Smart Ambulance System with traffic controller, Backup Ambulance Services, and Security using Raspberry Pi

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Abstract: **In Oman, the traffic problem is increasing day by day. Due to this problem, ambulances and other emergency vehicles cannot reach their destination on time. If an ambulance is stuck in traffic, then the patient will face the problem and lose their life. Sometimes, if an ambulance faces an accident, then it will create a more critical situation. The doctors in the hospital are not known about the patient's h eartbeat rate and body temperature who is in the ambulance. In our proposed system, we share the live location of the ambulance with the traffic control room to clear the traffic. The central server monitors the way of the ambulance. If the ambulance meets an accident, then the information will be passed to the backup ambulance. The heartbeat sensor and body temperature sensor are monitoring the patient's heartbeat rate and body temperature and send the information to the ThingSpeak server. So, doctors can monitor the live status of the patients and can also instruct the nurses in the ambulance.**

Key terms: smart ambulance, traffic control, GPS/GSM, Raspberry Pi 4

I. INTRODUCTION

Smart Ambulance systems are used to provide clearance to emergency vehicles during rush hours. The ambulance is equipped with sensors and WBAN using this technology the doctors can monitor the status of the patient and then give instructions to the nurses. There are many techniques to develop smart ambulance systems. We use GSM, GPS, Raspberry Pi, accelerometer sensor, temperature sensor, heartbeat sensor, wifi module, and Thingspeak server to develop the Project.

The live location of the ambulance is shared with the Traffic control room. Also, the location of the ambulance is monitored by a centralized server. If the ambulance met with an accident, then the centralized server sends one backup ambulance to the accident place. At the same time, we will send an SMS message to the police to take necessary action. The primary objective is to identify the emergency vehicle and track its location, and this is monitored by using Google's Thing speak. To monitor the position of the ambulance we use separate sensors. The patient's heartbeat and body temperature are monitoring by using Heart beat sensor, temperature sensor, wifi module, and Thingspeak.

II. LITERATURE SURVEY

The increase in population brought on by industrialization and urbanization has resulted in a significant increase in the number of automobiles on the road. The most significant obstacles for emergency vehicles, such as ambulances carrying critical patients, are the resulting traffic congestion and traffic jams because they prevent these emergency vehicles from arriving at their destination in time, which results in a loss of human life. We have reportedly developed another smart ambulance that uses IR sensors for the ambulance to partially address this problem. If the vehicle stops on the road in an emergency, the program uses the Global Positioning System to transmit an emergency command to the traffic signal server and also the direction in which the vehicle should drive from this place (GPS). Based on the ambulance's location, the closest signal is known. And once the ambulance has passed, that particular indicator turns green before returning to its previous state of management. In this way, it functions as a kind of life-saving project since it buys time in an emergency by controlling the traffic lights. [1]

The existing ambulance service is run using outdated techniques that do little to assist the residents of Cimahi city. Since each village controls the ambulance service, if one of their vehicles is already in use, the line cannot be moved to an available ambulance from a different village close by. This is subpar service optimization, which calls for quick deployment and maximum effectiveness.

In order to increase the effectiveness of ambulance services, this paper suggests an IoT-based smart ambulance platform that consists of IoT devices, a service-oriented architecture, and an Android-based user interface. With the use of this platform, it is hoped that the administration of ambulance alerts would be able to assist everyone in need without being constrained by geographical boundaries.[2]

One of the main problems in India is traffic congestion, particularly in large cities like Bangalore, Mumbai, and Delhi. Bangalore loses almost Rs 38,000 crore as a result of traffic congestion each year. The main cause of this is the growing population, which raises the number of vehicles on the road and impacts emergency services like ambulances. The patient may die as a result of the ambulance service's delay, and the frequency of these occurrences is rising daily. This essay suggests a way to make these services easily accessible to individuals in need. We also employ a microcontroller-based hardware module to ensure an ambulance journey smoothly to its destination. This is accomplished by utilizing RFID technology, which would automatically manage the traffic signals in the ambulance's path, cutting down on the amount of time needed to get there.[3]

An enormous increase in population brought on by the growth of urbanization and industry has inevitably increased the number of vehicles on the road. A loss of human life occurs as a result of the ensuing traffic congestion and traffic jams, which pose significant obstacles for emergency vehicles carrying important patients, such as ambulances. We have reportedly developed "Intelligent Traffic Control System (ITCS) for ambulance" to partially overcome this problem. An android application that is part of the system registers the ambulance on its network. With the aid of the Global Positioning System, the application uses the ambulance's current position to send a position update to the traffic signal server in case of an emergency if the ambulance stops while en route (GPS). Based on the ambulance's current location, the nearest signal is found. And that specific indicator is turned green until the ambulance passes by before returning to its previous state. By regulating the traffic lights, it functions as a life-saving project by reducing the amount of time needed to respond to emergencies. [4]

III. PROPOSED SYSTEM

We can save the life of the patients by reaching the hospital at the correct time with the help of the Traffic control Room. Because the live location link is shared automatically with the Traffic control room. If an ambulance met with an accident, then the message will go to the hospital automatically to send another ambulance and the message will go to ROP for further action. The emergency vehicle can reach the destination on time.

