

IOT Based Movable Road Divider with Automatic Traffic Signal Control

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ABSTRACT

The sharp rise in road traffic congestion has had significant negative impacts on individuals, the economy, and the environment, particularly in large urban areas around the world. Road dividers are used to separate incoming and outgoing traffic lanes, but with growing populations and vehicle numbers outstripping available road resources, congestion continues to worsen. This project aims to improve the efficiency of road use to save lives, particularly for ambulances. Instead of manually operating road dividers, the proposed solution uses IoT and sensors to automate their Movement

,allowing for better management of traffic and quicker response times for emergency vehicles. Road Divider is generally used for dividing the road for ongoing and incoming traffic. This helps in easy flow of traffic; generally, there is equal number of lanes for both ongoing and incoming traffic. The problem with Fixed Road Dividers is that the number of lanes on either side of the road is fixed. Since the resources are limited and population as well as number of vehicles increasing day by day, there is significant increase in number of vehicles on roads. This calls for better utilization of existing resources like number of lanes available Not only this but we will also be detecting Traffic Signal Violation, to detect this, we will embed the signals with RFID readers and vehicles with tags. All this includes some hardware like Arduino UNO, IR sensors, RFID, Ultrasonic sensor, DC motor.

Keywords: - Traffic Congestion, Movable Divider, Internet Of Things, IR Sensor, Microcontroller

1. INTRODUCTION

In past time, there is having a one-lane road constructed so people facing many problems and it doesn't have efficient to reach destination due to traffic congestion and also that time there were no more facilities, security, and flexibility. After that, the road is having two lanes constructed but this is not sufficient to solve the traffic congestion. After that, the road having a facility of 4 lanes which divides the road into four slots but this is not sufficient to reduce the traffic

.As many proposed articles, people's uses IOT, embedded system to control the traffic congestion using IR sensor to observe the traffic but it not efficient to recognize the traffic correctly and require many connections which are costly and high maintenance cost. But this is not enough. So, this paper shows the advancement in the existing system. As the number of vehicles increased day by day, the Road infrastructure is approximately the same which can't able to solve up with changes like unpredictable travel delays, congestion, and accidents. The traffic on roads is the biggest issue in today's societies. There are so many problems with emergency vehicles such as ambulance, where the ambulance stuck on traffic and also wait for several hours due to which the patient's health is at risk because of the crowd of traffic jams. These traffic jams create road accidents, harm the environment, and also create pollution which affects the health of people's lives. we design a movable road divider that moves depending on the traffic conditions. Real-time data of the traffic compiled using IoT in such that it will connect a link between traffic and divider with the help of computer vision. The road is having two phases that are incoming and outgoing. Many times, during peak hours the incoming road is having more traffic as compared to the outgoing side or vice-versa. This divider will shift according to their message received from camera vision or IR sensor module. This system gives more priority to emergency vehicles. In this, we use cloud computing which managed the database of traffic as received from camera vision and IR sensor which will fix on the roads. There is having two cameras or IR sensor on both the side of roads which directly acquires the image of number of vehicles and count the no of vehicles in each lane. GPS tracking, RFID (Radio Frequency Identification) technology, image processing using CCTV cameras, VANET (Vehicular Ad-hoc Network), text mining on data collected from social media, and many systems use algorithm-based systems for efficient traffic management are mostly used for the Traffic control system. A Raspberry Pi microcomputer and multiple ultrasonic sensors are used in each lane to calculate the density of traffic, operate the lanes, uploading traffic data to a website accessible by any user.

Need for Intelligent Traffic Management

The current traffic management system isn't enough to deal with changing traffic situations. Signals that stay on the same schedule and permanent barriers don't adjust well during busy hours. We need smarter traffic systems to make better use of the roads and cut down on traffic jams. The issue comes from growing traffic jams, poor use of road space, and slow responses to changing traffic situations in cities. Traditional road barriers and manually controlled traffic lights can't adjust to current traffic levels, causing long waits, congestion, wasted fuel, and more air pollution. An IoT-based movable road divider system uses sensors, microcontrollers, and real-time data to track traffic on both sides of the road. It then changes lane directions by moving the divider and automatically adjusts traffic signals. This system is especially helpful during busy times, emergencies, VIP events, or accidents when traffic needs change suddenly.

