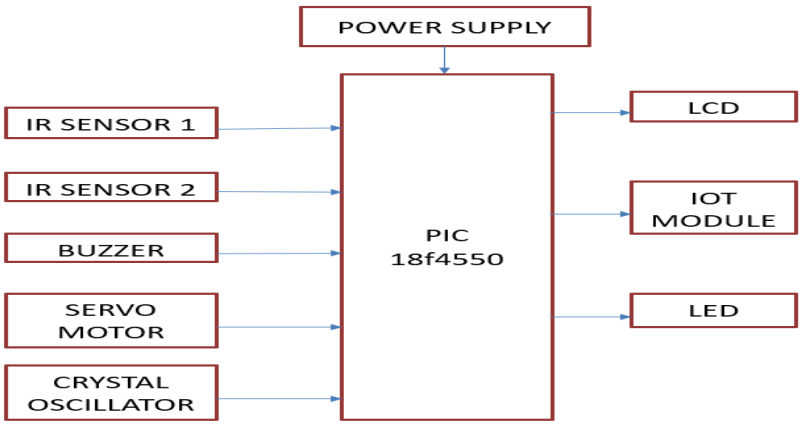


Figure 1 : Block Diagram of System

PIC 18F4550: It is a microcontroller that serves as the project brain. It processes sensor inputs (such as the IR sensor) and outputs (such as the servo motor, LED, LCD, etc.). The PIC 18F4550 is a good choice for USB communication and hence is well-suited for communicating with IOT modules.

LED: Light Emitting Diodes (LEDs) are employed for visual indications. LEDs in the project can indicate the status of the system, such as if the road divider is moving, or inform drivers of the divider's location.

LCD: A Liquid Crystal Display (LCD) gives instant feedback to the user, showing data such as the status of the movable divider, current location, or system warnings.

Servo Motor: This motor regulates the movement of the road divider. Through signals received from the microcontroller, the servo motor is able to accurately rotate and move the road divider to desired points.

Buzzer: The buzzer provides sound signals to warn users or operators when the divider is in motion or if an error is experienced in the system. It improves the interactivity and safety of the system.

IR Sensor: Infrared (IR) sensors are utilized for detecting cars or objects approaching the road divider. This assists in positioning the divider depending on the road environment and improves safety by making the divider move when necessary.

IOT Module: The IOT module enables remote monitoring and control of the smart movable road divider. It can be interfaced with a mobile application or web interface, making it possible for operators to remotely control the divider, receive status reports, or initiate actions such as moving or positioning the divider.

