IOT BASED MOVABLE ROAD DIVIDING SYSTEM

M. Mallikarjuna, S. Yasmeen, T. Gowthami, D. Danmaiah, C. Apoorva, J. Supraja

UG Students, Department of Electronics & Communication Engineering, Sai Rajeswari Institute of Technology, Proddatur, Andhra Pradesh – 516360

Mr. H. Raghunatha Rao M. Tech, Professor, Department of Electronics & Communication Engineering, Sai Rajeswari Institute of Technology, Proddatur, Andhra Pradesh – 516360

Email: maddakammalli@gmail.com, yasu98523@gmail.com, gowthamiganga.2003@gmail.com, danamaiahdara2003@gmail.com, chagallamariappuapoorva@gmail.com, jonnasupraja129@gmail.com, raghunathhanchate@gmail.com

ABSTRACT:

Road dividers conventionally serve the purpose of segregating traffic on roads into lanes for ongoing and incoming vehicles, facilitating smooth traffic flow. Typically, an equal number of lanes are designated for each direction of traffic. However, static road dividers present a limitation as they do not adapt to varying traffic demands.

Our objective is to devise an automated road divider system capable of dynamically adjusting lane allocation, thereby accommodating the prevailing traffic patterns. The potential benefits of such a system include significant savings in time and fuel consumption, particularly by reallocating lanes to the direction experiencing higher traffic volume. This innovation promises to alleviate traffic congestion effectively and enhance traffic management strategies.

Introduction:

Introduction: In today's rapidly urbanizing world, managing vehicular traffic efficiently and safely is a pressing concern. Traditional methods struggle to cope with dynamic traffic patterns. To address this, we introduce the Smart Movable Road Divider System. This innovative solution integrates IR sensors and a Node MCU microcontroller to autonomously detect vehicles and regulate movable road dividers. This introduction highlights the need for inventive traffic management solutions and sets the stage for discussing the system's design, components, and benefits.

Problem Statement:

Traditional traffic management systems face significant limitations when dealing with the complexities of modern urban environments. Static road dividers, which are fundamental to traffic regulation, lack the ability to adapt to fluctuating traffic densities, leading to congestion, delays, and increased accident risks. Additionally, manually adjusting these dividers is labor-intensive and often impractical, especially in densely populated or high-traffic areas.

Given these challenges, there is an immediate need for the development of more intelligent and flexible traffic management solutions. This necessity has prompted exploration into new technologies and innovative approaches aimed at fundamentally improving the effectiveness of traffic flow regulation on roadways.

Methodology:

The methodology for developing the smart movable road divider system is thorough and iterative. It begins with detailed system design, outlining architectural considerations and component selection. Hardware implementation follows, ensuring proper assembly and connectivity of chosen components. Software development focuses on creating firmware for sensor integration, data processing, and control logic.

Integration and testing phases validate system functionality under simulated and real-world conditions, leading to refinement and optimization as necessary. Deployment in controlled environments and subsequent evaluation assess system performance against predefined metrics. Throughout the process, documentation and reporting capture key insights, lessons learned, and avenues for future research and improvement, facilitating knowledge dissemination and iterative development cycles.

Components Used:

ESP-32 Dev:

The ESP32 development board serves as the central processing unit for the smart movable road divider project, coordinating the integration and control of various subsystems. Equipped with dual-core processors and operating at high clock speeds, the ESP32 provides ample computational power to manage sensor data processing, motorized road divider control, and TFT display communication simultaneously. Its generous allocation of flash memory and RAM ensures sufficient storage capacity for program code and runtime data, enabling efficient execution of complex tasks.

IR Sensors:

The IR sensors used in the smart movable road divider project are essential for detecting vehicle presence and monitoring traffic density in real-time. With their radiation-sensitive optoelectronic design, these sensors exhibit spectral sensitivity in the infrared wavelength range, ranging from 780 nm to 50 µm. Leveraging this capability, they effectively detect infrared radiation emitted by vehicles, enabling precise detection even in low-light conditions. Strategically positioned on both sides of the road, IR Sensor-01 and IR Sensor-02 cover a wide area, ensuring comprehensive coverage and accurate data collection.

By analyzing the signals from these sensors, the system can determine vehicle presence, calculate traffic density, and autonomously adjust the position of the motorized road divider, contributing to enhanced traffic management and safety.

