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AN INFORMATION TECHNOLOGY ORIENTED APPROACH TOWARDS AUTOMATING TRAFFIC SIGNALS

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ABSTRACT

Every other day there is a sight of an ambulance stuck in traffic signals. The motorists do not give way fearing possible fine for jumping traffic signal and since most of the signals are automated there wouldn't be any personnel available to tweak the signal and allow the emergency vehicle pass through. This is the present scenario, but it can be widely changed if we can make the traffic signals smarter. The approach that we have come up with, is to turn the signal to green in the path that the emergency vehicle would be travelling. To do this, the location of the emergency vehicle which is tracked in real time along with the destination of the emergency vehicle are passed to a high end sever where using the above stated values the next signal in the path of the vehicle is determined and tweaked to keep the signal free of too many vehicles.

Keywords- *Automation, Ambulance, Emergency Vehicles, Fire Engine, GPS, Green Corridor, IoT, Information Technology, Locations, Smart City, Traffic, Traffic Signals.*

I. INTRODUCTION

India has been ranked as the second largest road network in the world consisting of 1.66 km of roads per square kilometer of land. Being one of the most populated countries in the world the number of commuters and vehicles are in scads therefore comes the problem of traffic jams. As the number of vehicles are increasing day by day, the vehicles get clogged in the signals and must wait for a longer period to commute. The problem gets worse when there is an Ambulance or a Fire Brigade stuck in the signal.

Few cities in India have Area Traffic Control System (ACTS) which optimizes traffic signal, covering a set of roads for an area in a city. It is an intelligent traffic signal control system that use data from vehicle detectors and optimize traffic signal settings in an area to reduce vehicle delays and stops. The control system operates in real time with a capacity to calculate optimal cycle time, and feeds input to traffic signal controllers with a different set of stage timings. The timing plans of traffic controller change automatically to reduce stoppage time, which in turn reduces overall journey time.

Although we have various systems to control the flow of traffic, emergency vehicles such as ambulance, fire truck are still held up in traffic signals. A technology to change the traffic signals when these emergency vehicles approach must be implemented to save many lives. According to survey done in recent years there are many lives lost because of delay in ambulance reaching the destination due to traffic halts.

II. DELAY OF EMERGENCY VEHICLES AT SIGNALS

A. What are Emergency Vehicles

There are several emergency vehicles that are established in every country. In India, also there are a lot of emergency vehicles, these include ambulances, fire engines, police vehicles etc. These vehicles' free movement is very necessary for saving life or averting a possible catastrophe. Restricting the smooth drive of these vehicles is not expected at any point of time.

B. Cause of delay

Even though there is an existing rule that emergency vehicles should be given way, it is hardly followed. In other parts of the world like the Middle East and West, there are clear rules and methods available to allow and emergency

vehicle pass through at ease. In India, though due to various reasons even though a rule is in place, there are no appropriate measures taken to apply this rule into practice. The most seen scene is of emergency vehicles waiting at the signal since the motorists in the front are reluctant to move fearing of possible fine they might incur by jumping the signal. And even if the motorists were to move, still there will be a good amount of time wasted due to the high number of vehicles that would be present at the signal.

III. EXISTING SYSTEM

In the existing system, the only method available is purely manual. When an emergency vehicle needs way, the occupants convey the message via radio's or other means to the traffic department who in turn should send some personnel to clear the desired path of any vehicles by restricting the traffic flow until the emergency vehicle pass through. This method has been proven to be effective in some cases. It's called the green corridor. The green corridor has been successfully implemented in needs like transporting organs and in some cases to transport a patient for an immediate surgery. But this method cannot always be used, every day emergency vehicles like ambulance or a fire engine or a police vehicle keep plying on the road and these cannot be facilitated by green corridors always because it'll create havoc in the traffic.

IV. TERMINOLOGIES

A. GSM

GSM is used as a telephony system that is most commonly used in Europe and other parts of the world. It was developed as a standard to describe the protocols of 2G (second generation) cellular networks. One of the many key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. The network structure of GSM contains of a Base station subsystem, a network and switching subsystem, GPRS core network and the operations support system. GSM is a cellular network which means phones connect to it by searching for cells in the immediate vicinity.

B. IOT (Internet of Things)

Internet of Things utilizes electronics, software, sensors actuators and network connection to create an interconnection between various physical devices. With rapid developments happening in the IT sector, IoT has gained a lot of attention and is being implemented at a very quick pace. IoT is a great platform today for concepts like Smart City and Smart Energy Management Systems.

C. GPS (Global Positioning System)

It is a space-based navigating system and is owned by the United States Government and the operation is taken care by the United States Air Force (UASF). It is a GNSS (global navigation satellite system) which is used to provide geolocation to a GPS receiver in all weather conditions, at any part of the world where there is an unobstructed view of four or more GPS satellites. There are currently 31 satellites in orbit for GPS. The precision of GPS is ideally 5 meters and its coverage is globally available.

