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Smart Density based Traffic Light Control System with ESP32 & Blynk

Mr.CH.Venkatesarlu[1], M.Deepika[2], P. Nikhitha[3], P. Mrudula[4]

Assistant Professor, Department of Electronics and Communication Engineering, Malla Reddy Engineering College for Women, Hyderabad, Telangana, India[1]

UG Scholar, Department of Electronics and Communication Engineering, Malla Reddy Engineering College for Women, Hyderabad, Telangana, India[2,3,4]

ABSTRACT: This venture presents a Brilliant Thickness Based Traffic Signal Control Framework using an ESP32 microcontroller, ultrasonic sensors, LEDs, RFID, and an accelerometer. The framework means to advance traffic stream and improve metropolitan versatility by powerfully changing traffic light timings in view of ongoing traffic thickness.The center of the framework is the ESP32 microcontroller, which processes information from different sensors to pursue insightful choices. Ultrasonic sensors are utilized to quantify the distance of vehicles from the traffic light, giving a proportion of traffic thickness on each methodology. The traffic lights in four different directions are represented by LEDs. In order to reduce wait times and congestion, the system gives priority to lanes with a higher density of vehicles.

I. INTRODUCTION

In today's urban environments, traffic congestion has become a significant problem, resulting in longer travel times, increased fuel consumption, and pollution. Conventional traffic signal control frameworks frequently follow fixed timing timetables or straightforward pre-set designs, which can be wasteful in tending to the unique idea of traffic stream. Intelligent traffic management solutions that can respond to changing traffic conditions in real time are becoming increasingly required to address these issues.This project introduces a Smart Density-Based Traffic Light Control System that uses cutting-edge technology to improve traffic flow and alleviatecongestion. The ESP32 microcontroller is at the center of this system. It is a powerful and adaptable component that combines a lot of processing power with wireless communication.

II. EXISTING SYSTEM

Fixed time-based cycles, inductive loop sensors, video-based detection, adaptive traffic control systems (ATCS), smart IoT-based solutions, and emergency vehicle preemption systems are typical components of the current traffic light control systems. Fixed time frameworks work on foreordained stretches, frequently prompting failures as they don't adjust to continuous traffic conditions. Inductive circle sensors, implanted in the street surface, recognize vehicle presence yet can be expensive to introduce and keep up with. Traffic flow is monitored by video-based systems, which offer real-time adjustments at a high cost and complexity but make use of cameras and image processing. While ATCS, such as SCOOT and SCATS, dynamically adjust signal timings based on traffic data, they necessitate significant infrastructure investment and ongoing upkeep. For dynamic traffic management, IoT-based smart traffic systems make use of a variety of sensors and cloud-based analytics. These systems offer flexibility and scalability, but their implementation can be difficult and costly. Using RFID or other technologies for identifying vehicles, emergency vehicle preemption systems give priority to emergency vehicles, speeding up response times. The Smart Density-Based Traffic Light Control System with ESP32, ultrasonic sensors, RFID, and accelerometer is a more cost-effective and adaptable option than these other systems. It manages traffic flow effectively and gives vehicles priority in real time

2.1DISADVANTAGS

•Intricacy of Reconciliation
•Support and Unwavering quality
•Versatility Difficulties
•Sensor Constraints

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III. PROPOSED SYSTEM

The Smart Density-Based Traffic Light Control System that has been proposed makes use of cutting-edge technologies to improve traffic management by adapting and working more effectively in real time. The ESP32 microcontroller, which was chosen due to its integrated wireless communication and powerful processing capabilities, is at its core. The central hub for data collection and decision-making is this microcontroller.The system measures vehicle distances with ultrasonic sensors placed at each traffic approach, providing real-time traffic density data. By examining this information, the ESP32 can powerfully change the traffic signal cycles to focus on paths with higher vehicle counts, subsequently lessening clog and further developing traffic stream. Four LEDs address the traffic lights for various bearings, and their activity is controlled in view of the information got from the ultrasonic sensors. Instead of following a predetermined schedule, this setup enables adaptive signal timing that is responsive to the current traffic conditions.

