

SMART AMBULANCE FOR COVID-19 PATIENTS

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Abstract : Accidental situations, emergency situations with related to the health or life of any person is considered as the most important thing to deal with. But the problem that is faced is at the early stage that is taking the patient to the hospitals. Ambulances are used for this task, but just taking patient by ambulance is far enough. Here we need some specifications in the ambulance itself for treating the patient at initial level inside the ambulance. So here we have presented a SMART AMBULANCE model for treating the patients in this pandemic which is the COVID-19. The problem seen to reach the ambulance to the hospital is removed by using the GPS for knowing the traffic activity. Our SMART AMBULANCE model consist of a sanitizer machine that is sensor based, an oxygen sensor, temperature measuring sensor, heart rate sensor as well we also provided with the mask detector for the peoples entering the ambulance. A screen is provided on the device which shows the measures obtained by the sensors. The proposed model for the services to the patients in COVID-19 pandemic has worked well and the sensors are working well.

Keywords: Smart Ambulance, Temperature Sensor, Heartbeat Sensor, Sanitizer Machine, Mask Detection, GPS, GSM.

I. INTRODUCTION

In India the growing technologies in the medical field has been working for every aspect of the medical science. Many of the medical equipments are now available in the top most hospitals in every city. The emergency services have also been improved in the topmost hospitals, the machines for emergency cases are also available [1]. These all facilities can be accessed by patients if they reach the hospitals within time, and for this we have the ambulance that takes the patients to the hospital [2]. But the normal vehicle called as ambulance taking patients to the hospital is good enough, that is a question in front.

So here in this paper we have presented a model for the ambulance making it as a SMART AMBULANCE. The ambulance taking patient to the hospital should not be just a vehicle taking patient from any place to the hospital. It should contain some of the major emergency equipments to provide some facility to the patient on road. So, these all will help the patient for on spot treatment. There are some services like oxygen sensor, temperature sensor, sanitizer machine etc can be embedded in the ambulance.

The proposed SMART AMBULANCE is less with some of the major functionalities that are useful in this COVID-19 pandemic. COVID-19 pandemic is an ongoing global pandemic. This pandemic situation started from NOV 2019 and first patient was founded in China. and then pandemic has been seen in almost every country of the world i.e. china, Italy, USA, India, Russia and from this the race has begun for getting the powerful and efficient technology [3]. We have designed this model for the special COVID-19 pandemic scenario, where the temperature sensor for the peoples entering in the ambulance is necessary, also the sanitizer machine for the peoples that is based on the sensors as no touch can be made in between the machine and peoples is designed by using the ultrasonic sensor. The facility to the patient is provided by keeping the two sensors that are oxygen and the heart rate sensor. Apart from this an additional mask detector is also provided in this SMART AMBULANCE that is implemented by the OPENCV of the python.

Internet of Things (IoT) is a growing field in which embedded devices are interconnected via internet connection. The work of this all devices is to get the data from devices and peoples and sent them over the cloud. This data is then processed and analyzed for further use by the cloud computing services.

This all services are good enough but what about the traffic system that is faced in the route for the hospital [4]. So, to resolve this problem we have used a GPS system by using ThingSpeak interface, which will help in getting the fastest route with less traffic on the roads. The proposed system is working well and the sensing of the objects is accurate.

1.1 Components Used: Here in the proposed model we are using following sensors for the detection of particular kind of thing. Temperature mapping sensor, oxygen and heart rate sensor, sanitize machine sensor is made here using following components for specific task.

- a. Temperature sensor (MLX90614): High temperature measuring thermometer that is non-contact based, uses this MLX90614 sensor that is actually an infrared thermopile sensor used for temperature measuring purpose. This sensor having IR sensitive thermopile detector chip along with the ASSP for conditioning of signals that are placed in TO-39 can. For increasing the accuracy of thermometer additional low noise amplifier, DSP unit and 17-bit ADC is placed on it.



Figure1. MLX90614 sensor

- b. Oxygen sensor (MQ 135 sensor): The detection of gas can be done by such sensors, the MQ sensors are available in series and every sensor type is used for particular type of gas. This can be used in the air quality control systems and can detect various types of gases like NH₃, Nox etc.

