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SAFETY BENEFITS OF FORWARD COLLISION WARNING IN VEHICLES

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Abstract:

Traffic congestion and tidal flow management aretwo major problems in modern urban areas which lead to road accident and loss of life. To implement this, we introduce Automatic Ambulance Rescue System (AARS). The main idea behind this scheme is ambulance can reach smoothly to hospital in time, by mechanically controlling traffic lights in path. The ambulance is controlled by control unit which gives the shortest path for reaching hospital and controls traffic lights. The sensor senses the spot and the nearest ambulance reaches the accident spot. The traffic lights in the path of the ambulance are controlled. The ambulance is guided to hospital by server through shortest route. The vehicle unit installed in vehicle senses the accident and sends the location of the accident to the main server in the ambulance section. The main server finds the ambulance, nearest to the accident spot and also shortest path between ambulance, accident spot and nearest hospital.

Index Terms: MicroElectroMechanical Systems (MEMS),Automatic Ambulance Rescue System (AARS), Vehicle Section, Ambulance Section, Signal Section, Global System for Mobile Communications (GSM), Global Positioning System (GPS), Microcontroller.

I. INTRODUCTION

Human life is affected due to delay in the arrival of ambulance. The ambulance is not able to reach the hospital in the golden hour. It gets stuck in the traffic signals. It would be of great use to the patient if the traffic signals in the path of the ambulance are ON. There must be a system by which the ambulance would reach the accident spot and then hospital as soon as possible to carry out health services [1]. The existing systems are post accident detection systems. It has lack of intelligence. It fails to track the rear-end collision and pre-damage status. It depends on the way of monitoring people to be manual. It requires manual work to save human life which results in time delay and because of that first aid cannot be provided to the patient on time. This leads to loss of human life.

In Pre-collision system, one or more systems may not activate due to sensing and tracking limitations. The actual field performance may be less effective. Limitations in the algorithms and sensors may cause difficulty in real world applications. Moreover, it may use more complex algorithms to determine collision risk. There will be different effectiveness for different algorithms. For the driver's state, there was only limited information available prior to the collision. There was no effect of pre-collision systems on driver maneuvers such as steering, other than breaking. Further simulation of driver braking deceleration without instrumentation in real -world collision was not feasible beyond constant magnitudes. It did not capture all braking inputs of driver that were possible [2]. These are the disadvantages of existing system.

In this paper, we have described a design for automatically controlling the traffic signals so that the ambulance would be able to cross all the traffic junctions without time delay [3]. The server keeps a database for each node for easy access. Hence, each node will have a unique id for addressing the data. The ambulance is guided to the hospital by the server through the shortest route. The sensor installed in the vehicle senses the accident and Global Positioning System (GPS) tracks the location of the accident. Through GSM (Global System for Mobile Communications), it sends the location of the accident to the ambulance section. The buzzer produces sound when accident occurs. The central unit finds the ambulance, nearest to the accident spot and also the shortest path between the location of the accident, ambulance and the nearest hospital. Here, wireless technologies are used for information transferring.

The traffic signals on the path of the ambulance are controlled. When the ambulance reaches the traffic junction, the encoder converts the serial data into parallel data when it passes from the transmitter

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to the receiver. If the signal is red, it comes to green automatically. The decoder in the receiver section converts the parallel data into serial data when it is sent back. This helps the ambulance to cross the traffic junction as soon as possible. The prioritized traffic switching is done priority wise, i.e. if two ambulances are coming at the same time, the ambulance which will arrive first at the traffic junction will be given the priority to cross the traffic junction before the next ambulance arrives [5]. In this way, using wireless technologies, the information is transferred and the traffic signals are controlled so that the ambulance would be able to reach the hospital on time. [4] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .As per as security is concerned today most of the vehicles are running on the LPG so it is necessary to monitor any leakage or level of LPG in order to provide safety to passenger. Also in this fast running world everybody is in hurry so it is required to provide fully automated maintenance system to make the journey of the passenger safe, comfortable and economical. To make the system more intelligent and advanced it is required to introduce some important developments that can help to promote not only the luxurious but also safety drive to the owner. The system "Efficient Sensor Network for Vehicle Security", introduces a new trend in automobile industry.