3.1ADVANTAGES

•Continuous Traffic The board
•Upgraded Productivity
•Crisis Vehicle Prioritization
•Further developed Security

IV. LITRATURE SURVEY

1. " Versatile Traffic Signal Control Utilizing Ongoing Vehicle Discovery Frameworks"

ABSTRACT

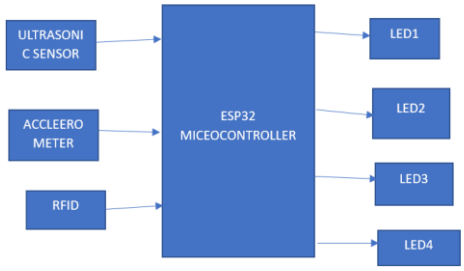
This paper investigates versatile traffic signal control components that use ongoing vehicle location frameworks to improve traffic stream. It evaluates the effectiveness of various sensor technologies in dynamic traffic management, such as inductive loops, infrared sensors, and ultrasonic sensors. The study demonstrates how real-time data collection can result in adjustments to traffic lights that are more responsive, thereby reducing congestion and increasing overall traffic efficiency. The benefits and impediments of various sensor types are examined, giving bits of knowledge into the execution of versatile control frameworks.

2. " IoT-Based Traffic The executives Framework Utilizing ESP32 Microcontroller"

ABSTRACT

The paper presents a Web of Things (IoT) based traffic the board framework utilizing the ESP32 microcontroller for upgraded traffic signal. It describes how the ESP32 is combined with a variety of IoT components, including communication modules and sensors, to produce a traffic management system that is adaptable and scalable. The review shows the way that ongoing information from traffic sensors can be handled by the ESP32 to change traffic signal timings, offering a cutting edge way to deal with improving metropolitan traffic stream and limiting clog.

V. BLOCK DIGRAM



VI. HARDWARE DESCRIPTION

- ESP32 MICROCONTROLLER
- ULTRASONIC SENSOR
- RFID
- ACCELEROMETER
- LED

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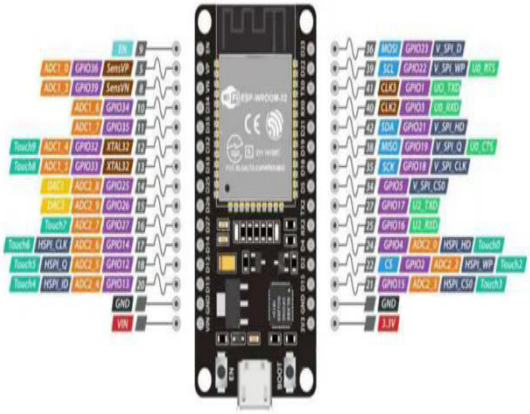
VII. SOFTWARE REQUIREMENT

- ARDUINO IDE

VIII. HARDWAR DESCRIPTION

8.1ESP32 MICROCONTROLER



Espressif Systems created the ESP32, a powerful, low-cost microcontroller with integrated Bluetooth and Wi-Fi capabilities. It is suitable for a wide range of applications that require high processing power, connectivity, and energy efficiency because it has a dual-core processor with clock speeds up to 240 MHz based on the Tensilica Xtensa LX6. The ESP32 is furnished with numerous advanced and simple info/yield (I/O) pins, which can connect with different sensors, actuators, and other electronic parts. The board is regularly modified utilizing the Arduino IDE, giving simplicity of improvement and admittance to a huge swath of libraries and local area support.

8.2 ULTRASONIC SENSOR

Ultrasonic sensors serve the market by offering a low-cost method of sensing that also possesses unique characteristics that no other sensing technology possesses. By utilizing a wide assortment of ultrasonic transducers and a few different recurrence runs, a ultrasonic sensor can be intended to take care of numerous application issues that are cost restrictive or basically can't be tackled by different sensors. Long reach discoveryMore and more applications in industrial sensing require distance detection. Limit switches and inductive sensors cannot detect over long distances of up to forty feet.

