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Density based traffic detection system using emergency override

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ABSTRACT

Traffic congestion is a severe problem in many major cities across the world and it has become a major issue for the commuters in all the cities. The delay of respective light is hardcoded in the traffic light and it is not dependent on traffic. This creates unnecessary waiting for drivers, which could not be endurable in every case, as being in time, is important to everyone. Density, speed, and flow are the three critical parameters for road traffic analysis. As the number of road Users constantly increases, and resources provided by current infrastructures are limited, the control of traffic has become a very important issue in the present. Also, one of the major problems faced by heavy traffic is by Ambulances. The aim of this project is to solve traffic congestion which is a severe problem in many modern cities all over the world. The traffic density is controlled using a microcontroller. This the system contains IR transmitter and IR receiver which are mounted on either side of roads respectively. The IR system gets activated whenever any vehicle passes on the road between IR transmitter and IR receiver. The objective for usage of IR sensor is to detect obstacles. The microcontroller controls the IR system and counts a number of vehicles passing on the road. The microcontroller also stores vehicles count in its memory. Based on different vehicles count, the microcontroller takes a decision and updates the traffic light delays as a result. It calculates the glowing time of LED according to the density of vehicles. If the density is more, LED will glow for a longer time than normal average and vice versa. It means that the timing of the traffic lights is set according to the density of the vehicles. This helps in the reduction of traffic congestion and it has a scope for further expansion in the future. By measuring the traffic lined up on a particular road the signal timings are adjusted to let that particular way clear out and then the next populated one. It also consists of an emergency override that allows traffic authorities to remotely let go a particular signal in case an ambulance or important vehicle arrives on that way.

Keywords— *Traffic density control, IR transmitter and receiver, 8051 Microcontroller, Emergency override*

1. INTRODUCTION

Traffic congestion is one of the critical issues in metropolitan cities. It has made commuters lives burdensome. A few years ago, there was a smaller proportion of vehicles on road. Also, the congestion of traffic was minimal. In the present scenario, roads are filled with a larger proportion of vehicles [11]. The primary reason for traffic congestion is growing unemployment and flexible timings in workplaces. By cohering to the timings in workplace which are fixed there is a greater possibility of congestion. The daily routine of the commuters is interrupted due to traffic congestion. This leads to delay in reaching their destination. This, in turn, leads to frustration and tension among the commuters. Everyone has to travel to and from work at the same time each day. The high population density and improper management of public transport system add to the reasons for traffic congestion [14].

Since 1980, the country's population has nearly doubled that is 90% of growth while the GPD (Gross Domestic Product) per capita multiplied by over 5 times. This is higher than anywhere else in the Asia-Pacific region. Also, there are the no priority services for any priority vehicles like ambulance, fire brigade, etc [7]. Hence special services should be provided to priority vehicles. Traffic congestion and mismanagement will result in long waiting, wastage of fuel and money. Therefore it is necessary to have a fast economic and efficient traffic control system for development. The current system can be enhanced by applying automation and intelligent methods that control traffic. It can be applied on a large scale.

Fig. 1: Traffic congestion scenario

2. LITERATURE SURVEY

Chaudhary, Abhishek Badoni and Mohammad Aqdas Khan [1] proposed a traffic control system to stop the traffic jam. The monitor and control of traffic in the city is the important problem in many countries. Traffic control Authority found new ways to overcome the problem because of increase in vehicles. This paper aims to design a smart traffic light controller with the use of an embedded system. This paper also aims to design a safe and effective traffic flow to minimize the delay on roads. Proposed traffic control system handles the emergency vehicle giving it the first priority. Like when an emergency vehicle is passing on the road then the remaining vehicles have to wait till it goes (will be given the red signal). So, the vehicle can easily pass. IR Sensors which are mounted on each side of the road helps to detect vehicle [9]. These sensors also detect the traffic present at the signal and give the input to the microcontroller. The time period will be decided then through programming and provides a signal through the dc control circuit [5]. So depending upon the current traffic at the signal, the time period is assigned to the lights (red, green), which glows accordingly. It's an important feature which is used in the case of emergency.

Prathmesh Nikam and Rohit Patil [2] proposed a density based traffic control system that allows different time slots based on vehicle density. IR sensors that are mounted on each side of road measures the traffic density. For the traffic signal to determine the traffic level (low, medium, high) on road, the roads are divided into 3 sections. For a road having low density traffic that is no sensor on that road was giving output prior to the instant when the signal turns green to that road, the minimum time is assigned when the signal turns green. So that no extra time is given to the road under consideration, avoiding unnecessary waiting. For a road having high-density traffic that is both the sensors giving output prior to the instant when the signal turns green to that road, the maximum time interval is assigned to this road so as to clear traffic on it effectively. The emergency override is done by using a set of RF transmitter and Receiver [1]. The system can save the data about traffic conditions it had to plan for the development of easy transport. RF encoder assigns different RF frequency for each road. As the proposed system uses RF signal for an override, there is a possibility that someone will bring the system down by transmitting false override signals. Therefore, highly secured coded signals should be made to use for emergency override operations.