II. RELATED WORK

Significant work has been done by the help of which a design for automatically controlling the traffic signals has been described.

The applications of powerful portable devices for human activities are described [6][7]. An automated mobile system for road safety services is described. It provides support to emergency service vehicles (EV) for accomplishing the mission faster. It is more reliable. The system must be based on standards, fully automated, flexible, intelligent and low cost. The availability of more pervasive and newer communication networks such as Zig Bee, WiMAX and mesh networks is more reliable. The objective of the system is to fulfill the needs of an error free and efficient emergency system. In case of an accident, it can accurately and quickly find the ambulance and send it to the accident spot without the requirement of manual work. It is made to reduce human errors, wrong data or treatment.

The solution to traffic congestion problem and an advanced algorithm have been described to find the shortest path in car navigation system [8][9]. It is difficult for many drivers to find an efficient route. These systems can perform the task of determining the best path to the destination. The process of finding the shortest route from one point to another is called routing. A new algorithm is proposed in this paper. It is a modified version of dijkstra. These methods can improve used memory and run times because the visited edges and nodes are limited. Traffic congestion is a social problem that occurs because of the increasing number of vehicles. Here, a pheromone model is applied to a traffic signal control to alleviate traffic congestion. It is spread by vehicles across the road. The amount of pheromone correlates to traffic congestion. The factors of traffic signals are controlled by the pheromone to reduce the inactive time in front of it.

In the references [10][11], the emergency rescue system reliability on highway and intelligent ambulance have been described. To make sure, that the ambulance would arrive at the location of the accident on time and would reach to hospital as soon as possible to provide health services to the patient, the emergency rescue system started. It analyzed its structure on highway in three ways: rescue plan, incident detection and equipment management. The reliability of the system is discussed based on the travel time. Then a mathematical model of the reliability of travel time is established. At last, a model example for the reliability of travel time is showed. The intelligent ambulance is designed for the wounded to maintain the level of self-balancing state. To detect the gravitational vertical stretcher, it works on the principle of gyroscope. It is converted into pulse signals to drive the motor through the

Microcontroller. To adjust the angle, it is controlled by the motor to the full balance from the ambulance.

In [12], an application on the ambulance routing of the A* algorithm is described. In the case of an accident, comprehensive care and quick response is vital for taking the patient to the nearest hospital if intensive care is needed. In order to ensure, the ambulance reaches the accident site on time and the patient is taken to hospital without time delay, the application of road network and A* algorithm for the development of the ambulance routing system is

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described in this paper. The methods which are mentioned are used to find the shortest route for the ambulances to reach to the emergency site faster. It is used for the emergency medical services (EMS) ambulances. It is always suitable if the ambulances an arrive at the emergency site faster as the intensive care can be given to the patient as soon as possible and many lives can be saved.

III. SYSTEM MODEL

A design for automatically controlling traffic signals so that ambulance would be able to cross all traffic junctions without waiting. In vehicle section, vibration sensor monitors the speed and if it is over speed, alert will be produced and automatically speed will be reduced. For rash driving, we have placed MEMS sensor. Once MEMS gets tilted, message will be sent through GSM with location. Once receiving the message, ambulance will arrive to the particular section. The display unit in ambulance section is used for driver's reference. It will show the names and distances of the nearest hospitals so that ambulance can reach hospital as soon as possible. The signal section receives the signal from ambulance section and signal comes to green automatically. It helps ambulance to reach hospital without any traffic problem.