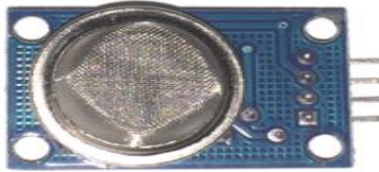


Figure 2. MQ 135 sensor

- c. Heart Rate sensor (Pulse sensor): It is used simply and direct, but positioning of this sensor matters for the correct detection of pulse rate. The sensors need to be covered with hot glue, vinyl tape or any other conductive material. The front of the sensor is the pretty side with the Heart logo. This is the side that makes contact with the skin. On the front you see a small round hole, which is where the LED shines

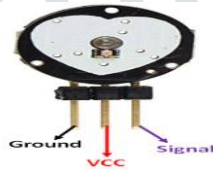


Figure 3. Pulse Sensor

- d. Sanitize machine (Ultrasonic Sensor): This is one of the sensors used for measuring the distance and for the objects sensing [6]. So here we have used this component in our sanitizer machine. This sensor works on the simple formula i.e. distance = speed * time. This sensor sends an ultrasonic wave and when any object comes in between this wave, the wave is reflected back to the sensor and the ultrasonic receiver gets this wave and starts working i.e. detects the object.



Figure 4. Ultrasonic Sensor

- e. GPS (Global Positioning System- NEO-6): This GPS system comes in a series of modules which involves u-blox 6 positioning engines for the high performance. This are actually receivers that are cheap and having high options for connection i.e. a package of 16*12.2*2.4mm.



Figure 5. GPS

GSM (Global System for Mobile- GSM 800A)- This is used for making an easier connection with the computer of any of the microprocessors via USB. This modem is having SIM800A chip of GSM and an interface of RS232 which makes it easier for connection.

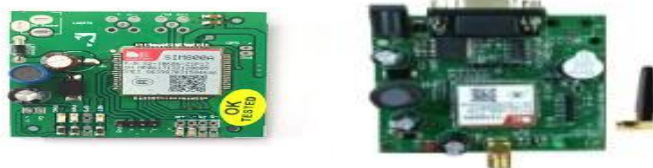


Figure 6. GSM

1.2 Software Used

- Cloud Partner (ThingSpeak): Think Speak is a third-party website for IOT. ThingSpeak application is used in IOT field for sharing and getting the data from the devices and for this it makes use of HTTP and MQTT protocol in any LAN or over the internet. The obtained data is analyzed by THingSpeak on the MATLAB software. This is an application which makes us live data stream analysis over cloud. Visualization is also provided by this application for the data obtained from devices.
- Arduino IDE- For the execution of all this above component we are using the Arduino IDE. The connection of every pin can be handled by this Arhuino IDE. Eagle is also used for the design of the circuit and PCB.
- OPEN CV (Open Source Computer Vision Library): It is a library used for the analysis of the real time data. Intel is the original developer of this but further it was supported by Willow Garage then Itseez, this was again acquired by INTEL. This is a cross platform library and it is free for use under the BSD licence.

II. LITERATURE REVIEW

Here authors have presented a traffic management system which is named as RFID based system. This system works on managing and regulating the traffic signals, at the time of emergency. They have presented a model which uses GPS for the ambulance and this location is send to the traffic signal management and then according to the GPS the signal blue light is turned on and the ambulance is passed, the blue light will state the peoples that there is an emergency situation [7].

Here a system is designed for the HPV driver, HPV driver will send a signal to the system. This signal will then be responded on the basis of the priority. The signal will make the green light turn on and the vehicle can be pass without any interruption of traffic. This system is analyzed on the SUMO and the 50% time is saved in various situations [8].

In this paper the authors have presented a system that is based on the android and cloud, also this uses the GSM for making it cheaper. System uses GSM module, MQTT, microcontroller, traffic signals and android mobile. The proposed system can control the stoplight as per the situation [9].

Authors have stated a true time system for the processing of the information of traffic conditions and the monitoring of these conditions can be done through this proposed model. This method involves the camera and sensor networks technology, and checks for the clearance time for the all lanes from which the ambulance is going to pass. Priority for the ambulance vehicles is obtained through the RFID. The presented system is implemented on GUI so easy to use [10].

The proposed traffic monitoring system in this paper has given a very intelligent method to deal with the traffic problems. The authors stated that the fixed interval of the traffic light needs to be intelligent and sense the traffic at present situation. The traffic signal lights should handle the timings according to the traffic present also the emergency vehicles like ambulance should also be detected and the passing of ambulance should be made on priority [11].

