An Ambulance Signalling System

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Abstract—Traffic congestion is a major problem in cities of developing countries like India. Traffic lights are not capable of knowing the traffic density and they can’t reflect the signal light according to emergency vehicles. One of the major problems faced by ambulances is heavy traffic. This can endanger patient’s life. And hence the death rate due to accidents is on the rise as the ambulances are not able to reach the hospital on time to save the patient’s life.

We developed an IoT system that can make the public aware of an incoming ambulance along that path. An application is present so that before the ambulance leaves the hospital the it enters the location where the accident has happened. A message is send out to all the major junctions on the shortest path to the location of the accident. At the junction the traffic controller is alerted through which way the ambulance is coming and how many ambulances are incoming. As the ambulance nears each traffic signal on the way, a sign is places at the junction to clear the road for the ambulances. This informs the public about the incoming ambulance and hence they are able to make way for the ambulance without causing delay.

Keywords—Ambulance, IoT system, Hospital

I. INTRODUCTION

Internet of Things is nothing but some devices that connect to one another and interact with each other using the Internet. The ‘thing’ in IoTs could be a person with a device or a vehicle with built-in sensors, i.e. objects that have been assigned an IP address and can collect and transfer data over a network without manual assistance or intervention.[1] The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions. When devices/objects can represent themselves digitally, they can be controlled from anywhere. This connectivity helps us to capture more data from different places.

II. A SMART SYSTEM

We calculate the shortest path to the accident zone with the help of the map at the same time sends control signals to the hardware units in the path to the accident zone. This helps us to reach the destination as the hardware units clears the path for the ambulance.

On clicking the "return to hospital" button in the application, after reaching the accident zone, sends control signals to the hardware units along the same path through which we came.

The destination entered from the Android application is taken from the online database where it is stored in using Internet connectivity and passed to the Arduino. The Arduino then calculates the shortest path to the hospital for the ambulance to travel. Arduino Board helps to alert the public by sending a signal and lighting up the various LEDs placed along that path. At the junction the traffic controller is alerted through which way the ambulance is coming and how many ambulances are incoming using a GSM Module. The Once the “Return to Hospital” signal is received by the Arduino each LED turns off, once the ambulance passes that junction.

III. PROPOSED SYSTEM

In the existing system it involves the manual effort to control the traffic systems. The normal traffic signals systems increase the time of travel, thus be notable as one of the major issues in metropolitan cities.[3] Emergency vehicles like ambulance and fire trucks need to reach their destinations as the earliest. If they spend lot of time in the traffic jams, valued lives of many people may be in danger.

- Present system is completely a static case
- Vehicles must wait at the intersection for a predefined time until microcontroller switches green light for that lane.[7]
- Exists no process of pre-emption.
- No green light service for priority-based vehicles.
- No alarm/call for emergency

This system is designed to overcome the disadvantages in the existing system. In the proposed system if a vehicle meets with an accident, immediately an alert message with the location coordinates is sent to the control centre. From the control centre, a message is sent to the nearby ambulance. Before the ambulance leaves from the hospital, the location of the site of the accident is entered to the android application and the shortest route is chosen.
The RFID sensors along the selected path are activated. As the ambulance nears each junction along the path, the sign is turned on so that the public are aware of the incoming ambulance and hence clears the road. Once the ambulance reaches the site of the accident, another message is given out so that the RFID Sensors will be activated on the way back. Hence there won’t be any delay in reaching the accident site or the hospital. At the hospital there[5] is database maintained which stores all the information on the drivers, paramedics and the patient who is in a particular ambulance and the hospital can be update on the requirements that are needed upon the arrival of the patient at the hospital.

IV. BLOCK DIAGRAM
A. Use case diagram

![FIGURE 4.1 Usecase diagram of the system](image)

B. Block diagram of system

![FIGURE 4.2 Flow Diagram of the System](image)

V. REQUIREMENTS
A. Hardware Requirements
- Android Smart Phone
- Processor-Quad-core 1.2GHz
- 256MB RAM
- LEDs
- GSM Module
- Ethernet Board for Arduino Mega
- Bread Board and Connecting wires
- Arduino MEGA
- RFID tags and readers
- Resistors

B. Software Requirements
- Android Studio
- Android SDK tools
- FRONT END: Android
- Arduino UNO
VI. SYSTEM DESIGN

There are mainly 3 modules to this project:

- Communication Module
- Calculation of ‘Shortest Path’
- Sensing Module

A. Communication Module

The application is an IoT based application. The Internet connectivity of the phone is switched on and the Android phone is connected to the Internet. Here the data is transferred through using the Internet connection into an online database. When the ambulance leaves the hospital, the driver is required to enter the accident spot into the destination field as coordinates.

As the “SEND” button is clicked, the data is transferred to the online database from which the data can be accessed from the table by Arduino Mega. The selection of path is based on this message and the RFID sensors are activated along the chosen path to the location of the accident. When the location of the accident is reached by the ambulance, the driver proceeds to the next page of the application. This allows the RFID sensors on the path back to the hospital to be activated again.

B. Shortest Path Calculation

The model map is implemented as a 2-dimensional array whose index values pinpoint to the locations and the values in these points indicate the roads.[8] The roads are having values which indicate the number of cells to traverse to reach the cell which houses the hospital. i.e. the cell farthest to the hospital is having a larger value and the cell closes is having the value 1. It indicates the number of cells yet to traverse to reach the hospital cell.

![Flowchart](image)

Figure 5.1 Flowchart

The rest of the map is set with a maximum value which wouldn’t be chosen in any case according to the working of the algorithm.[4] The code gets the input as a coordinate value which is checked to see if it is a road or not. This identifies whether it’s a road or not.

If it is a road then the shortest path will be calculated. the selected index points are flagged with a similar 2-dimensional matrix of the same size. Shortest path is determined based on the selection of cells.
The cells on the top, bottom, left and right of the current cell is checked and compared. The one with least value is flagged and then the process repeats. The new flagged matrix is used to activate the RFID tags. The coordinates of the tags are predetermined and if it is included in the flagged index values then they are activated. The LED works until the RFID reads the signal twice. This indicates the ambulance has passed and is returning.

C. Sensing Module

When the data table is accessed by the Arduino board (i.e. the destination coordinates), the Shortest path from the hospital to the accident spot is calculated. As the ambulance leaves the hospital, all the RFID sensors are activated and the LEDs on the selected are lit up. This serves as a sign to the public to clear the roads.

*FIGURE 5.2 Connection of RFID to Arduino*

After the ambulance picks up the patient the driver hits the “RETURN” button on the next page, all the RFID sensors on the path back to the hospital is activated. The LED on the first junction on the way back is turned off as the ambulance passes the junction. In this manner, the ambulance reaches the hospital without any delay and the patient is delivered in the expert hands of the doctor.

VII. EXPERIMENT AND RESULTS

The system takes the input from the driver through the app to the coordinate location in the map where the accident took place (2,6).
The RFID modules are set up in the coordinates – [2][9], [7][2], [7][5], [7][9]. The LEDs set up for the corresponding LEDs are now on.[2] These LEDs turn off when the RFID tags pass them twice. This indicates that the ambulance has reached the destination and is on the way back.

VIII. CONCLUSIONS

The System thereby provides speedy aid to those in need. The reduced traffic will be a result of prior signalling which would allow the public to drive accordingly and could get to clearing traffic jams, if any. The current mode could be automated to obtain the location by any registered requestor.

In this paper we have included the advantages of our system and its importance in the current situation. The mode of input and working is depicted. The working of the shortest path calculating algorithm is also specified here.

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