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Design of an IoT-Based Traffic Management System for Smart Roads

Deepa R[1]*, Gnandesigan R[1], Ranjith D[1], Siva Priya S[1], Sakthipriya S A[1], Tharunika N[1]
[1]Department of Electronics & Instrumentation Engineering, Bannari Amman Institute of Technology Sathyamangalam, Tamil Nadu, India

ABSTRACT

The primary objective of this design is to prevent traffic accidents. The great deal of research strongly indicated that the most of incidents happen in specific locations, such as school zones, restaurants, and so on. The proposed system's design is to avoid accidents in nearby areas by alerting or warning via Wi-Fi. A mobile notification is transmitted through the Wi-Fi link if the zone is fewer than 110 yards from wagon. In reply to this warning, the motorist slows the wagon's speed. A Wireless Fidelity warning will be sent to a cell phone if a school region is within 110 yards of it. After receiving alert from the Wireless Fidelity range to the driver's notification, the vehicle's speed is reduced. It provides message warnings to mobile devices within 100 metres of a Wi-Fi hotspot, as well as changes in weather parameters. The driver slows the vehicle's speed in response to this command. This sign contributes to a reduction in traffic based accidents.

This system's controlled power supply uses 5V and 500mA, three voltage terminal regulators (7805) were utilised for voltage power and A full-wave bridge rectifier is used to rectify the 230/12V transformer secondary ac output. We have used Wi-Fi AT89S52 switches and a Wireless Fidelity module to connect the controller to the Internet of Things, allowing it to be operated from anywhere through IoT.

Keywords : Traffic management system, Internet of things (IoT), Wi – Fi, Vehicles

I. INTRODUCTION

In order to accomplish traffic operations service provider aims, automatic traffic regulation systems include traffic signals. Intersectional traffic lights, additional network of communications that connects them as well as a central hub of computer or network of machines to supervise an operation are all part of these systems. Coordination is crucial and it may be enforced using a variety of mechanisms, including time-based and hardwired communication systems. Agency-wide traffic signal the creation of agreements on data interchange and traffic signal regulation are examples of collaboration. As a result, forming conventional and non- conventional consensus between jurisdictions to transmit traffic management and signal operation skills is a significant policy component of indicating the Traffic Signal. A traffic sign arrangement's main aim is to present drivers with a favourable signal period. The programme includes tools to help the developer accomplish that goal to the best of their abilities Adjustments and corrections in the signal of the systems are used to offer power. Those are the most important control features. They have access to the junction signal controller for care and upkeep. If the connection is complete and secure, the operator will become high effective and efficient. Several monitoring functions

are now accessible, including traffic detection, surveillance footage, and signal traffic management. These also offer better efficient traffic management techniques, such as efforts to adapt traffic in a predictable and adaptive manner.

Many metropolitan areas are experiencing issues due to population growth. This has resulted in a rise in automobile density; As a result, there is traffic congestion. Vehicle speeds are slowed during rush periods and during other times due to the change in traffic density. The current infrastructure can only regulate traffic jams with a limited number of resources.

IOT has been used to provide real-time traffic density control in order to manage traffic flow. It helps with traffic flow control, traffic shifting efficiency, and excessive avoidance [1]. These capabilities have been added to the website to show the current traffic status, allowing visitors to get an early update and avoid traffic jams by taking an alternate route. In the event of an emergency, vehicles can receive early access to their destination.

In an environment where native species are becoming rare and leftover animals are being driven there by vehicles when using roadways, IoT customs a concept to reduce accidents between wild life species and wagons on major roadways in protected regions [2]. Because electric fence poses a significant threat to animal life, our article proposes a wonderful alternative: providing notifications via smart phones and large LED displays strategically positioned across important areas where animals are spotted crossing highways. The approaches of observing the movement with certain devices and visual perception using machine learning techniques are applied.

In the United arab Emirates (UAE), vehicle violent incidents with regard to animals (especially camels) are growing increasing regularly, result in economic losses, animal deaths. Annually, there is significant loss in species. As a consequence, design and implementing a dependable plan for detecting wild life species and alerting drivers in the UAE has become a critical necessity. Although some such methods have been used in some other parts of the world [3]. The goal of this study is to create a suitable solution to avoid the occurrence of accident with wild life species by using the Internet of Things reliable r system that is cost-effective. The wild life species identification and driver safety systems seem to be the two key components of the system. Small level of data flow rate is required while uploading to the cloud. As a result, the chances of data traffic are minimal. It can also be employed at night, when most animal based vehicle accidents happen.