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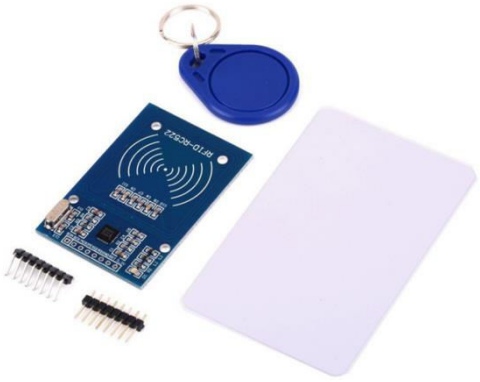
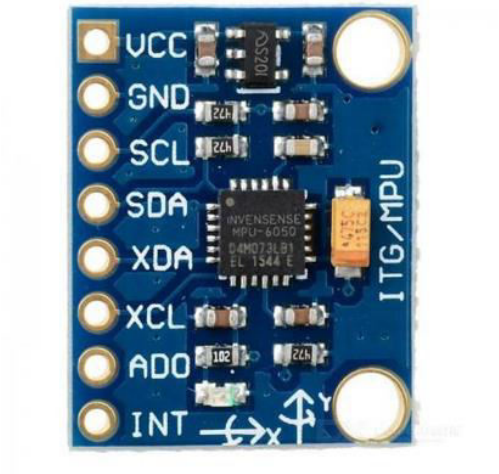
8.3 RFID



RFID is an innovation comparable in principle to scanner tags. Nonetheless, the RFID tag doesn't need to be filtered straightforwardly, nor does it require view to a peruser. In order for an RFID reader to read the tag, it must be within three to 300 feet of the reader. RFID innovation permits a few things to be immediately filtered and empowers quick recognizable proof of a specific item, in any event, when it is encircled by a few different things.
RFID labels have not supplanted standardized tags in view of their expense and the need to recognize each thing exclusively. RFID, or Radio Frequency Identification System, is a technology-based identification system that uses tags to identify objects without the need for a light source between the tags and the tag reader. Radio communication between the reader and the tag is all that is required.

8.4 ACCELEROMETER
Pitch is the vertical rotation seen from the front of the object, and Yaw is the horizontal rotation seen from above on a flat surface. Roll is the horizontal rotation seen from the front of the object.



Other than detecting the precise speed, Spinner sensors can likewise gauge the movement of the article. For more strong and precise movement detecting, in purchaser hardware Gyrator sensors are joined with Accelerometer sensors.There are three types of angular rate measurements, one for each direction. Pitch is the vertical rotation seen from the front of the object, and Yaw is the horizontal rotation seen from above on a flat surface. Roll is the horizontal rotation seen from the front of the object.

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8.5 LED

Light Emitting Diode

LEDs are made by putting three layers of semiconductor material on top of a substrate, which makes the process very simple. The middle region is active, the top region is P-type, and the bottom region is N-type. The order of these three layers is reversed. The development uncovers the three areas of semiconductor material. The openings are incorporated into the P-type location in the development; the N-type area consolidates choices while the unique region integrates the two openings and electrons.

IX. SOFTWARE DISCRIPTION

9.1 ARDUINO IDE

Programs composed utilizing Arduino Programming (IDE) are called draws. The file extension.ino is used to save these sketches, which were written in the text editor. The editor has tools for searching and replacing text as well as cutting and pasting. The message region gives input while saving and trading and furthermore shows blunders. The Arduino Software (IDE) outputs text to the console, which includes all of the information, including complete error messages. The base righthand corner of the window shows the designed board and sequential port. You can open the serial monitor, create, open, and verify programs, and upload and upload programs using the toolbar buttons.

ArduinoSoftware(IDE)

X. CONCLUSION

A significant advancement in traffic management technology is the Smart Density-Based Traffic Light Control System, which makes use of the ESP32 microcontroller, ultrasonic sensors, four LEDs, RFID, and an accelerometer. The system effectively addresses a number of important issues in contemporary urban traffic control by combining these parts.As the central processing unit, the ESP32 microcontroller efficiently processes data from various sensors and adjusts traffic light timings in real time. The ultrasonic sensors give precise estimations of vehicle thickness, permitting the framework to adjust signal cycles in view of current traffic conditions. In comparison to conventional fixed-time traffic light systems, this dynamic adjustment makes the system more responsive, reducing congestion and enhancing overall traffic flow.