Ultra Sonic Sensor:

Ultrasonic sensors, integral to the smart movable road divider project, operate on the principle of emitting ultrasonic sound waves and analyzing their reflections to determine the distance to nearby objects. Consisting of both a transmitter and a receiver, these sensors emit high-frequency sound waves beyond the range of human hearing, which bounce off obstacles and return to the receiver. By measuring the time taken for the sound waves to travel to the object and back, ultrasonic sensors calculate the distance accurately. In the context of the project, Ultrasonic sensor-01 and Ultrasonic sensor-02 are strategically positioned in front of the movable road divider, ensuring comprehensive coverage of the road area. These sensors serve to detect any obstacles or obstructions in the path of the divider, providing crucial input for autonomous navigation and collision

avoidance, thereby enhancing overall traffic safety and efficiency.

TFT 1.8 Display:

The TFT 1.8 LCD display featuring the ST7735 driver is a key component integrated into the smart movable road divider project, providing essential visual feedback to vehicle drivers. Utilizing Thin Film Transistor (TFT) technology, this display offers vibrant and high-resolution graphics, enabling the presentation of crucial information such as lane changes and other traffic-related notifications. With its ST7735 driver, the display efficiently controls the display of graphics and text, ensuring smooth and responsive performance. Positioned strategically along roadways, this display enhances communication with drivers, improving awareness and promoting safer driving practices in dynamic traffic environments.

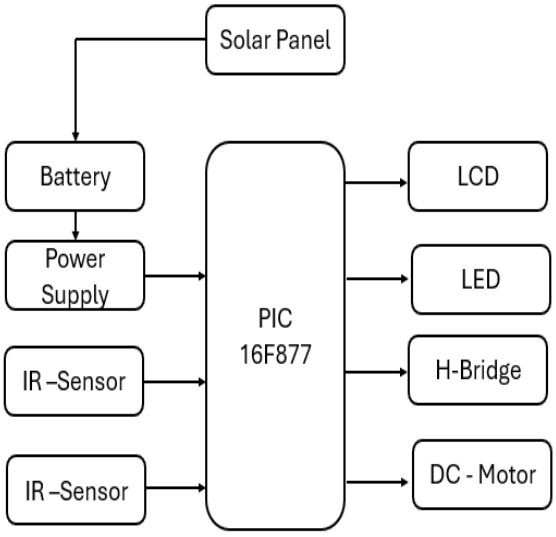
H-Bridge:

An H-Bridge constitutes an essential electronic circuit within the smart movable road divider system, facilitating precise control over the direction and speed of the motors. Specifically, the system incorporates the L293D H-Bridge, a dedicated motor driver designed to interface with microcontrollers and control the operation of motors. With its H-Bridge configuration, this motor driver enables bidirectional control of motors by accepting logic signals from the microcontroller and translating them into corresponding motor movements. By leveraging the capabilities of the L293D H-Bridge, the system achieves efficient and responsive motor control, essential for the dynamic adjustment of the movable road divider, thereby enhancing overall traffic management and safety.

DC Motor:

The smart movable road divider system incorporates DC motors as essential components for generating mechanical movement. As electrical machines, DC motors convert electrical energy into mechanical energy.

Block Diagram:



Buzzer:

The buzzer, converting electrical signals into sound, enhances safety by alerting pedestrians and nearby vehicles during divider movement. It warns of malfunctions, confirms successful actions, and provides emergency signals for caution, aiding individuals with visual impairments.

Solor Pannels and Battery:

The smart movable road divider system incorporates a solar panel and battery setup to ensure reliable and sustainable power supply. The solar panel harnesses solar energy, converting it into electrical power to charge the battery during daylight hours..

Conclusion:

In conclusion, the smart movable road divider system represents a cutting-edge solution for modern traffic management challenges. With its integration of advanced components and renewable energy sources, the system offers enhanced adaptability, responsiveness, and sustainability. Rigorous testing has demonstrated its effectiveness in real-world scenarios, showing promise for improved safety, efficiency, and environmental impact in urban traffic management. Continued research and innovation in this field are crucial for further advancements in traffic control systems, paving the way for smarter, more sustainable cities.

References:

- https://espressif.com/en/products/devkits
- https://www.espressif.com/en/products/socs/esp32
- https://www.researchgate.net/publication/333042509_Implementation_of_Movable_Road_Divider_using_Internet_of_Things_IOT
- https://www.arduino.cc/en/software

Acknowledgement:

We extend our sincere gratitude to our project guide Mr. H. RAGHUNATHA RAO M. Tech, whose guidance have been invaluable throughout the development process. Special thanks to our team members M. Mallikarjuna, S. Yasmeen, T. Gowthami, D. Danmaiah, C. Apoorva, J. Supraja, whose dedication and collaboration made this project possible. Additionally, we would like to acknowledge the support and resources provided by Sai Rajeswari Institute of Technology, without which this endeavour would not have been achievable.