The wildlife populations can be severely impacted by road fatalities. Few studies, however, have looked at the effectiveness of strategies for reducing wildlife-vehicle collisions (WVCs). We tested highway avoidance barrier to reduce the collision between wagons and wild life along the path segments of the Trans-Canada main road in Banff National Park, Alberta (phases1, 2, and 3A). We studied onslaught of wild life species on the barried right-of-way from 1981 to 1999 [4]. We discovered that WVCs were not dispersed randomly after netting and were related to and close to fence ends. Wildlife-vehicle collisions are also most common within 1 km of barrier ends, though access to key drainages likely influenced collision location as well.

In all metropolitan cities, traffic congestion is a concern, particularly in the downtown areas. Normal civilizations can be transformed into smart cities with new technologies (ICT) by utilising data and transmission technologies [5]. The Internet of Things (IoT) paradigm has the capacity to play a big role in the evolution of Cities with smart capabilities. This is an Internet- of-Things-based traffic solution provider for smart cities, in which road traffic can be actively controlled by local traffic cops using their mobile phones or constantly observed and managed over the Internet.

Using the Internet of Things, information, and insights, a true transportation planning system is presented (TMS). Increased car numbers result in a plenty of problems, including wasted time and fuel, Contamination of the air and sound, and even mortality from stranded external crises wagons. Ultrasonic sensors are used to measure traffic density [6]. The system controller employs a traffic management algorithm to alter traffic signal timing after evaluating data and transfers information to the cloud host via a Wireless Fidelity device. It can predict whether or not there will be road traffic at the crossroads. If an essential vehicle is detected, the intersection receives priority and a longer signal time. The world is changing at a breakneck pace, and it must continue to do so in order to progress. However, contemporary transportation fails to offer citizens with a smooth transportation system. Excessive traffic jams cause delays in getting to work or home, waste of gasoline, vehicle wear and tear, and even road rage among stressed and irritated drivers. We frequently observe people waiting in large lines to pay toll taxes. Vehicle owners face an additional headache in the form of parking. We have offered a solution to all of these challenges using the Internet of Things in order to realise the Smart City's goal. We've devised an algorithm for traffic congestion control and smart parking system [7]. In today's world of ever-increasing population, the Internet of Things (IOT) plays a critical role. Its uses include autonomous transportation, smart homes, smart cities, agriculture, and health care [8].

The Iot technology is a promising new technologies have the potential to make our society's infrastructure smarter and responsive to its users' needs. A good example of such framework is conveyance. So this paper investigates contemporary approaches and techniques for automatic vehicle traffic control in order to identify hotspots and ways for introducing IoT into the field. Existing approaches are examined for their benefits and limitations, as well as their effectiveness [9].

The basic purpose of the road safety system is to keep people safe on the roads. so that accidents caused by a driver's incompetence can be identified and fatalities avoided. As a result, the intelligent traffic structure proposed is favourable due to the Internet of Things' unique traits and capabilities.

II. METHODS

The proposed methodology will be split into two parts: one for the emitter and one for the recipient. The transmitter is depicted in the block diagram in figure 1, which is separated into numerous zones. Figure 2 shows how the RF transmitter will receive data from the switches and sensors in those specified zones. The information is emitted with help of RF transmitter, and the data obtained by the RF receiver and processed by the receiver's microcontroller. We can monitor everything in the website after it has been processed because the gadget is also connected to the Wi-Fi module.

