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Intelligent Traffic Management by Synchronized Signalling

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Abstract **- Traffic congestion is one of the major problems faced in our day-to-day life. The objective of this paper is to provide an innovative method to solve traffic congestion. In the present day scenario, there are numerous Traffic signals which delay the time taken to reach a destination. In order to overcome this problem, we need to synchronize the signals. The goal of this project is to develop a system which synchronizes the signals so that congestion is managed in better manner. Here, signals across neighboring junctions are synchronized in cooperative method and congestion will be cleared in accordance to the traffic density as well as direction of traffic flows. This paper also uses vehicle speed patterns to predict the traffic flow between two nearby junctions. The traffic flow patterns across all four directions will be analyzed and the same is mapped with various fuzzy rules. In accordance to such mapping, a relevant fuzzy rule will fire required module in real time traffic signal. Hence, the traffic congestion will be controlled in dynamic as well as adaptive manner. A vehicle should travel at a particular speed from one junction to another and we calculate the time limit for changing the signal based on that speed. The core objective of this paper is to provide a cost-effective way to manage the traffic and making hassle free driving.**
Keywords: **Traffic congestion, GSM,IR sensor, Priority inversion, Micro controller.**

I INTRODUCTION

Traffic congestion is one of the major problems faced in our day-to-day life. This paper aims at tackling this problem by an innovative method. In the present day scenario, there are numerous Traffic signals which delay the time taken to reach a destination. In order to overcome this problem, we need to synchronize the signals.

This intelligent traffic system is an independent system in itself and does not depend on any service from any external system. All the functions needed is performed by one or other component of the system itself and all the inputs and outputs concerned with our system is handled by various components of the system itself like sensors, display, processor, etc. Thus the intelligent traffic system with synchronized signals is totally self-contained.

Our paper mainly focuses on optimizing traffic density around five junctions through synchronization of signals between these junctions. Synchronization of signals is the process of coordinating signals along an arbitrary route. This project can be applied and implemented in anything from a small town to a large city. Efficient planning is required for successful synchronization in case of large cities as all the signals have to be timed relatively.

II. METHODOLOGY

Existing Techniques vs. Proposed Techniques

Primitive traffic systems are static as the traffic signals are changed at fixed time intervals. This increases the waiting time of the vehicles on the junction. Even when there is minimum traffic, the cars have to wait due to the static functionality of the traffic system.

Existing techniques cannot handle emergency situations such as incoming ambulance and VVIP vehicles, whereas the proposed system can accommodate these conditions using the GSM standard.

The Existing system incorporates isolated signal processing considering only the lanes of a particular junction whereas the proposed technique considers the entire city (of 4 or 5 junctions) at the time of planning ensuring synchronization of signals thereby reducing the traffic congestion and time delay.

III. IMPLEMENTATION

The main components of the proposed system are:

Microcontroller: It takes all the inputs it receives from IR sensors and processes them based on algorithms stored and provide the corresponding output to the LED and display. It also provide necessary input to the central database e.g. all the inputs, processing and output happen in real time.

IR Sensor: It is placed at every lane of a junction to monitor its status in real time i.e. if a car is present or not. It passes on this input to the microprocessor which then processes it to provide information for LED display and central database.

LED: These directional LEDs act as display unit. They give the status of the signal. If the green LED is on, then vehicles can pass, if yellow, they must slow down, and red to stop. If one lane in a junction has green LED glowing then all the other lanes will have red LED glowing.

Database: The central database stores the logical gate values of the traffic lights namely red, yellow, and green. On is 1 and off is 0 for each light in the signal. One junction would have four directions North, South, East and West and three LEDs for each direction.

