A DESIGN OF EMBEDDED MODULE FOR EMERGENCY VEHICLES (AMBULANCE): A CAR FOR CARE

Abstract

In recent times, accidents are increasing parallel with the ongoing increase of vehicles on the roads. In short, we can say that road accidents have drastically increased and are inexplicable. The valuable life of humans must be saved from accidents. Traffic congestions caused by the increased number of vehicles which lead to making a serious impact on emergency Vehicles like an ambulance. So the most aspect of controlling the traffic signal for emergency ambulances is highlighted by this proposal. A scheme called ETCS (Effective Traffic control system) using a wireless sensor and voice recognition module can be introduced to control the ambulance movement in the traffic time prior to 1 km of traffic signal which can reduce the loss of human life due to traffic congestions or accidents. The sensor which is attached to the ambulance will generate the signal prior to one km from the traffic signal and be received by the traffic system then without any interference from human control the traffic system will allow the ambulance very safely. This effective automatic control system of traffic light guides the ambulance to reach the hospital. The sensor which is used in this project is a voice recognition module and wireless sensor, in which both will have a transmitter and receiver attached to the ambulance and the traffic signal. The program will be written in embedded C. The main concept of this theme is the passage of the ambulance during heavy traffic congestion.

Keywords: Emergency vehicle, RF transmitter/receiver, Voice recognition module, Traffic signal, Sensor

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I. INTRODUCTION

The methodology hinges on three main steps: first, establishing a solid background for the issue; second, identifying the problem for Ambulance in traffic congestion; third, indicating the steps/components of possible solutions. Establishing a solid background requires a review of the literature and related information on transportation and traffic engineering system. The first step in establishing the background will be defining the planning of execution and its requirements, and providing a guideline for the planning process. The second step in establishing the background would be done for traffic stream parameters on which the data collection will be based on. Explaining the relationship between the parameters of the traffic stream will facilitate collecting the data which will ease for next step. All the data collection methods will be manual techniques based on the manipulation of traffic stream parameters. The data collection is done in the context of Coimbatore. Identifying the congestion with respect to the ambulance and clarifying the traffic congestion will guide us to form the components of possible solutions. This division describes the background of a traffic signal, its congestions and the objective that we need to overcome using RF transmitter/receiver and voice recognition module. It also describes the sketch of this project work and the content of each session of this work.

The main ideology of this proposal is to ensure that emergency vehicles like ambulances reach the hospital on time thus saving valuable human life. This proposal helps to clear the delay caused by traffic congestion and regains the smooth flow of emergency vehicles like ambulances. This system is equipped to control the traffic signal and helps to locate the ambulance and thereby guiding the vehicle to the hospital safely on time thus saving human life. The sensor which is attached to the ambulance receives signals from the automatic control system of the traffic light that guides the ambulance to reach the destination of the hospital. The sensor which is used in this project is a voice recognition module and an RF sensor, which both will have a transmitter and receiver attached to the ambulance and the traffic signal. The program is written using an embedded system. Passage of the ambulance during traffic congestion is the theme behind the paper.

When the ambulance approaches the sensor detects and the traffic signal is turned green towards the direction of the ambulance and when with signal turns green it displays "**Emergency ambulance**". This is given in order to warn the pedestrians and the motorist to give away space for the ambulance thus helping the ambulance to reach the hospital at the correct time. At first, we place two units one has a sound sensor and an RF sensor, one at a distance of half a km from the traffic signal and the other 1km from the traffic signal. This is done in order to make sure that the ambulance is coming in that direction

At this point, the sensor sends the data to the traffic signal system and the signal turns green while the signals in all the other directions turn red until the ambulance crosses the signal. During this time" **Emergency Ambulance**" is displayed on the **LED** display board. And almost immediately as the ambulance leaves the traffic control signal limits the traffic

restores to normal. These are the procedures that take place when the ambulance approaches the traffic area limits.

