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SMART AMBULANCE RESCUE SYSTEM

Rishabh Nagpal[1], Akash Kinwad[2], Vineet Bugtani[3], Ankita Nandanwar[4], Mrs. Usha Narayan[5]
[1,2,3,4]B.E. Student, [5]Assistant Professor
Electronics and Telecommunication Vivekanand Education Society Institute of Technology Chembur, Mumbai, India

Abstract: In urban areas traffic congestion is a major problem. It can cause hindrance in the movement of ambulances from one location to another .Hence we aim to create a smooth path for an ambulance by first calculating the shortest path for it from one place to another and second by controlling the traffic signals in the path making it green for some time so that the ambulance can pass through without any further delay. The project also aims to send a message to the traffic officers on the path regarding the coordinates of the ambulance for better co-ordination in case the traffic signals stop working due to some technical defects.

Keywords: node, RFID, GSM module, AT89S52 microcontroller.

I. INTRODUCTION

Traffic management on the road has become a severe problem of today's society because of growth of the urbanization, industrialization and population, there has been a tremendous growth in the traffic. With growth in traffic, there is occurrence of bundle of problems too; these problems include traffic jams, accidents and traffic rule violation at the heavy traffic signals. This in turn has an adverse effect on the economy of the country as well as the loss of lives [1]. This situation will become worst in the future. So this project aims to create a smooth path for ambulance by first calculating the shortest path and second by controlling the traffic signals in the path, making them green for some time so that the ambulance can pass through without any delay. The project also aims to send a message to the traffic officers in the path regarding the location of the ambulance for better co-ordination, in case the traffic signals stop working due to some technical defects. In case of an accident, the server also determines the location of the accident and in turn the server will give the accident related information to the nearest hospital for sending its ambulance.

II. FEATURES

- Ambulance which will be a variable node.
- Hospital and 2 traffic junctions as fixed nodes.
- Finding shortest route from ambulance (accident spot) to hospital through any of the 2 nodes.
- As the ambulance approaches the node, the traffic signal turns green (Green Corridor).
- Two messages will be sent, one to police and other to traffic police intimating about the route that ambulance will pass through.
- MATLAB coding and calculating shortest path.
- Wireless communication between server and traffic signals, also between server and ambulance.
- Server has a database of 2 traffic nodes and their respective police office contact numbers.

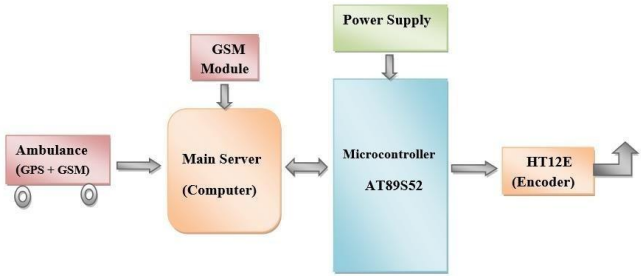


Fig 1. Block Diagram of Main server

III. WORKING

An accident spot is known from where the ambulance needs to reach the nearest hospital. The server will detect accident and send a message to ambulance to reach the accident site. There will be many paths via different nodes to reach the hospital. The GPS module installed in the ambulance gives the coordinates of this location to the server[2]. Then the server calculates a shortest path from the accident spot to the nearest hospital via any of the two nodes with the help of Dijkstra's algorithm using MATLAB software. To display the project we have created a model consisting of two traffic nodes and used Image processing. A camera will take an image of the accident spot location and send it to main server. The main server will calculate the shortest path and send it to the ambulance driver via SMS with the help of a GSM module. The camera will continuously scan the location of ambulance and upload it to the main server. In real time the GPS tracker in the ambulance, will send its location constantly which will be updated in the main server. As the path is selected and the ambulance approaches the traffic signal nodes, the server sends a signal to the nodes via RF transmitter and receiver. The microcontroller AT89S52 at the transmitting end, connected to the main server will generate a message and encoded by HT12E transmitter IC for RF transmission. At the node, HT12D receiver IC decodes the message and the microcontroller AT89S52 turns the green[3][4]. The main server will receive the location of ambulance and then it will send the command turn on green signal through the RF transmitter and every traffic node will have an RF receiver. So whenever the ambulance comes near the traffic, the main server will transmit a code say 'emergency' and the receiver on receiving this signal will immediately turn all the other signals red[5] and make the