The patient's (who is inside the ambulance) heartbeat and body temperature are monitoring lively by using Heart beat sensor, temperature sensor, wifi module, and Thingspeak. The following figure-1 shows the proposed system architecture.

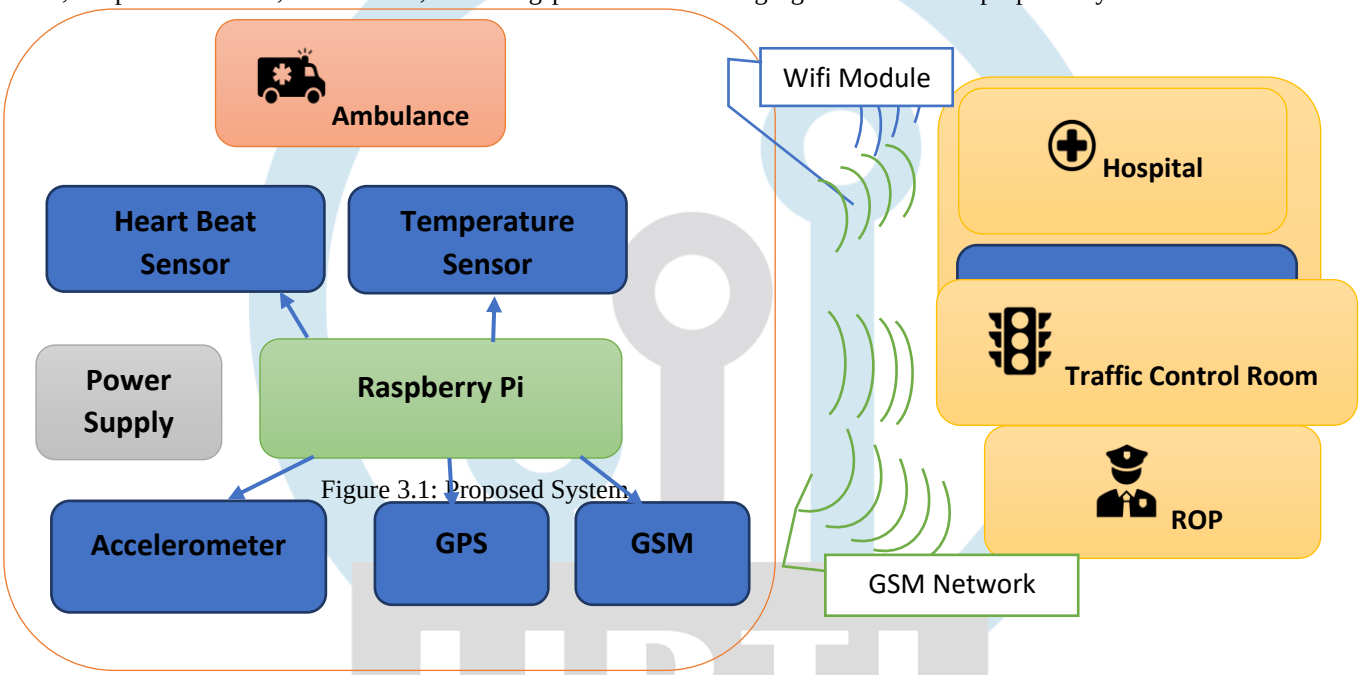

Figure 3.1: Proposed System

3.1 Ambulance

The ambulance contains the major parts of the proposed system. The heartbeat sensor monitors the patient's heartbeat. The temperature sensor monitors the body temperature of the patient. The accelerometer monitors the position of the ambulance. If an ambulance faces any kind of accident, then the position of the ambulance will vary. The GPS module is used to monitor the location information. The GSM module sends the location information to Traffic Control Room and ROP.

