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IOT based Fully Automated Speed Bumps and Road Blockers for Smart Cities

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Abstract – *The population of city and number of vehicles is increasing day by day. An increasing population growth leads to create traffic congestions and choosing wrong way to travel. This paper presents the automatic speed controlled of the vehicles through road blockers, speed bumps and tyre killers and it synchronizes the concept of IoT with roads to make them smart and an ability to make things more coherent and effective. Now a days, vehicles are IoT enables and connected to the internet, we have an effective technique to guide emergency vehicles like ambulance and fire trucks need to reach their destinations earlier with shortest path. This system is very important to design an intelligent traffic system intelligent to avoid accidents, collisions and traffic jams. This IoT system is a combination of Radio Frequency Identification (RFID) technology and internet platforms which works with complete automation.*

Key Words: **IoT, RFID, Road Blocker, Speed Bumps, Tyre Killer, Emergency Vehicles.**

1. INTRODUCTION

Technology has brought fine changes into every portion of our life by making it reliable and smart. There are many situations in which technologies can be used to avoid accidents in roads which open a wide window for the requirement of smart road system. The design involves the road side units as part of intelligent transport system involving internet of things (IOT). The road blockers are the controlled traffic settings it isavailable to protect the lives and properties. These proposed systems is specially designed for the traffic flow community, commercial areas, in parking slots, residential areas, by limiting access to only authorized vehicular traffic and high level traffic control commercial entrances and exit. Speed bumps are placed on residential places, crammed places, and school zones [1]. It places on the ground (road) to control the speed of vehicles at the day time. There is no need of the speed bumps at night time, it rotates downwards and gets flattened on the road. Tyre killers are spike barriers. This system is fixed at the road and composed of heavy duty spikes that rises from the ground it operates like an access control barrier, it prevents the passage of unauthorized vehicles or it allows exit from a supervised area.

2. OBJECTIVES

- The main purpose of the tyre killer and traffic barrier is for instance, controlling the flow of Traffic or preventing unauthorized vehicles from entering secure areas.
- The main purpose of the speed bumps is to control the over speed in particular region Road.
- To avoid the unnecessary accidents and save our peoples.
- Work zone barriers are used to protect traffic from Hazards.
- To reduce the human work.
- To reduce the time consumptions.

3. EXISTING SYSTEM

In this method is fully focused to make the traffic light fully adaptive using the wireless sensor network [2]. According to the concept of this method, traffic light change their states from Red to Green or vice versa as per the load of traffic and static time limit has the least importance as load of traffic over rule the traffic signal automatically is shown in figure 1.

Fig -1: Traffic loaded intersection

This method does not focus upon the prioritization of vehicle on intersections because at some point of times it happens that emergency vehicles keep on waiting for their intersection side to get green and clear to pass. And it's been seen that it slow thanks to this, rescue team gets delay to reach their destinations which results in more damage. Hence, these want bit refinements to create some changes that takes take care of the emergency vehicles to urge pass with priority [3].

3.1 WSITMN

WSITMN is a traffic monitoring system that uses radio frequency identification (RFID) tags and wireless sensor network (WSN) is shown in figure 2. Here each vehicle is given a RFID tag and once a vehicle with a RFID tag enters the observance zone, the RFID reader reads the information on the RFID tag and gathers information about the traffic flow. All the data collected is processed and sent to the base station. The base station then compiles the data, and transmits it to the monitoring center, where all the data gathered are analyzed and decisions are made. Here the disadvantage is that the most observance center could be a centralized system and if it fails then the total system becomes useless. This process is also a bit time taking and it is also not possible to set RFID tags on all the passing vehicles [4].

Fig -2: WSN using RFID

The Government has approved a National Road SafetyPolicy is shown in figure 3.

Fig -3: Road facilities in India

This Policy outlines various policy measures such as promoting awareness, establishing road safety information data base, encouraging safer road infrastructure including application intelligent transportenforcement of safety laws etc., [5]. The death survey is shown in table 1.

Table -1: Death Survey on the Road

Accidents Type	2019	2020
Over Speeding	1,39,985	63,940
Dangerous Driving	2,34,422	1,11,483
Red Light Jump	1,67,911	1,02,180
Drunken and Drive	33,343	16,000
Fatal Accidents	1,565	629
Simple Accidents	5,017	2,064

4. PROPOSED SYSTEM

The microcontroller is the major part of the controlling system is shown in figure 4. The consequence block can be designed on the requirement converter blocks gets supply directly from the source through a filter circuit.