particular direction (the direction in which ambulance has to move) signal green so that traffic is cleared before the ambulance arrives at the node. The server will have a database of the police and traffic police numbers corresponding to each node, so when the ambulance approaches the nodes the server sends a message to the police numbers to intimate them about the emergency and handle the public if there is an issue. The database will be created using VB software.

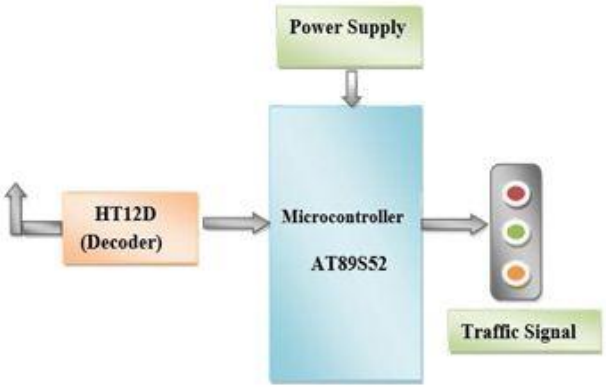
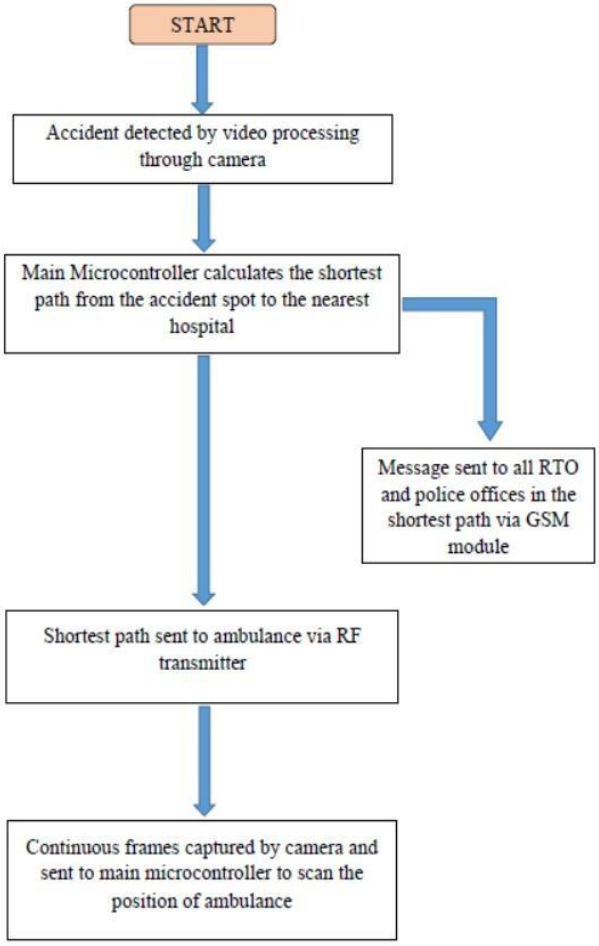


Fig 2. Block Diagram of Nodes (Junction)