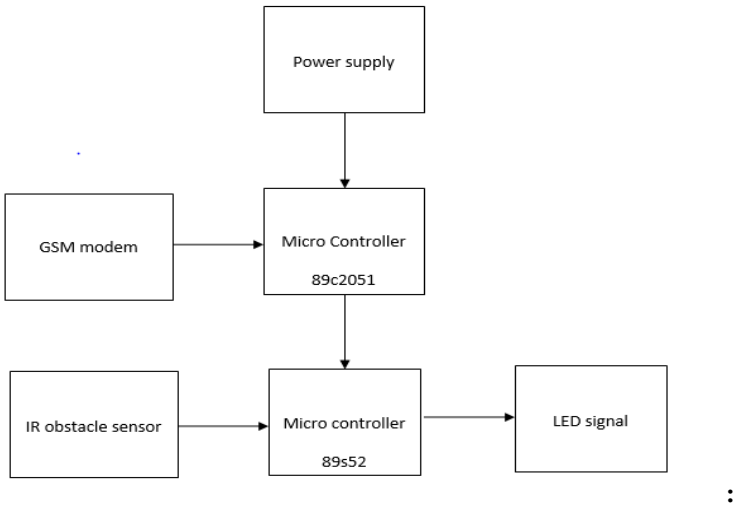

Fig 1. General outlook of the project

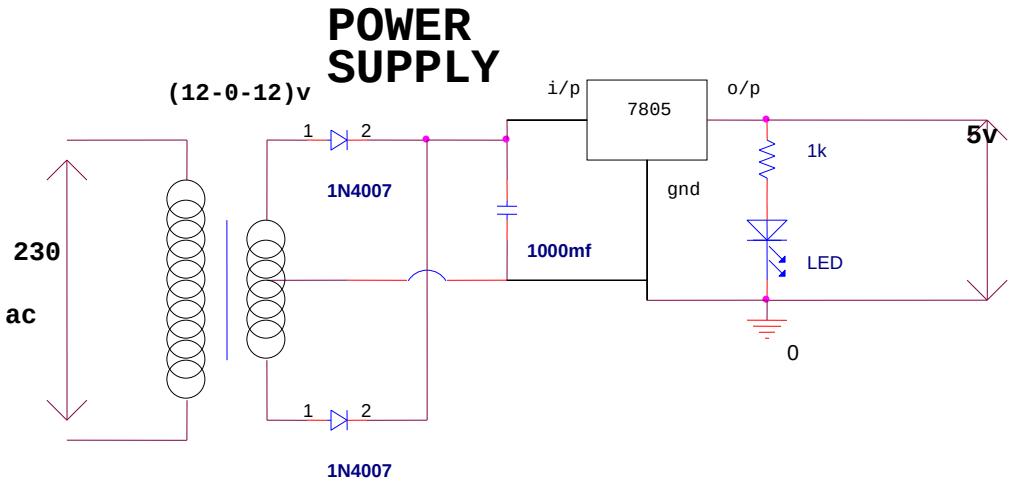

Fig 2. Regulated power supply

GSM: GSM/GPRS MODEM

GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

- Receive, send or delete SMS messages in a SIM.
- Read, add, search phonebook entries of the SIM.
- Make, Receive, or reject a voice call.

The MODEM needs AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network.

GSM – Architecture

A GSM network consists of several functional entities whose functions and interfaces are defined. The GSM network can be divided into following broad parts.

- e Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)
- The Operation Support Subsystem (OSS)

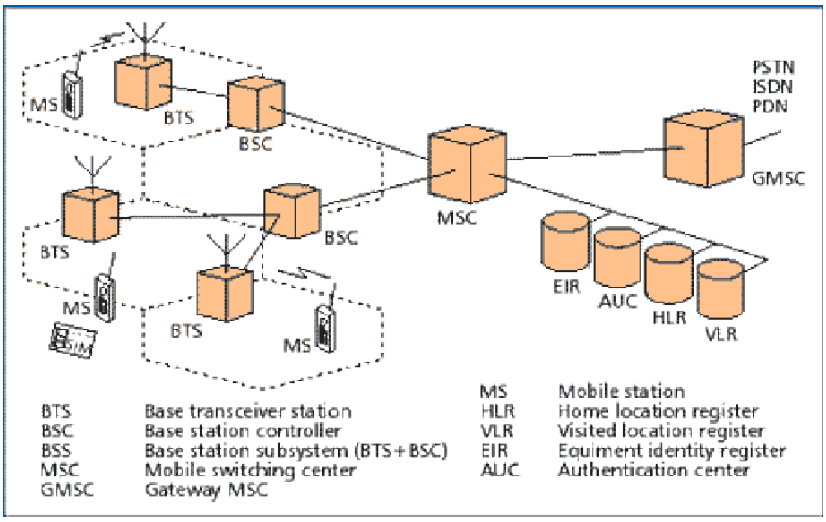

Fig 3. GSM Architecture

Cell : Cell is the basic service area; one BTS covers one cell. Each cell is given a Cell Global Identity (CGI), a number that uniquely identifies the cell.