A. Vehicle Section

In Vehicle Section, all the equipments are connected to microcontroller. The Piezoelectric sensor is used as vibration sensor to measure flex, touch, vibration and shock. Piezoelectric sensor is a device that uses piezoelectric effect to measure changes in acceleration, pressure, temperature, strain or force by converting them to an electric charge. Sensor based on piezoelectric effect can operate from transverse, longitudinal, shear forces and are insensitive to electric field and electromagnetic radiation. This piezoelectric sensor measures dynamic pressure which includes blast, ballistics and engine combustion under varying condition. An electronic amplifier is an electronic device that increases power of a signal and converts alternating current into direct current.

Here, we have used Microcontroller ARM7 for this vehicle section. ARM7 is a group of older 32-bit ARM processor. ARM is a family of instruction set architecture for computer processor based on a reduced instruction set computing. A RISC-based computer design approach means ARM processorrequires significantly fewer transistors. LPC2148 is the widely used IC from ARM7 family which we have used in vehicle section. It is pre-loaded with many inbuilt peripherals making it more efficient. Power supply, crystal oscillator, reset circuit, UART are the minimum listed hardware needed for LPC2148. It works on 3.3V power supply, transformer is used to step down 230V AC to 9V AC supply and provide isolation between power grid and circuit. Rectifier in LPC2148 is used to convert AC supply into DC and regulator is used to regulate DC supply output, reset button is essential to avoid programming pitfalls and provide clock for RTC operation. LPC2148 has inbuilt ISP which means we can program it within the system using serial communication on COM0. Indicator indicates through buzzer whether accident has occurred. The buzzer produces sound when accident occurs

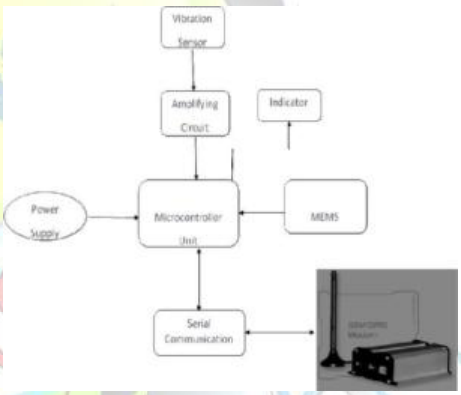

Fig. 1: Block Diagram for Vehicle Section

MEMS sensor used for this project is one of the most promising technologies for 21st century. It is an enabling technology for pressure and acceleration sensors. MEMS-based sensors provide an interface that can sense and process. They are a class of devices which makes small mechanical and electrical components on a single chip. They are crucial components in hard disk drives, automotive electronics, computer peripherals, wireless devices, medical equipment and smart mobile electronic devices such as PDAs and cell phones.

The benefits of MEMS are high performance, miniaturization, integration, low power and low cost. GSM (Global System for Mobile communications) is a widely used digital mobile telephony system. GSM uses time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). The Global Positioning

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System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

The sensor installed in the vehicle unit senses the accident and GPS tracks the location of the accident. Through GSM, it sends the location of the accident to the ambulance section [13]. The buzzer produces sound when accident occurs. The central unit finds the ambulance, nearest to the accident spot and also the shortest path between the location of the accident, ambulance and the nearest hospital. The ambulance crosses all the traffic junctions by automatically controlling the traffic signals and reaches the nearest hospital. Here, wireless technologies are used to transfer information.