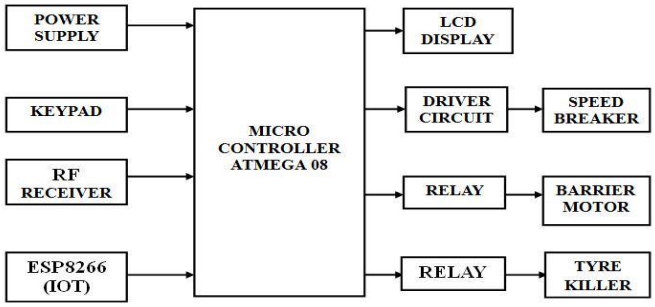

Fig -4: Block diagram for the proposed system

The converter block converts the AC source supply into controlled DC supply and also the converter block provides the constant voltage with the help of voltage regulator to the microcontroller is shown in figure 5.

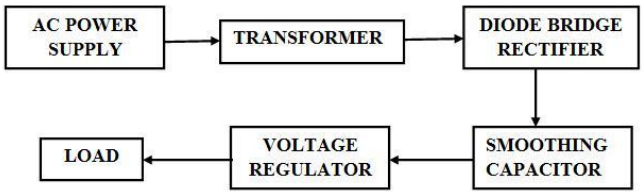

Fig -5: Power supply

This is provided with a crystal oscillator to get a stable clock signal which also converts the mechanical signal into the electrical signal with a very precious frequency. Reset button is used to stop the current process and restart the process. The input signalfor the microcontroller was received from the sensor. RF sensor will measure Radio Frequency waves from the objects in its field ofviews. According to the signal received the microcontroller will execute the system [6]. Then the output from the transceiver is sent to the traffic signal and display board. Depending on the signal the information on the display board is updated. The 230V AC supply is step down to 12V and this AC voltage is rectified to the DC voltage by the bridge Rectifier and then this voltage is send to the capacitance for removing the harmonics gift within the voltage. This filtered voltage is then regulated by the voltage regulated to 5V and then passed into another capacitor to filter the noise signals. The input from the power supply is given to the radiofrequency sensor and to the microcontroller unit.

The computed data from Microcontroller is then transmitted to the smart mobile through IoT (Internet of Things). The controller makes use of the discussed and planned algorithm to perform the intelligent routing. In this system, the primary purpose aim is to gather the information of moving emergency vehicles based on WSN to provide them a clear path till their destination should switch automatically to present a transparent method for these emergency vehicles [7]. The systems are also capable of making way for ambulance which is sensed with the help of RF modules. The speed breakers are laid down flat when an ambulance reaches the area and the tyre killers and the barriers are set down. The system can also be operated manually by the touch of a button. The system can also be viewed and controlled via IoT (Internet of Things). This is done with the use of ESP8266 module.

4.1 Relay

Relay is an electrically operated switch. Many relays use a magnet to operate the automatic change mechanism, although alternative operating principles are used. Relay field unit to regulate circuits wherever necessary, by low power signals (with complete electrical isolation between control and controlled circuits), or wherever multiple circuits must be controlled by a single signal. Necessary management is done [8]. The first relay was employed in long-distance telegraph circuits, continuing a signal coming back from one circuit and re-transmitting it to a different one as shown in figure 6.

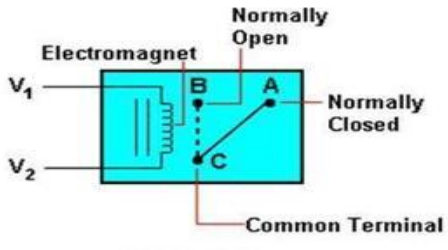

Fig -6: SPDT Switch

4.2 Driver Circuit

L293D is a binary H-ground motorist integrated circuit (IC). Motor drives act as current amplifiers because they take a low current control signal and provide a high current signal which is shown in figure 7.