1. **Traffic Congestion Problems:** Traffic congestion is one of the major uprising problems in the world especially in populated countries like India. There is a drastic increase in the human population and a rise in vehicles on the roads. And another problem is due to the lack of a poor road management system and the responsibility of an individual.

   Due to this population, more number of cars and other types of vehicles are found on the narrow roads. As it is needed for a family consisting of four members or more. Poor infrastructure of roads in the city leads to traffic congestion as these roads are for a smaller population. The causes of various traffic congestion:

   - Encroachments of private lands.
   - Establishment of commercial and religious buildings in the location which is used for expansion.
   - Poor road design which is unplanned for future population.
   - Lack of bus bays and cycle tracks
   - Very poor coordination between various government departments

2. **RF Transmitter/Receiver:** The main purpose why we use RF is that it can pass through the conducting materials also thus there is no loss of data. The RF plays a crucial role in communicating with the traffic unit. The transmitter which is placed on the ambulance is used to transmit an RF signal to the receiver which is placed half a km from the traffic unit. This is done to make sure that the ambulance is approaching that direction so that it can open the signal for the passage of the ambulance. The RF is turned "ON" only when the siren is turned ON. This is done only to make sure that the ambulance is in an emergency situation.

3. **Voice Recognition Module:** The voice recognition module is a small and compact board. It is an easily controllable speech recognition board. It can support up to 80 voice commands. The main role of voice recognition is to detect the sound from the siren of the ambulance. This voice recognition module is placed one km apart from the traffic signal unit so that it makes sure that the ambulance is approaching in that same direction. So when the voice module detects the sound signal and it sends the data to the traffic unit at a moment both the inputs are the traffic unit turns green. In this project, when the RF transmits a signal to the RF receiver and when the voice module also receives data, when both the inputs are transmitted to the traffic unit and both are true signals in the traffic unit turns green for the passage of the ambulance. Thus saving the life of a precious human life. Rajeshwari Sundar 2015[1], et al This paper pledges with intelligent traffic control system to pass of ambulances or emergency vehicles. Every emergency vehicle consists of an RFID reader and NSKEDK-125-ttl & PIC16F87A, which is used to read using this we can count the number of vehicle present or passed. According to the number of vehicles, it changes the signal to green. In this module consist of Zig Bee module with CC2500 and PIC16F877A for the use of wireless communication between traffic

controller & ambulance. SarikaB.Kale 2013[2],et al This paper deals with a distinctive feature that will be very much time-saving and efficient for the ambulance driver. It helps the driver to take a substitute route in case of a traffic block. The numerous features which are used for evolutionary criteria are average waiting period, average and distance traveled by vehicle switching time period of green light at a cross-section, capable of tight situation mode of operation and appeasing operation of SMS with use of GSM mobile. The arrangement is based on the correlation between the fixed mode traffic light controllers and Intelligent traffic light controllers. The designed component is simple, fast reaction time, user friendly, and has scope for further development. Suresh Sharma 2013[3], et al This paper applies RFID movement control wipes out issues that for the most part upraises with standard activity control frameworks, particularly which manage picture preparation and pillar intrusion methods. This RFID module works with multivehicle, multilane, multi-road intersection territory. It is an uncommonly time productive plan, the dynamic time plan is worked out for continuous for the section of movement column. The number of vehicles in every segment and the steering are upon the count and it is based on judgment. Mr. S.Iyyappan 2013[4],et al In modern days road accident shave increased to certain level. There is a loss of human life due to an accident. Traffic congestion is the major cause of delays in ambulance services. To avoid this, they propose a system called ITLS (Intelligent Traffic Light system).