Location Area : A group of cells form a Location Area (LA). This is the area that is paged when a subscriber gets an incoming call. Each LA is assigned a Location Area Identity (LAI). Each LA is served by one or more BSCs.

MSC/VLR Service Area : The area covered by one MSC is called the MSC/VLR service area.

PLMN : The area covered by one network operator is called the Public Land Mobile Network (PLMN). A PLMN can contain one or more MSCs.
There are three major milestones as well as sever smaller tasks that must be achieved in order to reach the milestones. The three milestones are:

Priority Inversion
In the traffic system, if there is congestion in a particular lane in comparison with the others, then the priority inversion system makes sure that the lane is decongested by giving it higher preference of green lights.
The traffic inversion works by measuring the density on each lane, the traffic is categorized into heavy, average and light traffic.

GSM function
In real time scenario, there are various accidents and emergency situations like passage of for VVIPs or ambulances. To handle such situations, we are employing an innovative idea of sending a text message to the subsequent signal to make way for these vehicles by turning the signal green for them.
Once the emergency condition returns to normal the stack is refreshed and pushed back into sequence to resume normal function.

Synchronization of signals

When a car reaches a signal in the central junction, then the subsequent signals on its way are green. The delay is calculated by measuring the length of the lane and the average speed taken by a car to reach the next junction. This enables minimizing the time taken to reach one's destination and also aids in relieving congestion at the same time.

IV. RESULTS AND DISCUSSIONS

An 'Intelligent Traffic Management System' offers the flexibility of prioritising particular lanes where the preference is given to the traffic on main route in relation to other participating routes. And ,by using priority inversion easily able to handle emergency situations like ambulance /VVIP vehicles.

Sample snapshots

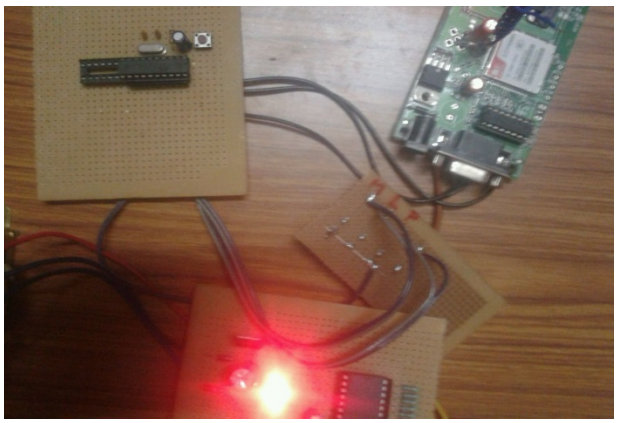

Fig 4. Integration of the modules

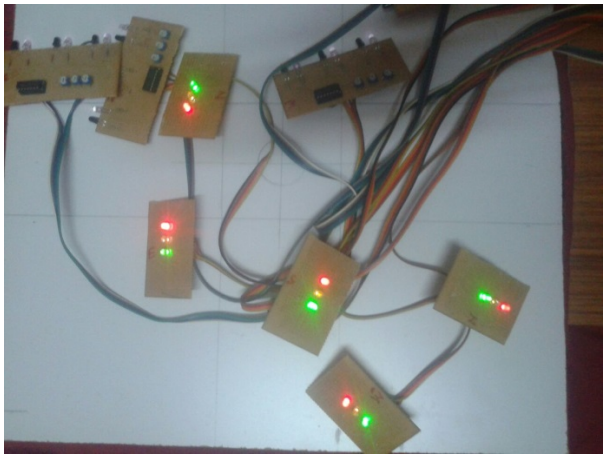

Fig 5. Five junctions enabled with microcontroller.

V. CONCLUSION

This paper sucssesfully demonstrated the self contained intelligent traffic system with synchronized signals,and the handling of emergency cases like ambulance. For future work, the system can also be linked to a fuzzy logic to work dynamically with the traffic density information on each junction.

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