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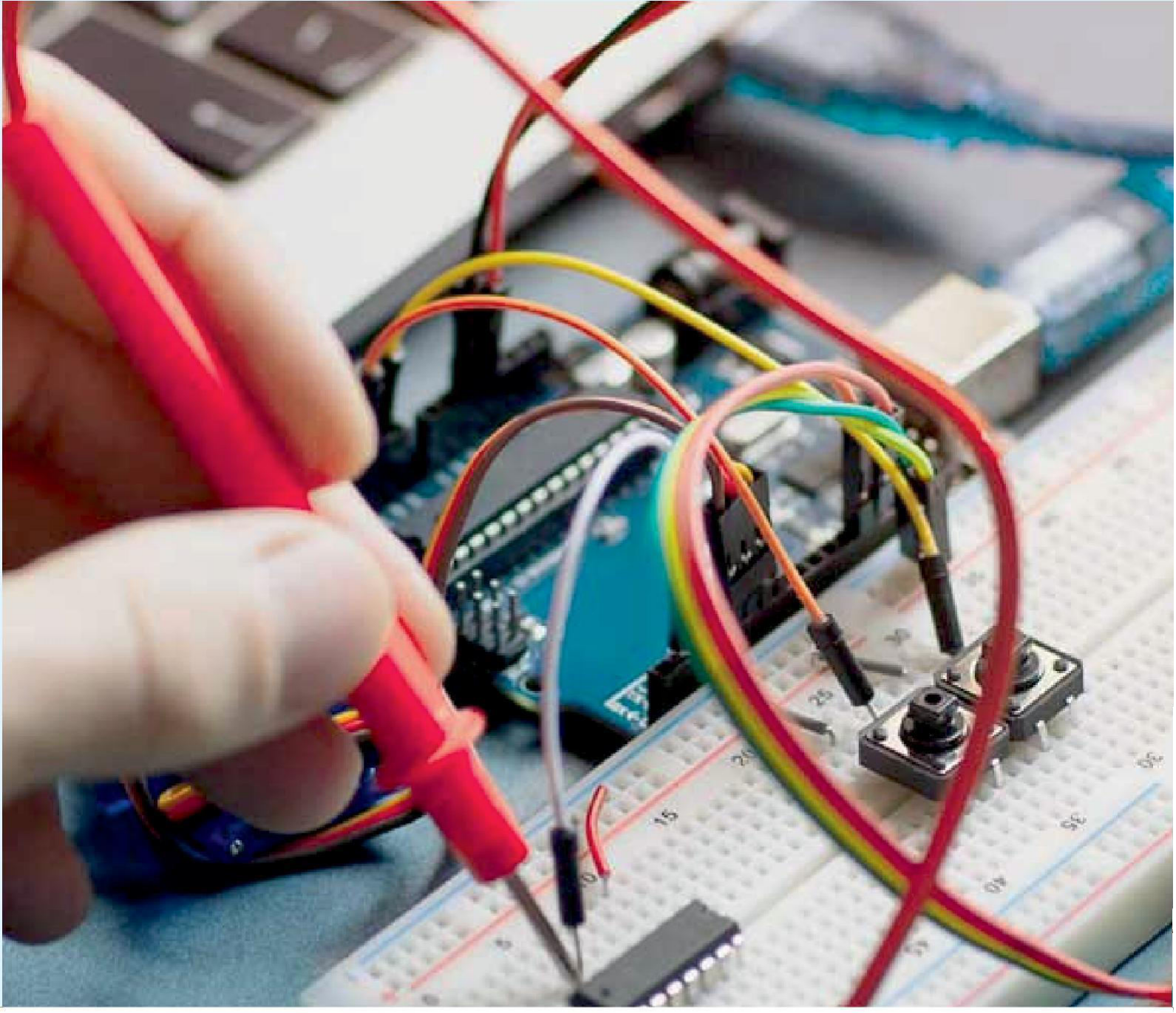

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