In this paper the authors have designed a sanitizer machine that works on sensor, along with this the system also having a temperature sensor. This system is designed to take the preventive measures for the COVID-19 disease. This system uses TMP36 for temperature calculation and ultrasonic sensors are used for the sanitizer machine [12].

Here the authors have given an intelligence ambulance system for the traffic control. This model includes health monitoring as well the traffic controlling. They measured temperature and sent it to the hospital. RF transmitter and RF receiver is used for traffic signaling. This signaling is used for getting the actual condition of traffic and ambulance gets the traffic less route [13].

In this paper the authors measured the body temperature, heart rate etc. And then this all information is sent over any mobile phone connected with GSM. GPS and GSM is used for tracking vehicle and programming is done on assembly language. This system works as the microcontroller fixed for measuring values, will itself sent a notification to a mobile number whenever any limit exceeds and the facilities can be provided [14].

III. COMPONENTS USED IN OUR MODEL

Here in our proposed model for SMART AMBULANCE following components are used in a required flow. The proposed model can be seen in two parts. First one is for the sensor of temperature, oxygen and heart rate along with the GP system, that is seen in normal ambulances as well. Secondly, we have added the sanitizer machine and the mask detection technique for making our ambulance as SMART AMBULANCE. Below table lists the required components.

Table 1: System Specification

Temperature Measure	MLX 90614 sensor
Oxygen Measure	MQ 135 sensor
Heart Rate measure	Pulse Rate Sensor
Sanitizer machine	Ultrasonic sensor
Motor	DC Motar RO
Sanitizer Tank	Dolphin Ro Body
Management IDE	Arduino ESP 32

Power Supply Details	Regulated (IC7805, IC 7812) , Transformer 12V/1 AMP, Capacitor 1000uf/16V Bridge rectifier
Adapter	adapter 24 V / 1.5A
Cloud Service	ThingsSpeak
LCD screen	LCD 20x4
GPS system	GPS NEO 6M
GSM System	GSM 800A
Software used	EAGLE (PCB Design) Arduino IDE OpenCV (Python)

In our proposed model of first stage we have used ESP 32. This module is bigger as compared with the ESP8266-01 and it is easy to use as many pins are broken out because the IO pins are facing each other, and this is very useful. For second stage we have used an Arduino UNO R3 microcontroller for the managing of overall components that are fixed in our model. This microcontroller is able enough to handle digital and analog sensors. Another task it can implement is the sending and receiving of the internet data.

Then we come up with the sensors used in our model that are temperature sensor, pulse sensor MQ135 sensor and ultrasonic sensor. All these sensors work for a specific task, temperature sensing by MLX90614 sensor, Oxygen sensor is the MQ sensor and Heart rate analysis through pulse sensor.

The GPS system is used here for the traffic analysis and is added to the model. The cloud system here used is the ThingSpeak for the access of the GPS and the IOT devices. An LCD unit is also fixed here for the display of temperature and other sensing elements. The LCD used here is having 24x2 (columns * rows). The contrast of this screen is maintained by using the potentiometer of 250k ohm.

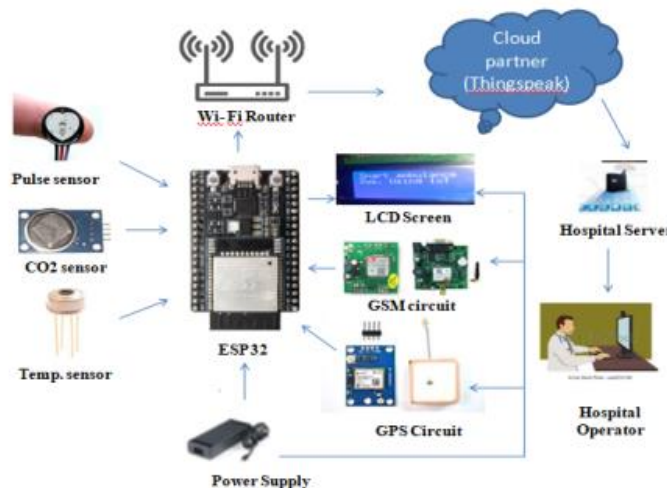


Figure 7. First phase of the SMART AMBULANCE

The second phase of the SMART AMBULANCE added the sanitizer machine and the mask detection method for this the components used are ultrasonic sensor, power circuit, ultrasonic control device and for mask detection the components we have used are:



Figure 8. Sanitizer body and DC RO motor.