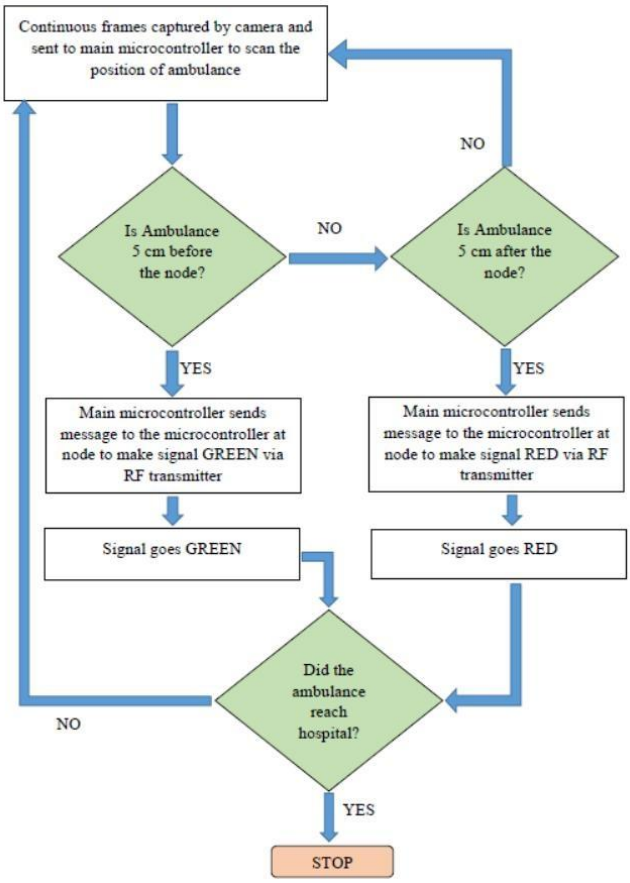


Fig. 3. Main Flow Chart

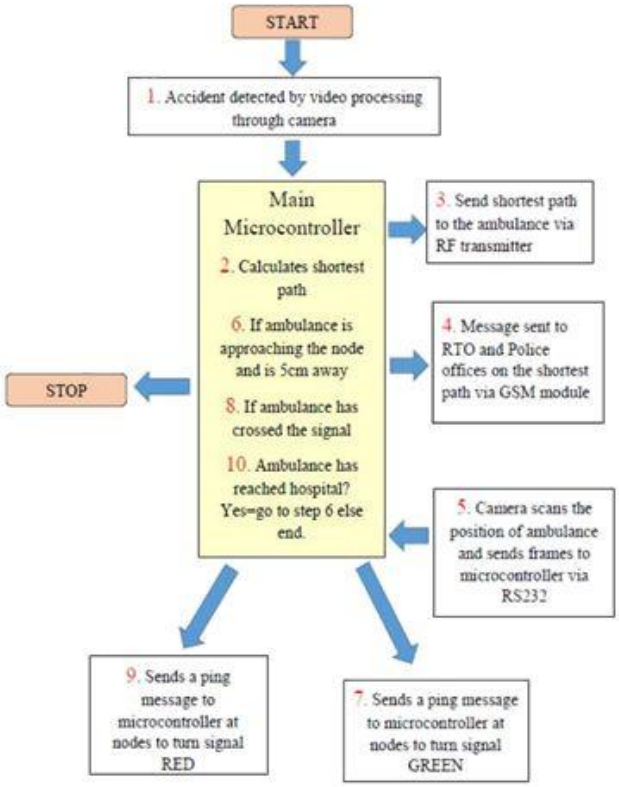


Fig. 4. Main Server (Micrcontroller) Flow Chart

Radio frequency identification is a technique that uses the radio waves to identify the object uniquely. RFID is a technique that is widely used in the various application areas like medical science, commerce, security, Electronic toll collection system, access control etc. There are three main components of RFID: RFID tag, RF Reader and Database. Various types of tags are available but we can mainly divide them into two categories: passive tags and active tags. The passive tags don't contain any internal power source. There are three parts of the tag: antenna, semiconductor chip and some form of encapsulation. The life of the passive tag is very long. The reader sends electromagnetic waves that produce current in the tag's antenna. In response antenna reflects the information stored in it. The active tags contain a battery as an internal power source used to operate microchip's circuitry and to broadcast the information to the reader. The range and cost of these tags is more as compare to passive tags [6][7][8]. We have three kinds of tags which work on the three different frequency ranges: low – frequency, high-frequency and ultra high frequency. GSM cell phone interface is also provided for users those who wish to obtain the latest position of traffic on congested roads. This is a unique feature of this project which is very useful to car drivers to take an alternate route in case of congestion. The various performance evaluation criteria are average waiting time, average distance traveled by vehicles, switching frequency of green light at a junction, efficient emergency mode operation and satisfactory operation of SMS using GSM Mobile.