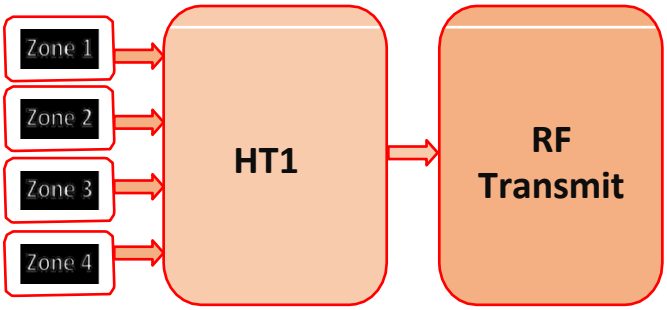

Figure 1 Transmitter Section

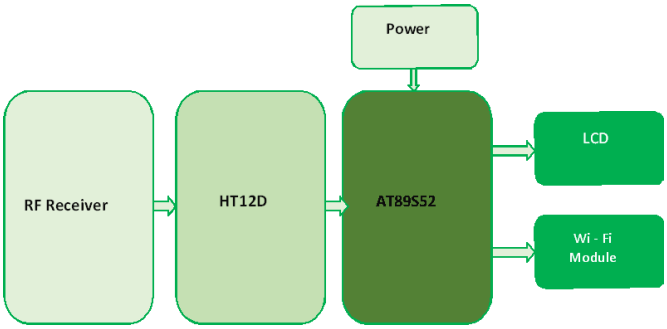

Figure 2 Receiver Section

III. MICROCONTROLLER – AT89S52

Figure 3 shows the AT89S52, an 8-bit, limited power, 8-bit CMOS microcontroller with an in- command Flash memory of 8 kilobytes. The machine uses Atmel's heavy non-volatile memory technology and follows the 80C51 pin and operation set, which is industry standard. You can use your computer or a escapees memory programmer to rewrite your program's memory utilising the Flash functionality. The Atmel AT89S52 is a sophisticated microcontroller that combines the configurable 8-bit CPU with a Flash configurable processor on a monolithic chip to produce a more versatile to time-saving solution for many applications in the field of embedded .AT89S52 contains 8 K bytes of Flash, 256 bytes of RAM, 32 I/O blocks, two data points, three 16-bit timers/counters, a six-vector double-speed serial interface, an on-chip oscillator, and a timer monitor. Regardless, AT89S52 has a null frequency static working concept that enables for various programming state saves. The Kernel is disabled in Idle State, and RAM, clock, and machine interrupt activities are performed. The OSC is frozen until the next break is completed, but the RAM contents are stored.

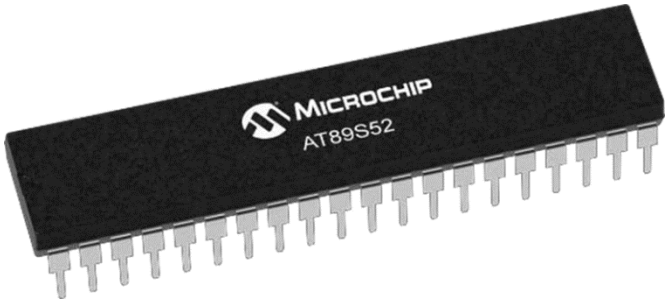

Figure 3 AT89S52 Microcontroller

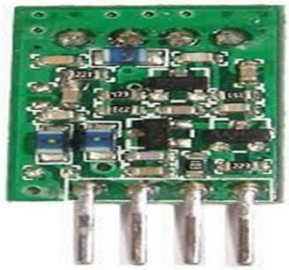

Figure 4 RF Transmitter

IV. WIRELESS RF TRANSMITTER

The STT-433, with its 433MHz RF transmitter portion illustrated in figure 4, is designed for small economy, high-range hand held applications. Because this transmitter runs on 1.5-12V, it's suitable for battery-powered applications. In order to achieve accurate frequency control and the best output, the transmitter uses a SAW-stabilized oscillator. Controlling output power and sinusoidal emissions is a snap, making FCC and ETSI compliance a breeze.

V. Wi-Fi MCU

The ESP8266 solves Wi-Fi development issues by allowing the machine for highlighting or the wireless fidelity channel for managing from a different function processor. It can launch immediately from an additional flash if the machine is serving and the device's only processor. Any microcontroller-based device can be used as a Wi-Fi adaptor by extending internet access via wireless facility via the UART interface or the CPU AHB bridge interface.

A wireless internet connection can also assist any micro - controller reliable device. The ESP8266EX is a well-designed and equiped with WiFi SoC which matches customer objectives for low power consumption, less weight, and equipped with consistent action in the IoT field. Because of its extensive and self-sufficient Wireless fidelity networking capabilities, the ESP8266EX can be used as an independent system or as a host MCU slave. Because the ESP8266EX throws the script, and application runs right instantly. The integrated super-speed cache improves system stability and memory utilisation. The ESP8266EX can be used as an SPI/SDIO or I2C controller as well.

Designs of micro controllers have the UART interface as a Wireless fidelity adapter. The ESP8266EX includes switches for antennas, RF, controlled amplifier, filters, amplifier, and power controlled devices. The small design reduces the total size of the

designed PCB, and just a few outer circuits are required.

