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IoT-Based Automatic Vehicle Speed Control System

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ABSTRACT

The most frequent occurrence is traffic accidents, which happen relatively often. Overspeeding is a major factor in most fatal collisions. An increase in speed may increase the likelihood of an accident and the danger of injuries occurring in one. Our team has thus developed a technology that intends to automatically manage the speed of cars in the restricted region in order to lessen this hiccup. Recent research on the IoT has found that since people are impatient to get where they're going, accidents near places like hospitals and schools have increased significantly. The primary goal of this work is to control vehicle speed using IoT sensors. This work used an RFID module to control the speed of the vehicle. The RFID receiver should be installed inside the vehicle, and the RF transmitter will be put at the start and end of the prohibited regions. The speedometer of the car was used to determine the speed. The controller then compares and keeps track of that speed. When a vehicle's speed exceeds the allowed limit, it automatically adjusts its speed to fit the zone.

Keywords: IoT, Traffic Monitoring, Vehicle tracking, RFID.

1. Introduction

Globally, traffic congestion has expanded exponentially in recent years, and the number of accidents has climbed at a rapid rate. However, according to a recent study, the huge growth in accidents is killing hundreds of millions of lives annually [1]. To prevent and eliminate such sad losses of life caused by traffic accidents or associated situations, the necessity for enhanced and effective traffic monitoring and control procedures has been developed and approved internationally.

The road system has a significant impact on society and the economy in today's complicated world. Each human activity requires a high-quality roadway transportation system. However, no matter how properly the road is constructed, it will deteriorate over time as a result of stress. The typical road inspection technique involves human professionals visually inspecting and subjectively evaluating pavement segments. This labor-intensive procedure of human inspection and classification based on samples and experience costs a lot of money. It requires a computationally viable and efficient autonomous surveillance solution to provide optimal monitoring, control, and other activities. Unlike in the past, when there were only a few or countable automobiles, there used to be one or two lanes on either side of the road. The vehicles were traveling at a higher speed of a few kilometers per hour and not in a hasty manner. It was usually simple to keep track of such vehicle movements. Monitoring the movement of cars, particularly tracking the movements of automobiles, is difficult these days.

Vehicle tracking can be aided by strategies such as placing cameras, monitoring using a GPS, and putting in counting sensors. The rapid increase in vehicle density in both urban and rural areas has made it unavoidable to fulfill the demand for effective traffic supervision and control management. Inductive loops, wireless sensing devices, electromagnetic microwave sensors and detectors, and other classic ways. There are still several limits, as well as significant functional, financial, and maintenance difficulties. Conventional methods are large, expensive, and, of course, complex in function, and they are unable to execute vehicle recognition and tracking collaboratively to detect or monitor a targeted vehicle.

2. Related Works

Patole Gitanjali et al. (2017) examined a vehicle tracking and vehicular emergency system based on the Internet of Things (IOT), which covered essential building blocks and procedures. The page discusses the modeling and functioning of several system units, including the vehicle and ambulance units, as well as the server and traffic units. It covers IoT and its various layers, microcontrollers (ATMEGA 16A) and their architecture, accelerometer sensors (ADXL 355) and their pin diagrams, RFID readers and their operation, GPS, GSM, and LCD displays that are interconnected with microcontrollers.

Vehicle counting, according to **Reha Justin (2018)**, gives suitable information regarding traffic flow, vehicle crash incidences, and traffic maximum hours on roads. Using image processing techniques and technologies on traffic cam footage outputs is an acceptable strategy for achieving these objectives. They demonstrated a vehicle counter-classifier based on a mix of object detection, frame distinction, edge detection, and the middle filter, among other video-image processing approaches. The proposed technique has been implemented using Python programming. It explains how to use different libraries and algorithms with real-time image processing for traffic flow monitoring and identification.

According to **Can Aydin et al. (2015)**, given the current shifting public management style, public institutions should provide more effective and valuable services at lower costs. The degree of performance improvement has been demonstrated in public institutions employing transport service information technology under the determined performance indicators. The performance level of the institution was evaluated. It's become clear that the government requires an information system to keep track of its transport vehicles. The impact of the transportation management application was repeatedly assessed using the above-mentioned performance appraisal. It was calculated that car costs and expenses were reduced by at least 25%.

Srikanth et al. (2016) developed a prototype model for automatically detecting an accident. It also sends out a notification that medical help is available nearby. Thru the tilting of automobiles, it identifies vehicles that are out of control. The 8051 microprocessor collects and analyzes the accelerometer output. It connects the Global System for Mobile Communication (GSMC), GPS, and the Micro-Electro-Mechanical System (MEMS). The General Network Subsystem, Ground Station Sub-system, and Operation and Support System are the three key systems that make up GSM. The Base Station Controller is in charge of all base transmitter stations. The system's control and monitoring are handled by the Operation and Support Network.

3. Block Diagram

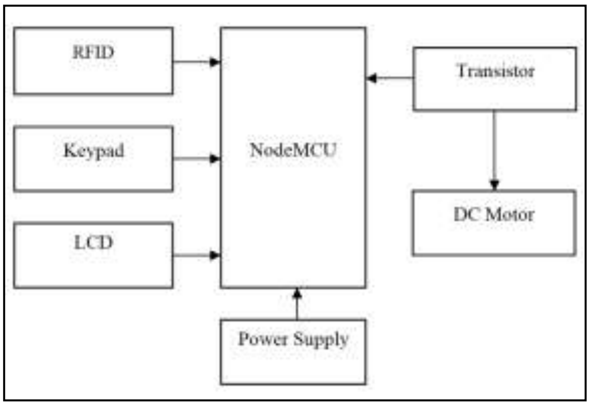

Figure 1 Architecture Diagram

a. Node MCU

The NodeMCU is a free development board based on the ESP8266 chip, which is Wi-Fi microchip with complete TCP/IP stack and microcontroller capabilities. It is intended to be a straightforward and user-friendly platform for IoT initiatives. The NodeMCU board has a built-in voltage regulator to supply the ESP8266 chip with steady 3.3V power, as well as a USB-to-serial interface for programming and powering the board. Additionally, it contains many GPIO pins that may be utilised to communicate with different kinds of actuators, sensors, and other electrical parts. Developing Internet of Things projects is made simple by the Arduino IDE, which can be used to program the NodeMCU board.