The main idea behind the scheme is the smooth flow for emergency vehicles like ambulances to reach the hospital in time thus saving the life of human beings. The project vehicle is controlled by the control unit which outfits adequate course to the crisis vehicle and moreover controls the action light according to the crisis vehicle zone and thusly accomplishing the mending office securely. Manoj Prabhakar K2013[5], et al. In today's world due to heavy and crowded traffic, it is necessary to save human life by taking the patient to hospital as soon as possible. In this paper it explains how it detects an ambulance among the thick traffic using GPS which replaces the RF transmitter receiver circuitry. This paper also uses image processing technology to identify the ambulance presence. Fuqiang Zou Bo Yang YitaoCao 2009[6], et al this module manages confounded activity lights checking control system. In the present movement lights observing framework can't make full utilization of paths. In this topic, the activity stream is distinguished by the single hub attractive sensor and transmitted by remote sensor arrangement. In order to realize a real-time dynamic control of traffic lights and to reduce the vehicle passing during the green lights would be dynamically adjusted by the fuzzy algorithm. Contrasting with conventional activity light settled cycle system, it is more appropriate to the many-sided quality of current movement condition. Jin-Shyan Lee 2008[7],et al This module reveals a frame work and a technique for canny movement control utilizing remote sensor and actuator networks. This framework comprises the control center, Mprovincialen try ways, and Nsensor and actuator nodes. The N sensor and actuator hubs and L bunch head shape L clusters. Each group incorporates a group head and at least a sensor and an actuator node. This framework and strategy apply a disseminated registering methodology to naturally change the activity control on each activity stream in this manner accomplishing a proficient activity control. Marco Wiring 2004[8], et al Vehicular travel is expanding all through the world, especially in substantial urban regions. Consequently, the need emerges foreign acting and enhancing activity control calculations to better suit this expanding request.

In this paper, we contemplate the reproduction and improvement of activity light controllers in a city and present a versatile streamlining calculation in view of support learning. We have actualized an activity light simulator, Green Light F that enables us to try different things with various frameworks and to think about various movements of light controllers. Exploratory outcomes show that our versatile activity light controllers beat other settled controllers on every examined framework. Dave Gross 2001[9], et al, the cutting edge creation unveils a framework that enables administrators of crisis vehicles to get realistic information with respect to other crisis vehicles that may associate in the danger of crashing cars. The programmed flagging occurs between crisis vehicles inside the scope of each other to transmit directional information with respect to the course of movement of every crisis vehicle. The system includes equipment for pre-empting traffic signals by selected emergency vehicles and for informing other emergency vehicles that traffic signals have been pre-empted. Jerome H.L Emelson 2001[10], et al, this is a framework for controlling activity and movement lights and specifically conveying cautioning messages to drivers is depicted. The activity data is transmitted to no less than one focal controller. The focal controller is utilized to decide blockage parameters and cautioning data. The blockage parameters and the notice data are transmitted from the focal controller to the clever controllers. The clever controllers are utilized to decide fitting activity in view of the clog parameters and the notice data. Worldwide Positioning System innovation is utilized by the System and strategy keeping in mind the end goal to track moving vehicles and Signs and have the capacity to communicate with crises vehicles. Paul A. Markow 2000[11],et al, In this framework, it is utilized for notice driver of the procedure of a crisis vehicle is provided. The framework incorporates a transmitter adjusted to be coupled to the crisis vehicle for emanating a crisis signal. This framework likewise utilizes bearing observing receiving wire adjusted to be coupled to the vehicle of a driver's vehicle, a recipient coupled to the course discovering reception apparatus and adjusted for getting the crisis flag and creating a directional flag accordingly. Michael R.Smith 1988[12],et al, A framework to enhance activity stream on a wide range of interconnected roadways, which lessens fuel consumption, emissions and outing times, depends on versatile control the direction and movement flag timing. The parameters used to practice this control are produced by detecting nearness, span, time, and speed of vehicles passing restricted street fragment upstream from the signalized crossing point and with convergences in closeness to each other, likewise downstream from that crossing point. The data created by every sensor is prepared into three running total amounts, total force information, total experienced clog information and total halted vehicles information. A fourth amount, activated by conditional unit distinguishing proof, depends on the speed and thickness of a little example of vehicles and paces reaction time to a moving toward detachment by preempting signal planning quickly. For crossing points implanted in arterials and systems of streets, a fifth amounts presented by a customized clock, which acts to synchronize the planning counterbalances between nearby convergences, to speed up the movementstreamgiventhenormalactivityconditionandotherdata.Thetotalamountsaresumm edtogetherinblendsdictated by the movement flag condition. The entireties are contrasted and proportional aggregates created by processors related to the meeting road way, producing a distinction extent which thus controls a movable rate clock, contingent upon existing sign conditions.
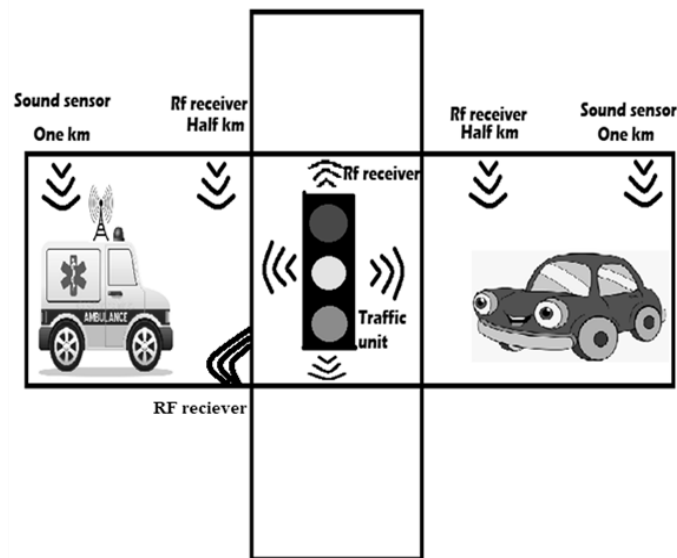
Figure 1: Simplified block diagram of proposed system