IV. SOFTWARE REQUIREMENTS

1) MATLAB

SHORTEST PATH USING DIJKSTRA:As the nodes in the given region are fixed points and the distance between the nodes are predetermined, the shortest path[9] between the nodes can be selected using the DIJKSTRA algorithm. Consider a case when the ambulance travels from accident spot to the hospital. The database in the server as said earlier contains the node and the distance between the adjacent nodes to which it is connected. The accident spot is taken as the source and the hospital is taken as the destination. The node next to the accident spot and the node in the path to hospital must be traced. So that accident node is taken as source and the hospital node is taken as destination and the DIJKSTRA algorithm is applied for these nodes. There may be several paths between these nodes and the algorithm finds the shortest path. There may be one way roads along this path, therefore this must be a vector quantity. The server finds nearest node from source and marks it as visited. Then that node is considered as source and the procedure is continued till the destination. Initially, the source doesn't know the distance to destination, so it will be infinite and after complete computation the shortest path along with the distance will be known.

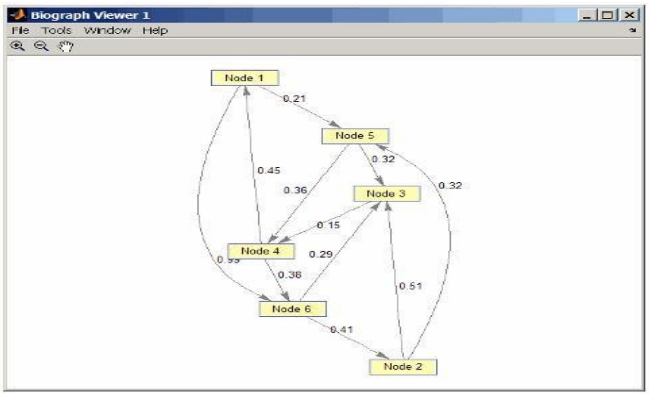


Fig 4: Shortest path graph on Matlab

Implementation of Dijkstra's algorithm to run on the graph in Figure 4 on MATLAB. The graph data is provided to you in the files example1 Graph.mat and example1 Cost.mat. The file example1 Graph.mat contains a scalar numNodes, and a matrix called Graph. The scalar numNodes contains the number of nodes in the graph (numbered 1, 2, · · · , numNodes). The matrix Graph contains information about the graph connectivity, summarized in Table 1.

linkID	upstream node	downstream node
12	1	2
13	1	3
...	...	...

Table 1: Graph matrix for the graph in Fig 4.

The first column gives the link name, which connects the upstream node given in the second column with the downstream node in the third column. Thus, link 12 connects upstream node 1 to downstream node 2, while link 13 connects upstream node 1 to downstream node 3. The file example1 Cost.mat contains a matrix called Cost, which is summarized in Table 2. The first column of the matrix gives the link name, and the second column gives the cost of traversing the link.

linkID	free flow travel time (seconds)
12	5
13	3
...	...

Table 2: Cost matrix for the graph in Fig 4.

2) Visual basic

Visual Basic is a third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model first released in 1991 and declared legacy in 2008. Microsoft intended Visual Basic to be relatively easy to learn and use Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects.