D. Embedded System

Basically, an embedded system is a simple computer unit with a dedicated function to be performed. Mostly, an embedded system is used for real time applications. Since embedded systems use embedded processors, they consume far less power than other kind of systems. And since these processors use a surface mount form factor the size of the embedded system is mostly very small. Embedded system ranges from systems dedicated to do only one task and without user interfaces to completely complex graphical user interfaces that perform real time heavy weight applications.

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V. PROPOSED SYSTEM

In the proposed system, we are trying to provide a mechanism to overcome the delay that emergency vehicles face at the traffic signals and ensure a smooth drive through for all the emergency vehicles when under an operation. There are two sides for this system, one in the emergency vehicle and the other one at the signal. The emergency vehicle will be having a smartphone with GPS capabilities. And each signal will consist an embedded system as shown in Fig. 1, equipped with the code to alter the signal if necessary.

First, the driver of the emergency vehicle in case of an emergency will turn on "emergency mode" in the application that would be pre-installed in the smartphone. Once this is done the application will search for the best route available and starts navigating. In google maps there is a functionality through which a user, when navigating from A to B, can search for restaurants, petrol pumps, coffee shop etc. along the route they have chosen. Therefore, using googles API's we can device a method through which we can identify and list down all the existing signals in the best route that had earlier been selected in the same order as they appear in real life. This information along with the emergency vehicle's GPS coordinates are used to find the upcoming signal in the route. After this is found, as and when the emergency vehicle is around 500 meters away from the signal, that particular signal is changed to green so that the existing vehicles will move out of the way even before the emergency vehicle reaches the signal. And after the emergency vehicle has passed the signal and completed around 100 meters the signal will be restored back to red. This is in case the signal was red, if the signal is green already, it is kept green itself until the emergency vehicle passes. When this is applied, the vehicles in the other roads must wait for higher time than they would have had to. To overcome this issue, the time from the moment the signals are tweaked till the signal is reinstated is automatically calculated and is divided among the other roads that had lost time.

Figure:

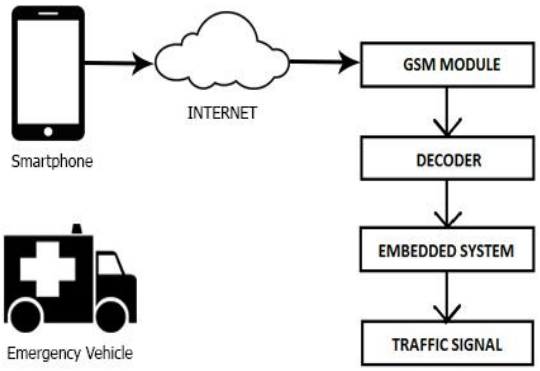

Fig. 1. Block Diagram of the System on Signals

VI. CONCLUSION

This paper discusses a method through which the emergency vehicles can be given a green path at signals so that they wouldn't have to wait for long periods. This method is cheap and that is the boon of this system. All that is needed is an embedded system at all the signals, which are very easily available these days and a smartphone (preferably android), with google maps and a stand-alone application in the emergency vehicle. Other papers that we have referred to in this paper are also very effective in attaining the same result but are costlier methods since most of them have suggested to use sensors which are costly and more difficult to install. Further, this method can be extended by making all the traffic signals to be connected and controllable from one control station so that it is more easy to keep track of all the signals and modify if necessary. This method can also be used to implement 'Green

Corridor', mostly used to transport organs and patients with emergency conditions on road and has a lot of time constraints.

VII. ACKNOWLEDGEMENTS

TVasuki Shankar et.al in their paper [7] "Automated Traffic Signal for Hassle Free Movement of Ambulance" have given a way of using RFID tags to detect any emergency vehicles on the path and switch the signal.

In [1] the authors provide a design of an integrated intelligent system for management and controlling traffic lights based on distributed long range Photoelectric Sensors in distance prior to and after the traffic lights. The traffic management department determines the distance for sensors to monitor cars moving towards a specific traffic and then transfer this data to software installed in the traffic control cabinet to control the traffic lights depending on the sensor readings. It will monitor the traffic and gives longer time to the overcrowded traffic.

In [2] the authors present an intelligent traffic signals control system based on a wireless sensor network. It evaluates the length of the queue during the red cycle to determine the duration of next green cycle. It is useful in reducing the average waiting time in traffic depending upon the number of vehicles in each traffic signals.

The authors in [3] use fuzzy logic adaptive traffic controller. According to the observed changes, the controller can adjust signal timing. The decision to extend or terminate the current signal phase and select the sequences of phases is done by three levels model of fuzzy controller.

In [4] the authors propose a wireless Sensor Network based adaptive traffic interaction system in which communication of traffic light in one signal with traffic light in next signal is possible. The prioritization for clearance of traffic for special vehicles is achieved through sensors.

To make the traffic light controlling more efficient, the authors in [5] use technique called as intelligent traffic light controller which makes use of sensor networks along with embedded technology. The traffic on all adjacent roads are considered to intelligently decide the timings of red and green lights which can be helpful in smooth flow of traffic and prevent traffic congestions.

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