II. PROPOSED MODEL

The main ideology behind this is the safe and time effective passage of ambulance during traffic congestion. When the ambulance reaches the traffic limit the RF attached to the siren transmits signal which place at distance and the voice module which placed at another distance detects the siren sound and when both inputs are true for the receiver at the traffic unit the signal turns green. Thus allows an easy passage for the crises ambulance. The major requirement for this project is with use of Arduino MEGA and the software used based on Arduino software program. And it uses RF transmitter/receiver for long range transmission for transferring data and voice recognition module to identify the emergency vehicle in order to find the direction of the vehicle.

Arduino MEGA: Arduino is a signal board micro controller kit for building digital devices. Arduino consist of programmable C circuit board and a software or IDE (Integrated Development that can be used to run on the computer and it is also used to write program and upload it to the arduino board. The main reason why we use arduino is for easy interface of equipment and of low cost. We write a program for these equipment and we upload to the arduino. The basic language which is used to write the arduino program is C++. The operating voltage of arduino is from 5V and the input voltage is from 7V-12V signal. So when it receives the signal it transmits data to the traffic unit. The same procedure is done with the voice module placed one km apart from the traffic unit. The Arduino mega is used to for complex projects as it contains more number of pins comparing to the other type of arduino boards. Arduino Megaisa based on microcontroller board. It consists of 54 digital input and output pins and it   will very useful for this project. It can be powered by USB cable with help of a computer or it consists of AC-DC adapter to run the board. So these are the basic keywords needed in order to under- stand the Flowchart used for writing a arduino program. At first we initialize the program with siren and RF transmitter from the ambulance then the receiver at a half a km from the traffic signal and the voice recognition module

placed at a distance of one km from the traffic unit and the receiver at the traffic signal is also kept at stand by to receive signal from the RF transmitter. If the siren is turned ON and the RF transmitter is also turned ON and If both the inputs are true only then the signal turns green and even if the RF receiver input is true, the signal turns green. All these transmission of signal take place in RF transmission. And again when the RF transmits signal to the receiver near the traffic unit in order to find out the passing of the ambulance and the traffic is restored back to normal. An RF receiver is placed at a distance of half a km from the traffic signal, as the RF receiver gets the signal from the RF transmitter it sends the signal to the traffic signal unit through another RF transmitter unit attached to the receiver unit.