Figure 2 Node MCU

b. RFID

RFID, or radio frequency identification, is utilized in a location tracking system to track the object, and cloud computing is employed to increase calculation speed while keeping hardware costs low. A transponder or tag is attached to the luggage in order to track it inside the museum. When the tag is close to the reader or integrator, it activates. Additionally, the impact of various offset angles on tag read rates was investigated. The findings indicate that as the offset angle is increased, the reading rate falls. About 60 degrees is the effective recognition angle, and the effect is better around 45 cents.

The reading rate significantly decreases beyond 75 cents. As a result, there are specific guidelines for the placement of cultural artifacts and reading angles in order to guarantee their veracity.

Figure 3 RFID Tag

c. Transistor

A transistor is a type of semiconductor device used to switch or amplify electrical impulses. It is among the essential elements of modern electronics. It is made of semiconductor material and has at least three terminals for attaching to an electronic circuit. The current flowing through the other pair of terminals is controlled by the voltage or current provided to one set of the transistor's terminals. A transistor can magnify a signal because its regulated (output) power can be greater than its controlling (input) power. Even though integrated circuits include a large number of transistors in tiny size, not all of them are arranged in a single pack. Transistors are widely regarded as one of the greatest innovations of the 20th century since they are the primary active elements in almost all modern electronics.

Figure 4 Transistor

d. DC Motor

A direct current motor is an electrical device that uses the magnetic field created by direct current to transform electrical energy into mechanical energy. When a direct-current motor is turned on, a magnetic field is created in the stator. The rotor revolves because the magnets on it are attracted to and repellent to the magnetic field. The motor's wire windings get power from the commutator, which is linked to brushes that are connected to the power supply, to keep the rotor turning constantly.

Figure 5 DC Motor

e. 12V Power Supplies

One of the most often used power sources today is the 12V (or 12VDC) supply. It is common to use a transformer, diode, and transistor combination to change a 120VAC or 240VAC input into a 12VDC output. Regulated power supplies and unregulated power supplies are two different types of 12V power supplies. In addition, significant EMI filtering and shielding are used in an acopian switching-regulated power supply to reduce noise that is passed to the line and load in both common and differential modes.

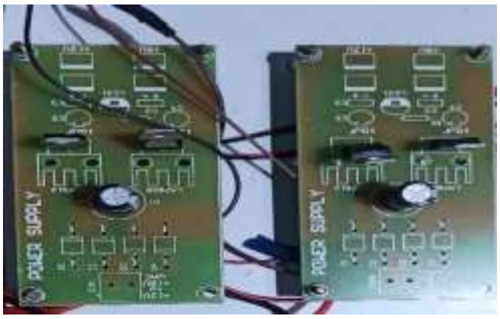

Figure 6 Power Supply

f. LCD

LCD module at a temperature and relative humidity of 40% and 40%, respectively. Lower temperatures can slow the display's blinking pace, while higher temperatures can cause the display's overall color to change. The display will return to normal when the temperature falls within the established range. Heat and humidity can cause polarization degradation, bubble production, or polarizer peel-off.

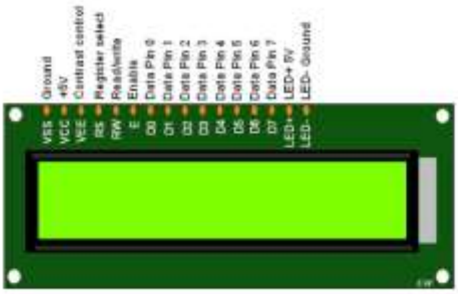

Figure 7 LCD

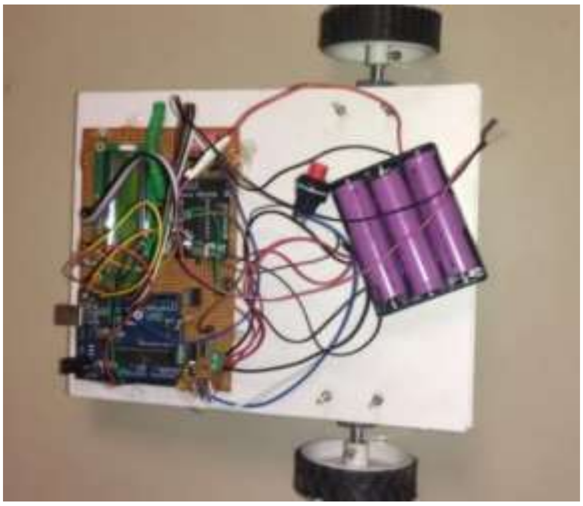

Figure 8 Hardware of Automatic Speed Controlling System

4. Conclusion

In the automobile driving field, providing safety to the drivers and preventing accidents with the vehicle are important factors. The primary goal of this work is to control vehicle speed using IoT sensors. This work used an RFID module to control the speed of the vehicle. The RFID receiver should be installed inside the vehicle, and the RF transmitter will be put at the start and end of the prohibited regions. The speedometer of the car was used to determine the speed. The controller then compares and keeps track of that speed. When a vehicle's speed exceeds the allowed limit, it automatically adjusts its speed to fit the zone.

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