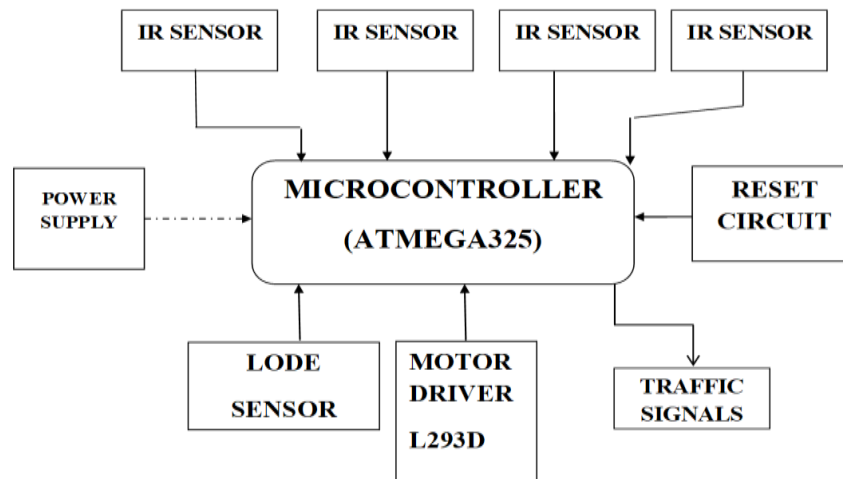
Objective of the Proposed System

To detect real-time traffic density using sensors. To automatically move the road divider left or right to increase lane capacity where traffic is heavy. To improve road safety and reduce traffic delays by optimizing lane usage dynamically. To develop a smart, reliable, and cost-effective traffic management system. To ensure efficient utilization of existing road space during peak and non-peak hours. To reduce vehicle waiting time and overall travel delay.

2. METHODOLOGY

The project uses a method that starts by sensing how crowded the road is on both sides using sensors like infrared (IR) and ultrasonic sensors. These sensors keep checking for vehicles, counting them, or measuring the space between them. This helps the system know how busy each side of the road is in real time. The data collected by the sensors is sent to a microcontroller such as Arduino UNO, NodeMCU, or ESP32. The microcontroller processes this information and compares the traffic levels on both sides. Based on a set of programmed rules, it decides if lane changes are needed. If one side is very busy and the other is not, the system takes action to adjust the lanes. In IoT-based setups, this processed data can also be sent to a cloud platform or a dashboard for monitoring, analyzing, and remote control. Once the system decides to change lanes, the actuation mechanism is started. The microcontroller controls DC motors or gear motors that are attached to the movable road divider.

Fig -1 Block Diagram

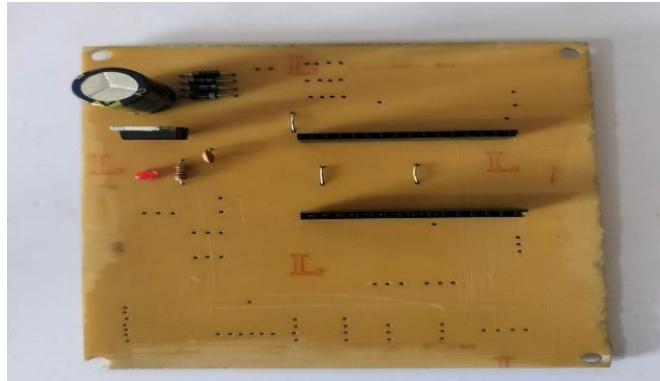


Working

The IoT-powered movable road divider with automated traffic control operates entirely automatically, responding to real-time traffic data. Subsequently, traffic density sensors, such as infrared/ultrasonic/camera systems, are strategically placed on both the road's edges. These sensors monitor the count of vehicles and transmit the data to the microcontroller, which could be an Arduino, AVR, or ESP. Using the IoT module (Wi-Fi/GSM), this data can also be monitored remotely by traffic authorities. In situations where traffic on both sides is equal and evenly distributed, the movable barrier stays in the middle position. The traffic lights operate according to standard procedures: Green light allows vehicles to move, Yellow light gives a warning before signal change, Red light stops vehicles. If sensors identify heavy traffic on one side, the controller automatically triggers the adjustment of the divider mechanism. In order to guarantee safety, both lanes are initially directed to RED, causing all vehicles to halt. Next, the yellow light flickers momentarily to alert motorists about lane changes. Subsequently, the DC motor drives the road divider closer to the less busy side, thereby opening up an additional lane for the busy direction. When the divider reaches the designated spot, the green light illuminates

for the busy side, facilitating the smooth flow of traffic through the newly created lane. The other side is still marked in red. When traffic conditions stabilize, the system initiates the reverse procedure. Both indicators change to red, the barrier is shifted to its location, and the usual red-yellow-green signal sequence is reinstated. During the operation, the IoT system performs real-time monitoring, records data, and controls remotely, minimizing human involvement, enhancing traffic efficiency, and boosting road safety.

3. RESULT



In an IoT-based movable road divider that uses automatic traffic control signals, the system evaluates several key factors. These include how quickly sensors and the controller respond, how accurately traffic density is detected, how fast and reliably the divider moves, and how correctly the traffic signals switch automatically. The analysis also looks at the system's stability, how much power it uses, how well the IoT parts communicate with each other, and how well it handles faults during busy traffic or emergencies. Additionally, the performance assessment considers improvements in traffic flow, reduced congestion and waiting times, better safety, and overall efficiency compared to traditional fixed dividers and manual traffic control methods.

4. CONCLUSIONS

The IoT-based movable road divider with an automatic traffic control signal offers a smart and efficient way to reduce urban traffic problems. It adjusts lane directions in real time based on current traffic conditions, which helps use road space better, lessens traffic delays, and cuts down on the need for traffic officers to manually direct vehicles. By combining sensors, control systems, and automatic signals, the system makes roads safer, improves traffic movement during busy times, and allows emergency vehicles to pass more quickly. As a whole, this system is a smart, affordable, and adaptable transportation solution that works well for modern smart cities.

5. REFERENCES

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