Vinayaka S Vanjre, Basavaraj. P., Prof. Chetan H.R and N. Dandish B M [3] proposed a Control System to overcome traffic jams. With the increase of population and the vehicles in the cities, the control signals have been playing a major role in managing traffic flow. For traffic analysis, the three main important variables are density, speed, flow. Due to the increased number of vehicle users day by day, the inadequate infrastructure and the irrational distribution of the signaling systems are the main reasons for the traffic congestions. Though the traffic is controlled, the engines are remained on in most cases. So, a large quantity of natural resources like petrol and diesel is consumed without any fruitful outcome. To reduce these problems to a significant level, new ideas need to be implemented by bringing in sensor-based automation technique to the traffic system [4]. In this paper, the density based control system is proposed which reduces the excessive traffic jams, thereby providing a smooth traffic flow. In the existing system, the traffic police control the traffic through the use of hand signs, traffic signals, and markings. The traffic lights that are located in different directions having a fixed time delay, causing unwanted jams on a specific lane while the remaining lanes are vacant. The proposed system identifies the density on each line and assigns the signal timing. IR transmitter and the receiver counts the no of obstructions and gives information about density in each lane. This information is sent to the controller unit. The controller unit will make particular decisions based on the information. The microcontroller counts the no of vehicles and calculates the glowing time of LED, based on traffic density. If density is more, LED glow for a longer time than normal average and vice versa. By implementing the above methods, traffic congestion can be avoided leading to enhancement in the traffic management system.

3. PROPOSED SYSTEM

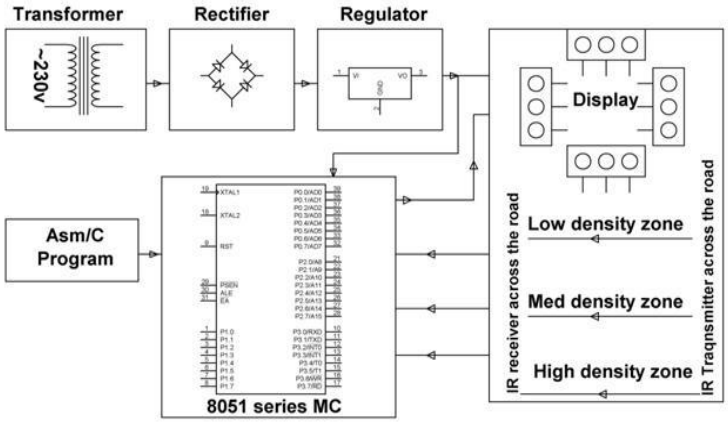

Fig. 2: Block Diagram of proposed system

The limitations of current traffic system are eliminated in the proposed system. In this system, an 8051 microcontroller that is interfaced with IR sensors to change the timing of traffic signal automatically to ensure that there is free movement of vehicles on road. The problem caused due to fixed time delay is eliminated [4]. The proposed system is observed to be more efficient than the existing traffic controller in terms of reducing delay and emergency override feature.

4. HARDWARE COMPONENTS

4.1 Power supply unit

The 8051 microcontroller takes a 5V power supply. The entire circuit is operated with a TTL logic level of 0-5V. It consists of a 12V transformer that converts the 220-230V AC supply to 12V. This is then changed to DC supply by a rectifier circuit. 1kμf Capacitor and a regulator are installed to get supply.

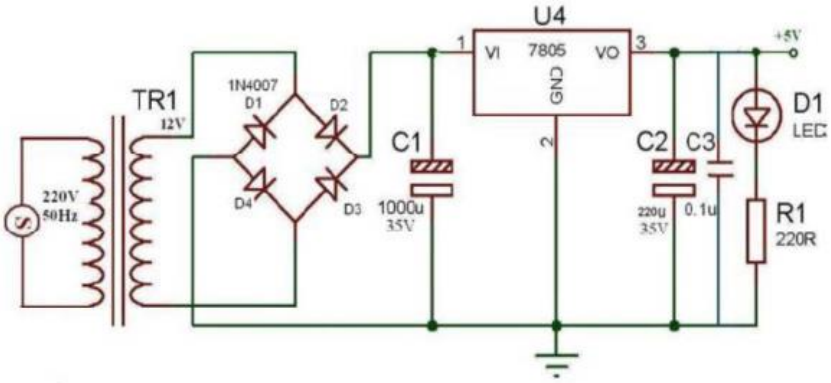

Fig. 3: Diagram of power supply unit

4.2 Control unit

4.2.1 8051 Microcontroller: The 8051 Microcontroller [8] has 40 pins as follows:

- PSEN - reads the signals from program memory.
- Vss - Ground connection (0 V).
- ALE - For de-multiplexing address-data signals.
- EA - For memory interfacing. If no external memory is required then ea is set to high.
- RESET pin - It resets all values of 8051, during initialization of the application.
- Vcc - Main power supply (5V DC).
- Port 0 - serves as Input/Output port, and it also serves the purpose of memory interfacing.
- Port 1- A bi-directional (quasi) port with the internal pull-up.
- Port 2 – serves as Input/Output port.
- Pins 18 - 19: Perform system interfacing.
- Port 3 - controls signaling for the external memory interfacing.