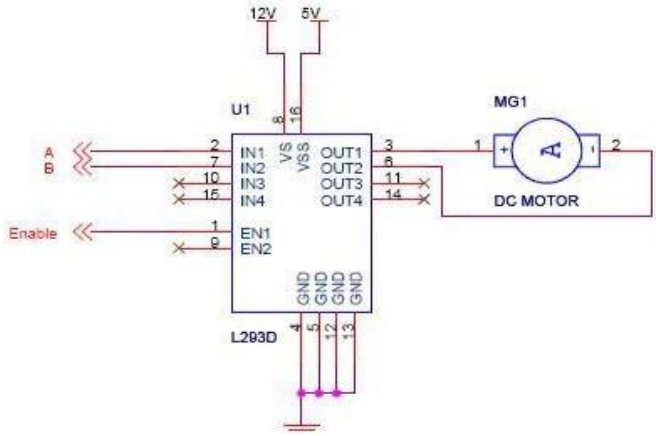

Fig -7: Interfacing a DC Motor using L293D

This high current signal is used to drive the motor. The L293D has an inbuilt H-bridge driver circuit. In their normal mode of operation, DC motors can be driven both forward and backward simultaneously as shown in table 2.

Table -2: Motor driven circuit truth table

Enable	A	B	Description
1	0	0	Motor Stops or Brakes
1	0	1	Motor Runs Anticlockwise Direction
1	1	0	Motor Runs Clockwise Direction
1	1	1	Motor Stops or Brakes

4.3 RF Sensor

An RF module (radio frequency) can be a small electronic device accustomed to transmit and/or receive radio signals between 2 devices, shown in figure 8.

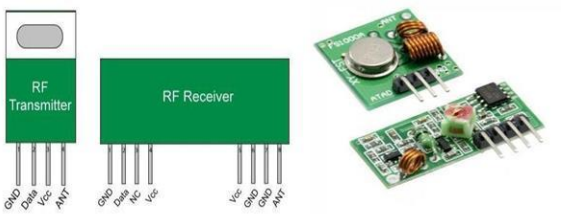

Fig -8: RF Transmitter and Receiver

The transmitter itself generates a frequency AC, which is applied to the antenna. When excited by this AC, the antenna transmits radio waves. In addition to their use in broadcasting, transmitter area units are essential part elements of many electronic devices that communicate by radio, two-way radios in aircraft and the spacecraft, such as cell phones, Wi-Fi and Bluetooth enabled devices, ships, garage door openers, radar set and navigational beacons are

shown in figure 8. The term is used more specifically to refer to transmitting equipment used for broadcasting, as shown in table 3 in radio transmitters or television transmitters.

Table -3: Specification of RF Module

Power Requirements	+9V DC to +16V DC
RF Carrier Frequency	433.92 MHz
Output Drive	200 mA (Maximum)
Operating Temperature	+32 °F to +122 °F (0 °C to 50 °C)
Operating Humanity	5% to 95% Non-Condensing
Module Dimension	89mm x 86mm x 25mm (3.5"x3.4"x1.0")
Antenna Length	330mm (13inch")
Weight	125g

4.4 Wi-Fi Module

It is a Wi-Fi serial transceiver module based on ESP8266 SoC. The SoC has an integrated IP/TCP protocol stack. The ESP8266 is a designed for the needs of a new connected world and it is highly integrated chip design [9]. It provides a complete and self-contained Wi-Fi networking solution, allowing it to either host applications or offload all Wi-Fi networking functions from another application processor.

The ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with sensors and other application specific devices via its GPIOs, with minimal development up-front and minimal loading during runtime. Its high level of on-chip integration allows for minimal external circuitry, and the entire solution, including front-end modules, is designed to occupy minimal PCB area [10].

4.5 Tyre Killer

The blocking segment will consist of spikes at an angle of 60° and will be made of tempered steel. The spacing between the spikes, as measured from the center of the spikes, should be between 100 mm and 200 mm, shown in figure 9.

Fig -9: Tyre killer

4.6 Road Blocker

The height of the road blocker at the guard position should be mm (site and hazard specific), as measured from the top of the foundation frame to the top of the barrier. In the raised position, the blocking segment is hydraulically locked with an anti-leak device and hydraulically rotating mechanical support and in the final lower position by rigid support. (Blocking heights available from 650 to 800 mm) are shown in figure 10.