B. Ambulance Section

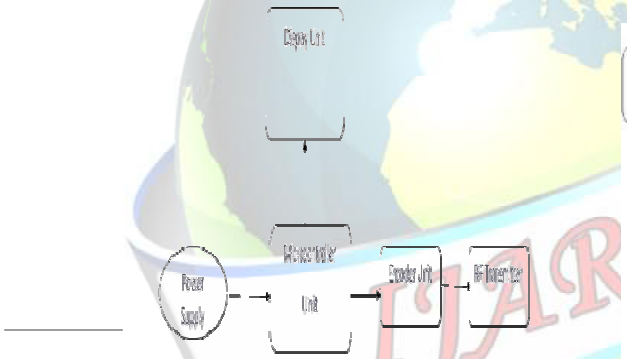

Fig. 2: Block Diagram for Ambulance Section

In Ambulance Section, we used PIC microcontroller. The serial number of the IC is 16F877A. This section consists of crystal oscillator, power circuit and serial communication. 9V input supply is given and the operating voltage is 5V. The crystal oscillator is used to work according to the frequency change. In a PIC microcontroller, there are totally 40 pins and 5 ports; port A to port E. PIC is a family of modified architecture microcontrollers. The name PIC initially referred to Peripheral Interface Controller. The MAX232 is an IC,
which converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. Here, it is used for the purpose of serial communication. It is a dual driver/receiver. The display unit is for the purpose of driver's reference.

An encoder is a device, transducer, circuit, algorithm, software program, or person, which converts data from one format or code to another, for the purposes of speed, standardization, security, secrecy or compressions. Here, the encoder converts the serial data into parallel data because the controller performs only serial functions and wireless is parallel communication. The RF transmitter consists of switches, the signal changes according to it [14]. An RF module is an electronic device used to transmit or receive radio signals between two devices. It is often preferable to communicate with other device wirelessly in an embedded system. The wireless communication may be performed through optical communication or RF communication. The choice is RF for many applications as it does not require line of sight. RF communications use a transmitter or receiver.

C. Signal Section

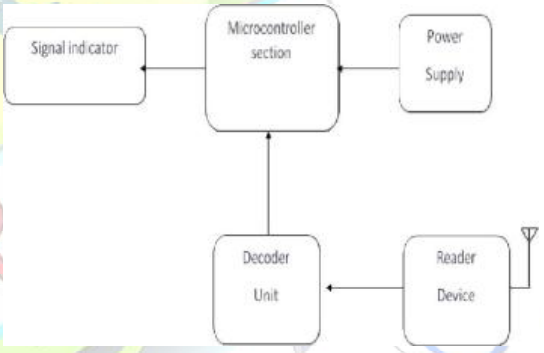

Fig. 3: Block Diagram for Signal Section

Here, we used reader device, decoder unit and signal indicator. The reader device receives the data which the RF transmitter sends from the ambulance section. Any device may act as a reader that can display text on a screen. A decoder is a device that performs the reverse operation of an encoder. To recover the original information, it undoes the encoding. Normally, the same method which is used to encode is reversed to decode. It is a combinational circuit that converts binary information. Here, the decoder unit converts the parallel data into serial data and sends it to the microcontroller section.

The received signal strength indicator (RSSI) measures the power present in a radio signal which is received. RSSI is a radio receiver technology metric, which is normally invisible to the user of the device

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which consists of receiver, but is directly known to users of wireless networking. The output of RSSI is a DC analog level. The ambulance unit is the transmitter and each signal is the receiver. When the data is transmitted to the receiver, the signal comes to green automatically [15]. The decoder converts the data from parallel to serial because the controller knows only serial language. In this way, this system helps the ambulance to reach the emergency site and then to hospital without time delay so that intensive care can be given to the patient in the golden hour and many lives can be saved.

IV. CONCLUSION

In this paper, we have described a design for automatically controlling the traffic signals so that the ambulance would be able to cross all the traffic junctions and reach hospital without time delay. Human life is affected due to delay in the arrival of ambulance. The ambulance is not able to reach the hospital in the golden hour. The existing system has many disadvantages. It depends on the way of monitoring people to be manual which results in time delay and because of that health services cannot be provided to the patient on time which leads to loss of human life.

In our proposed system, the ambulance is guided to the hospital by the central unit through the shortest route. The sensor installed in the vehicle senses the accident and Global Positioning System (GPS) tracks the location of the accident. Through GSM (Global System for Mobile Communications), it sends the location of the accident to the ambulance section. The central unit finds the ambulance, nearest to the accident spot and also the shortest path between the location of the accident, ambulance and the nearest hospital. Here, wireless technologies are used to transfer information.

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