FLOW CHART OF SYSTEM

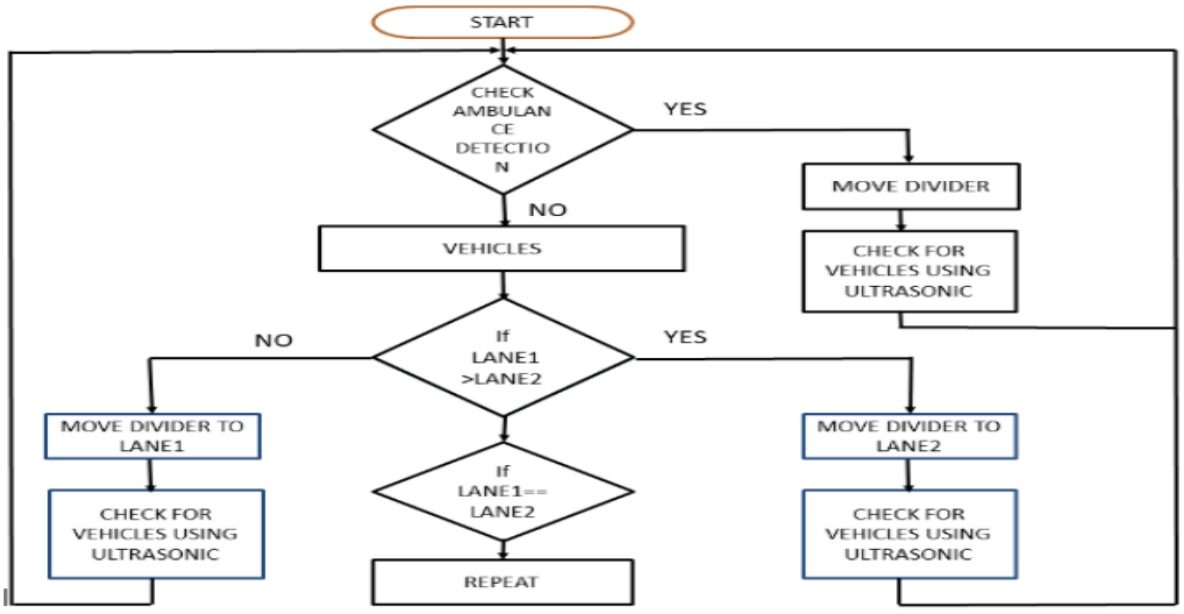


Figure 2: Flow chart of the system.

This flowchart depicts a smart mobile road divider system. Here's how it breaks down:

Start: The system starts its process.

Ambulance Detection: It continuously looks for an ambulance.

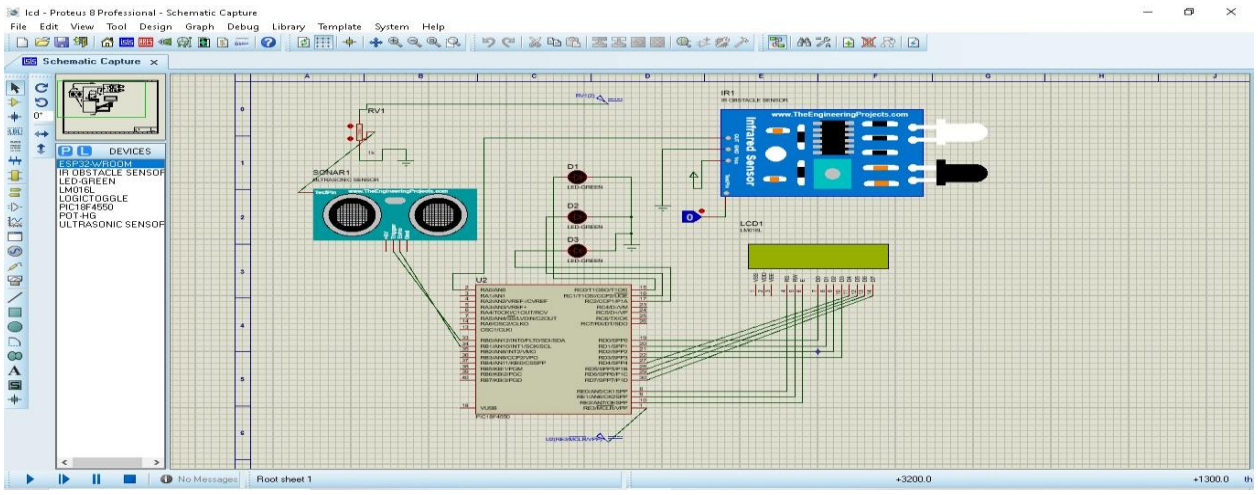
- **YES**: If an ambulance is found, the divider is moved to make way for it, and cars are scanned with ultrasonics to make passage safe.
- **NO**: If no ambulance is found, it goes on to detect vehicles using ultrasonic sensors.

Lane Check: It checks which of the two lanes has more traffic (Lane 1 or Lane Z).

- **Lane Z is more crowded**: The divider switches to Lane 1, and cars are inspected with ultrasonics.
- **Lane 1 is more crowded**: The divider switches to Lane Z, and cars are inspected with ultrasonics.

The system regularly repeats the process of observing ambulances and traffic in both lanes to dynamically modify the divider position

SOFTWARE RESULT



CONCLUSION

This project tackles a major urban issue of traffic congestion, which is a result of fixed road infrastructure that can't keep up with the rising population and increasing number of cars. By implementing a smart movable road divider system, we showcase the ability to greatly reduce emergency response times, improve traffic flow, and boost road safety. By introducing a smart, adjustable road divider system, we've shown how it can greatly cut down emergency response times, enhance the flow of traffic, and improve overall safety on the roads.

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