1. **RF Transmitter and Receiver:** RF module, radio frequency is a device that is used to transmit or receive between two electronic devices. So same kind of principle takes place in this project which is the transmission of signal and receiving of the signal. The whole idea is based on transmission and receiving. Depending upon the frequency range, the distance of the transmission range also increases. In order to transmit the signal to a distance of 1km we use the 433MHzRF Transceiver module which uses the frequency band from433.4 –473.0MHz and the transmitting power is from 100mW. So in this module, we use a long transmitting frequency of up to 1km in order to communicate with the ambulance and make sure the ambulance is in the right direction. So when an ambulance arrives with an RF transmitter module it starts transmitting only when the siren is turned ON in order to find out it's in crisis situation. When ambulance RF is turned ON it starts transmitting signal. This is the basic function of the RF Transmitter/Receiver unit in the system. The process of work in the device is that initialize the siren and the RF Transmitter so whenever the siren is turned the RF transmitter is also turned ON. So this is the basic working principle of the RF module in the project. This RF receiver module which placed Half a km from the traffic unit. This only works when an RF receiver receives the signal and sends the signal to the traffic unit. This module is always in standby mode. So it is done in order to receive a signal at any instant in time.

2. **Voice Recognition Module:** The voice recognition module also plays a vital role in the proposed system. The main purpose of the module is to identify the crises vehicle with the help of the siren sound which is attached to the ambulance. The voice recognition module is compact and easily interfaced. We load more than 10 voices of the siren as it can support 80 voice commands. So when a siren sound is detected it processes the voice with the given input command voice. As it can process up to 7 voice commands at the same time. The operating voltage is from 4.5-5V. The voice recognition module is a small and compact board. It is an easily controllable speech recognition board.

   The main role of voice recognition is to detect the sound from the siren of the ambulance. This voice recognition module is placed one km apart from the traffic signal unit so that it makes sure that the ambulance is approaching in that same direction. So when the voice module detects the sound signal and it sends the data to the traffic unit. And when both the inputs are the traffic unit turns green. The voice commands are stored in these kinds of libraries containing 7 different voice commands. So at one time, 80 voice commands can be stored in the voice recognition module. So at a time, it processes 7 voice commands from the   80 input commands. When the siren sound is detected then it

sends the signal to the traffic signal unit using an RF transmitter unit attached to the voice recognition module.

When the RF module and Voice module receive the signals. The signal at the current direction turns yellow to warn the vehicle and the signal to the direction in which the ambulance is approaching turns green.

III. CONCLUSION

Planning is the process that determines what needs to be done and how it needs to be done. Occurring at different levels, planning was made by the number of hospitals, number of ambulances present in that area, four/three-way lane, distance and availability of hospitals and mainly population of the area. Planning places was modified to a large or a reduced extent based on the ideas that dictate what the place should serve or become. The traffic flow has vital parameters that are related to it. The traffic flow parameters are to allow those who will do the analysis to understand driver and vehicle behavior in addition to identifying variations in the traffic flow. Since the traffic stream is an arrangement of vehicle and driver behavior, it is considered as a no-uniform stream. The main factors that contribute to the non-uniformity of traffic streams are human behavior, signal system, and the interactions of all the stream parameters with each other. It is safe to assume that these parameters are predictable within a range that is set by traffic regulators. Parameters of the traffic stream are classified as macroscopic which describes the traffic as a whole including quantitative parameters (density, flow) and qualitative parameters (speed), or microscopic which describes the conduct of vehicles and its impact on the stream. The first part of data collection will cover mainly, survey design, data analysis, and collecting a number of hospitals and their respective number of ambulance and household data. As per the source of traffic congestion, there are three intersections. The role of traffic intersections is to regulate vehicle pathways. The complexity of traffic intersections increases when vehicles from different lines and pedestrians want to occupy the same space at the same time and improper traffic control. In the end, the crucial part of the project for getting the desired outcome.

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