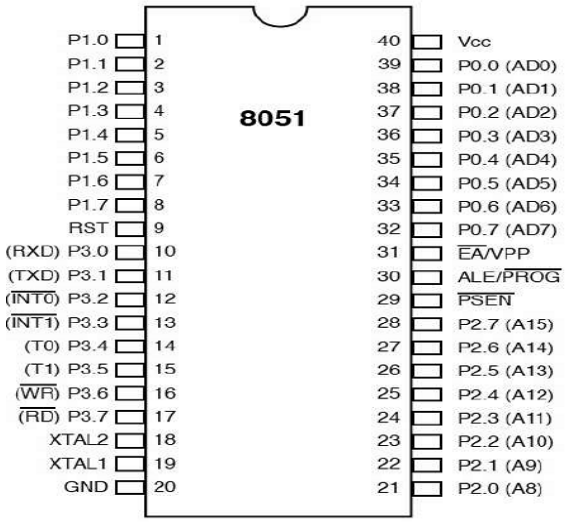

Fig. 4: 40 PIN DIP (8051 Microcontroller)

4.2.2. LEDs: The LEDs used in the system are available in three color- red, green and yellow. They are available in different sizes. The basic LED size is 5mm. The maximum current flow that is allowed through LEDs is 20mA. It can be implemented at a four-way road. The system consists of 12LEDS that is, red, green and yellow at each point of the four-way road [15]. The connection of all LEDs is given to 8051 microcontroller's input/output pins. It is achieved through respective current limiting resistors.

4.2.3. Sensor unit: IR sensors are placed on each road [12]. It is used to measure the density of vehicles at each road. An embedded system comprising of IR transmitter, 8051 microcontrollers, IR receiver, and LEDs is developed for executing the proposed system. The IR transmitter is a unit of an IR (infra-red) light emitting diode [13]. It has the ability to send modulated data within the range of the infra-red band. It is usually a battery-powered handset, like a remote. This is used for emergency override.

5. RESULT

By adopting the proposed system, we can overcome excessive traffic jams thus leading to smooth traffic flow. It provides a modernized way of controlling traffic. This is a real-time project which can be implemented on a large scale. The graph depicts the traffic density at the junctions, classified by the month of the year. This paper describes the traffic monitoring which is essential in the reduction of traffic congestion.

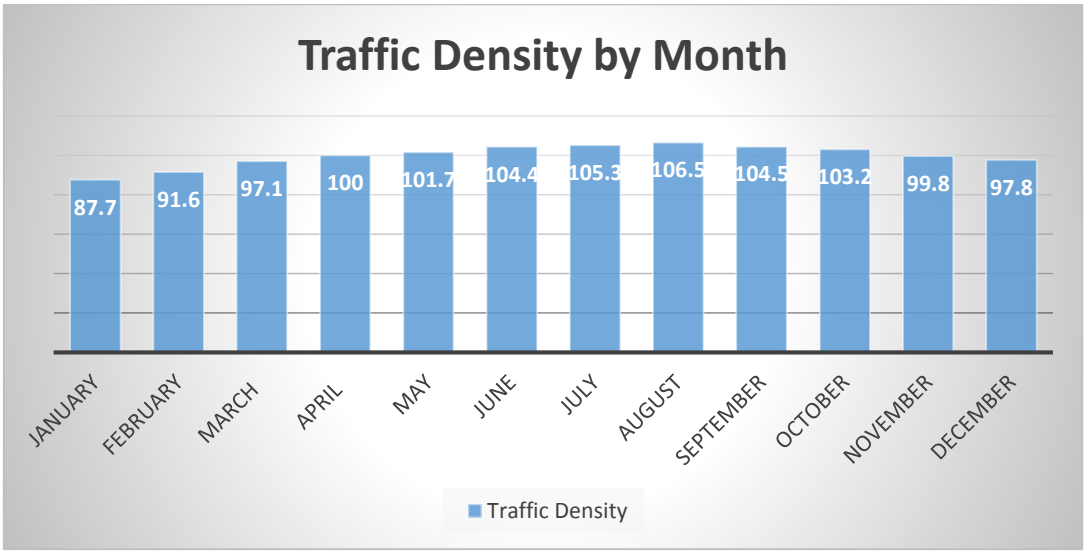

Fig. 5: Traffic density by month

6. CONCLUSION

The proposed system is a density based traffic detection system that provides efficient traffic light control by limiting unnecessary wait on road to a large extent. The number of IR sensors installed will decide the density range of traffic and hence it serves as a priority based system as it provides emergency override features.

7. FUTURE EXPANSION

The future scope of this project lies in the successful implementation of a real-time control system by improving the accuracy of the system. Implementation of the proposed system in large-scale yields benefits like less congestion and thereby less consumption of fuel.

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