The ESP8266EX has an stable version of Ten silica's 32-bit based Processor called diamond processor as well as on-chip SRAM memory, in addition to Wi-Fi capabilities. GPIOs can be used to link various outer sensors and other devices to it. Sample code for a range of works is provided through the Software Development Kit (SDK).

Using common wireless, Bluetooth, DD Radiation (DDR), LVDS, and LCD interruption management, the Descriptive Systems Smart Communication Platform (ESCP) allows for advanced data processing, spur-calling, and radio co-existence techniques to effortlessly switch back and forth to disrupted napping and raise methods.

VI. RESULTS

The RF transmitter section and the RF receiver section is displayed at the figure 5 and figure 6 respectively. Also Wi-Fi module is discussed in the above section and the hardware setup of the transmitter section and the receiver section is shown in the figure 7.

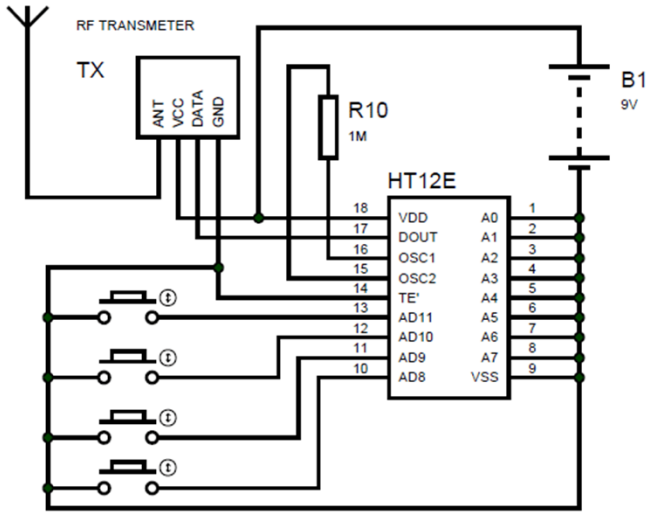

Figure 6 RF Transmitter section

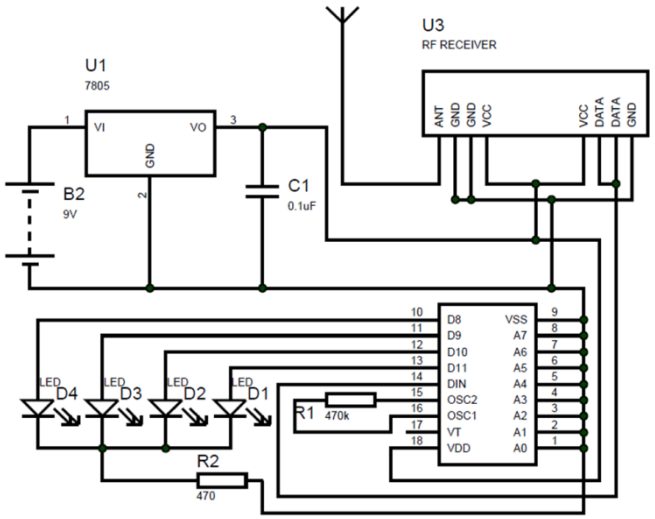

Figure 7 RF Receiver section

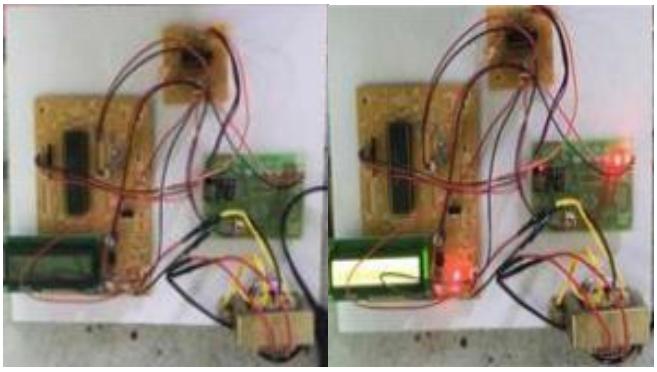

Figure 8 Hardware Setup

VII. CONCLUSIONS

The results were based on weather circumstances as well as expected scenarios such as accidents or traffic jams, and the results were based on local road monitoring with warning messages to improve traffic. It was created by combining all of the hardware components that were used. Each module's existence was meticulously designed and precisely positioned to ensure the device's best performance. Furthermore, cutting-edge ICs and technology were used to finish the work efficiently.

VIII. REFERENCES

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