Visual basic is used in our project to create the database of the police numbers of the nearby areas and to send the sms via the GSM module. The GSM module is being controlled by the VB software itself

The basic steps to create a database are:

- On the File menu, click New Project.
- In the New Project dialog box, in the Templates pane, click Windows Forms Application.
- In the Name box, type FirstDatabase and then click OK.
- A new Windows Forms project opens.
- On the Project menu, click Add New Item.
- In the Add New Item dialog box, click Local Database.
- In the Name box, type FirstDatabase and then click Add.
- The Data Source Configuration Wizard opens.
- In the Data Source Configuration Wizard, click Cancel.
- A new database, FirstDatabase.sdf, is added to the project and appears in Solution Explorer.

3) Keil

Keil provides a broad range of development tools like ANSI C compiler, macro assemblers, debuggers and simulators, linkers, IDE, library managers, real-time operating systems and evaluation boards for Intel 8051, Intel MCS-251, ARM, and XC16x/C16x/ST10 families. The microcontroller used in the traffic nodes and also used in the transmitter and the receiver are coded with the help of keil software. Also the .asm files are being converted into hex files and the code is burned into the microcontroller using keil. The microcontroller in the transmitter gets the signal from matlab to send a ping to a particular traffic node.

4) HyperTerminal

HyperTerminal is an application used in order to connect computer to other remote systems. These systems include other computers, bulletin board systems, servers, Telnet sites, and online services. However, a modem is required, an Ethernet connection, or a null modem cable before you can use HyperTerminal. Within HyperTerminal's user interface there are menus, buttons, icons, and messages. All these elements and controls work together so as to provide convenience for the user, especially for accessing the necessary features and performing various tasks. This application is a useful tool, particularly for testing if modem is working well and in verifying if there is a stable connection with other sites. In order to check if modem's settings are configured correctly or if modem is connected properly, send a set of commands through HyperTerminal and view the results given. Other functions of HyperTerminal would include the recording of data being sent to and from the service of the computer you are connected to. Through this information, the stability of connections can be determined. Hyperterminal is used by us only for testing purposes.

V. HARDWARE REQUIREMENTS

A. Microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable. Flash memory. The device is manufactured using Atmel's high density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8- bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector twolevel interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

B. Receiver and Transmitter

The HT 12E Encoder ICs are series of CMOS LSIs for Remote Control system applications. They are capable of Encoding 12 bit of information which consists of N address bits and 12-N data bits. Each address/data input is externally trinary programmable if bonded out. The HT 12D ICs are series of CMOS LSIs for remote control system applications. This ICs are paired with each other. For proper operation a pair of encoder/decoder with the same number of address and data format should be selected. The Decoder receive the serial address and data from its corresponding decoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data.

C. USB to TTL cable

The cable is easiest way ever to connect to your microcontroller/Raspberry Pi/WiFi router serial console port. Inside the big USB plug is a USB<->Serial conversion chip and at the end of the 36" cable are four wire - red power, black ground, white RX into USB port, and green TX out 16 of the USB port. The power pin provides the 5V @ 500mA direct from the USB port and the RX/TX pins are 3.3V level for interfacing with the most common 3.3V logic level chipsets.

D. GSM module

GSM SIM300 module is used and has following specifications:

- High Quality Product
- Triband GSM/GPRS 900/ 1800/ 1900 MHz

- Built in RS232 Level Converter (MAX3232)
- Configurable baud rate
- SMA connector with GSM L Type Antenna.
- Built in SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Audio interface Connector
- Most Status & Controlling Pins are available at Connector
- Normal operation temperature: -20 °C to +60 °C
- Input Voltage: 5V-12V DC

VI. CONCLUSION

The proposed framework is capable of providing its customizable best route identification based on multiple possible optimization factors such as travel time and distance. The dynamic time management scheme operates in real time and emulates the judgment made by a traffic policeman on duty. This system aims at saving a large amount of man-hours caused by traffic problems and accidents, where prevention can save lives and property. It is able to manage priority emergency tag vehicles. It offers a valuable detailed database records and preference to planner and investigators. The proposed work considers not only the priority of the vehicles but also the density of the vehicles on the road and controls the traffic light sequence efficiently and more accurately.

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