Fig -10: Road blockers

4.7 Speed Bumps

While speed bumps are effective at keeping vehicle speeds low, their use is sometimes controversial because they can increase traffic noise, damage vehicles when driving at very high speeds, and slow down emergency vehicles. Poorly designed speed bumps that stand too high or with a very steep angle (often found in private car parks [citation needed] can be disruptive to drivers, and difficult to navigate for vehicles with low ground clearance Maybe, even at very low. The motion is shown in figure 11.

Fig -11: Speed Bumps

5. EXPERIMENTAL SETUP

Proteus is the best simulation tool for various designs with microcontrollers. It is popular mainly because of the availability of almost all microcontrollers. Proteus is a simulation engine that combines with architecture specific modules and user applications to form a simulator. The resulting executable provides a high-performance simulation of a user's application on the target architecture. Required for the conduction of work is provided PROTEUS 7.7Sp2 figure 12 shows the circuit diagram of the proposed system.

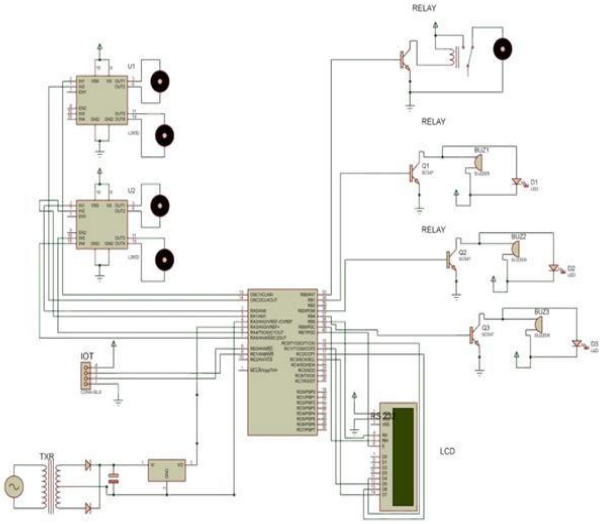

Fig -12: Circuit diagram for proposed system

The hardware outputs of the proposed system are displayed with the help of LCD display. Figure 13 shows the hardware module of the proposed system. The hardware module consists of various components like power supply, AtMega16 microcontroller, RF sensor, motor, speed bumps, road blocker, tire killer, alarm and LCD display. The working function of the proposed system is mainly controlled by the microcontroller. RF sensor is used to sense emergency vehicles based on RFID technology. The outputs are displayed by using LCD Display.

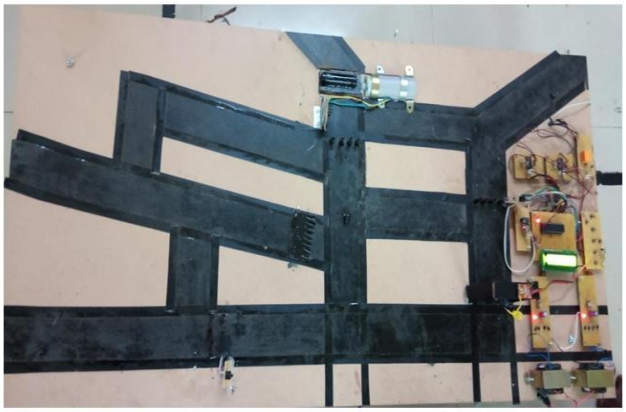

Fig -13: Hardware module of the proposed system

6. OUTPUT ANALYSIS

In this section proposed system, simulation circuit diagram is carried out using proteus simulation software tool and various outputs of hardware are analyzed and displayed. The implementation of the hardware module is done by using the electronic components.

Figure 14 shows that the position of the road blocker and the output is display on the LCD display. This can be operated through the manual switch or IoT.

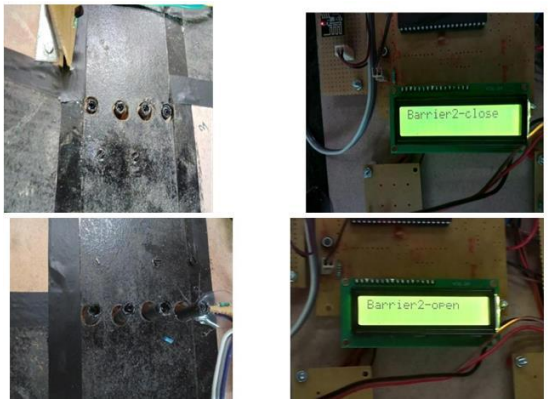

Fig -14: Output of road blocker close and open position

Figure 15 shows that the position of the speed bumps and the output isdisplay on the LCD display. This can be operated through the manual switch or IoT.