Heartbeat sensor:

A pulse sensor is a plug-and-play sensor that records heart rate information. Connecting this sensor from the human ear or fingertip to an Arduino board will enable it to function. such that it is simple to compute heart rate. A 24 inch color coding wire, an ear clip, Velcro Dots 2, transparent stickers 3, etc. are all included with the pulse sensor. Header connectors are linked to a color-coded cable. Therefore, there is no need for soldering to connect this sensor to an Arduino in the project. The heart rate sensor can have an ear clip attached to the rear using hot glue so that it can be worn on the earlobe. On the hook side, two Velcro dots are fully sized toward the sensor. These come in very handy for creating a Velcro strap that covers about a fingertip. This is used to cover the finger's sensor. Protective coatings called transparent strikers are utilized to shield the sensor from perspirant fingers and earlobes. This sensor has three holes towards its outer border so that accessories can be connected to it with ease.[5]

LM35:

The LM35 is a thermometer with an analog output voltage that varies with temperature. It gives output voltage in degrees Celsius (Celsius). No additional calibrating circuitry is needed. It is a 3-terminal sensor that is used to gauge ambient temperatures between -55 °C and 150 °C. The temperature output from the LM35 is more accurate than the output from a thermistor.[6]

Accelerometer sensor:

A device that monitors the acceleration of any person or object in its immediate rest frame is an accelerometer sensor. It is not an acceleration in coordinates. There are several applications for accelerometer sensors, including in wearable technology, smartphones, and other electrical equipment.[7]

GSM Module (SIM 900A):
This wifi module is incredibly reliable and small. The SIM900A is a full Dual-band GSM/GPRS solution in an SMT module that can be integrated into customer applications, giving you access to solutions with minimal dimensions and lower costs. The SIM900A offers GSM/GPRS 900/1800MHz performance for phone, SMS, Data, and Fax in a tiny form factor and with low power consumption. It has an industry-standard interface. The SIM900A can meet practically all space requirements in your applications because to its small configuration of 24mm x 24mm x 3mm, especially for applications that call for designs that are slender and compact. [8]
GPS Module (Neo-6M):
The Global Positioning System (GPS) uses signals transmitted by satellites in orbit and ground stations on Earth to pinpoint a user's location on the planet. The GPS receives radio frequency signals that are transmitted by satellites and ground stations. These signals are used by GPS to pinpoint its precise location. There is no need for the GPS to transmit any data. Time stamps indicating the time at which the signals were transmitted are included in the signals that are received from satellites and ground stations. through the calculation of the time difference between the signal's transmission and reception. A straightforward formula for distance using speed and time can be used to calculate the distance between the satellites and the GPS receiver using the speed of the signal.[9]

3.2 Hospital
The patient's heartbeat rate and body temperature who is inside the ambulance can be monitored by the doctor who is in the hospital. If the ambulance met with an accident, then the hospital sends the backup ambulance vehicle to that particular location.
ThingSpeak:
Assembling, visualizing, and analyzing real-time data streams in the cloud is possible with the help of the IoT analytics platform service ThingSpeak. Data sent by your devices to ThingSpeak is instantly visualized by ThingSpeak. For IoT systems that need analytics, ThingSpeak is frequently used for prototype and proof of concept solutions. Many vertical applications, including environmental monitoring and control, health monitoring, fleet monitoring, industrial monitoring and control, and home automation, are built for IoT solutions. [10]

3.3 Traffic Control Room
The location of the ambulance is shared with the traffic control room. If an ambulance faces any type of traffic issue, then it can be solved by the traffic control room.
3.4 ROP
If the ambulance met with an accident, then the location of the ambulance will be shared with ROP. The ROP can do the necessary for the accident.

IV. IMPLEMENTATION
This system is divided into four modules.
Module1:
The heartbeat sensor and body temperature sensor send the patient's information to the ThingSpeak server using the wifi module (ESP8266).
Module2:
The Location of the ambulance is shared with the hospital by using GPS/GSM Module to send the emergency vehicle.
Module3:
The Location of the ambulance is shared with the traffic control room by using GPS/GSM Module to clear the traffic.
Module4:
The Location of the ambulance is shared with the ROP by using GPS/GSM Module to do some necessary action.

V. CONCLUSION
In this proposed system, the Raspberry Pi sends the patient's Heart beat rate and body temperature to the ThingSpeak using Wifi Module. The doctors in the hospital can monitor the live status of the patient. If Ambulance is stuck in traffic, then the Traffic Control Room can clear the traffic immediately. Because the GPS location link is automatically shared with Traffic Control Room and Hospital. If the ambulance met with an accident then the accelerometer sends information to Raspberry Pi. And Raspberry Pi send location link to Hospital and ROP using the GPS module and GSM module.

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