Fig -15: Output of Speed Bumps close and open position

Tyre Killer is for the one way path. It works when there is vehicle movement in opposite direction of one way path. Tyre killer Open when there is a vehicle in an opposite direction. It closes when the vehicle is in correct direction is shown in figure 16.

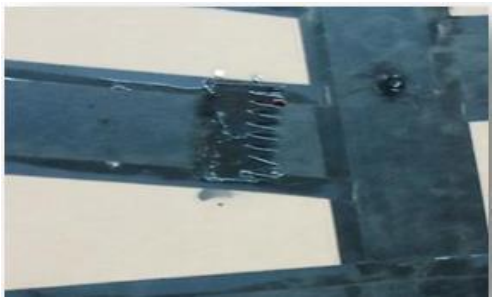

Fig -16: Output of tyre killer

Figure 17 represented the Route Map for the Proposed Work and placing the Road Blockers, Speed Bumps, Tyre Killers, LCD Display and Alarm.

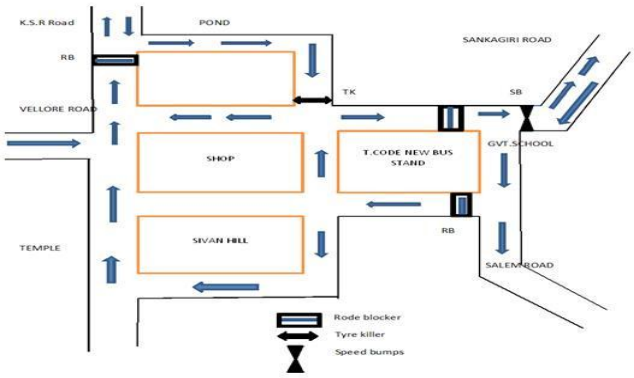

Fig -17: Road map of the proposed work (Tiruchengode)

Figure 18 explains the Road blocker, Speed Bumps and Tyre Killer position are ON or OFF. This monitoring is done by connecting the IoT Wi-Fiwith IP address.

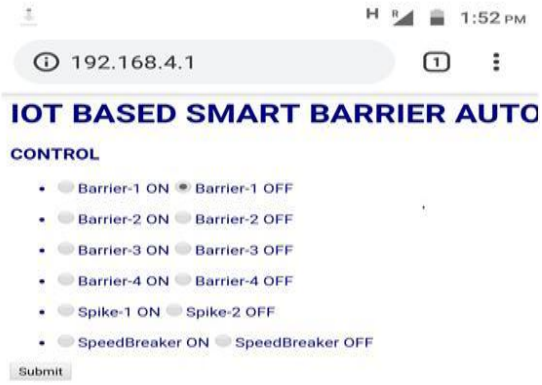

Fig -18: IoT enabled monitoring and controlling the proposed work

7. ADVANTAGES

- Increased safety on the roads
- Less maintenance required
- Reduced traffic jams and congestion

8. CONCLUSION

As the world grows, it emerges with complex problems. The Internet has found solutions to many problems; It is the method which needs to be applied in the right way to find equitable solution. Therefore, we have synchronized the complexities of the road platform with the Internet of Things to reduce the problems. This paper introduced the technical idea by using RFID which is configured with the internet via a cloud platform. The RF sensor helps vehicles to identify the edge and reduce the risk factor. RFID technology contributes to the guidance of less congested emergency vehicles. These proposed systems have overcome the problems of increased congestion and priority operation, which further complicates security. The proposed method makes the process safe and reliable. Therefore, these advanced technologies can reduce the severity of road disasters to a great extent. The above proposed system for IoT based fully automatic road blocker and speed bump for smart city. The Internet has found solutions to many problems. This technology needs to implement minimum speed of the vehicles which helps in reducing the traffic problems.

9. FUTURE SCOPE

In future this project can be extended this system can be used to inform people about breakers or blockers through LCD display, signal and alarm. There is traffic congestion which can operate the blocker or breaker can be controlled via IoT via telephone network and mobile data or manual switch. This technology allows the operator to collect data remotely on a home computer without having to go anywhere. Although the results are encouraging, several improvements should be incorporated into the system. This technology can be applied to roads in the future.

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