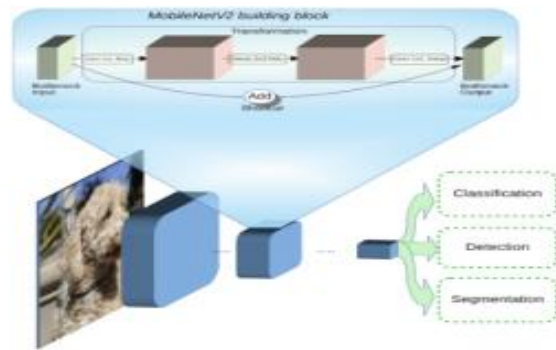


Figure 9. MobileNetV2 building Block for Mask Detection

IV. PROPOSED MODEL

As the SMART AMBULANCE model is working in two phases so the model is also presented in two parts. This first part shows the implementation model for the temperature, oxygen and heart rate sensing. Along with this the model in first phase works with the help of the wifi and ESP-32, GSM for the traffic control and the ThingSpeakcloud interface. We have added a required power supply for the model and LCD screen for the display of the finding of the sensor. Below we have stated the first phase flow of the model [Figure 10], in which the system analyzes the temperature, oxygen and heart rate from the sensors applied and for the handling of all this the Arduino esp32 has been used which is used for the management of all the sensors and outcomes can be seen on the LCD screen. Another side of this works for the traffic jam related problems that uses the GPS technology and uses the ThingSpeak for the knowledge of the traffic jam and the short and route with less traffic is selected by this model. Power supply is given to this model, that can be seen in the figure10.

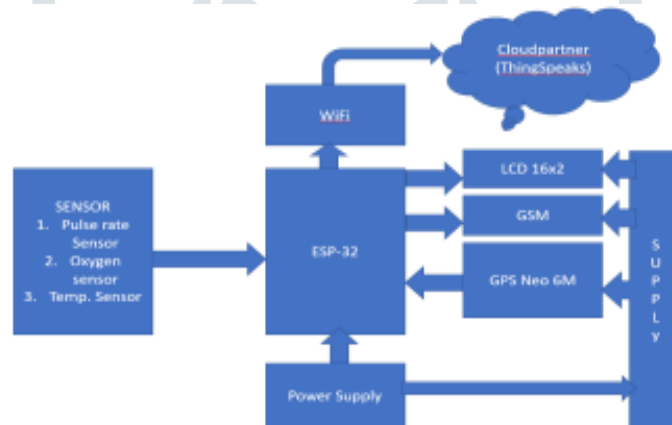


Figure 10. Proposed model for the first phase of SMART AMBULANCE

The second flow of the model works for the sanitizer machine and the mask detection as per the situations seen in the COVID-19 pandemic. We have designed this model specially for the COVID-19 pandemic scenario. The mask detection and sanitizer machine are implemented here. The sanitizer machine uses ultrasonic sensor for providing sanitizer to the peoples without touching the machine. The mask detection can be seen on the LCD screen and the alert can be made. The flow of work can be seen in below Figure 11.

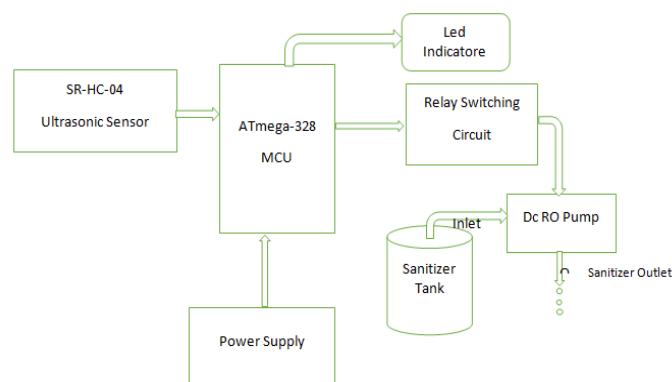


Figure 11. Sanitizer machine workflow.

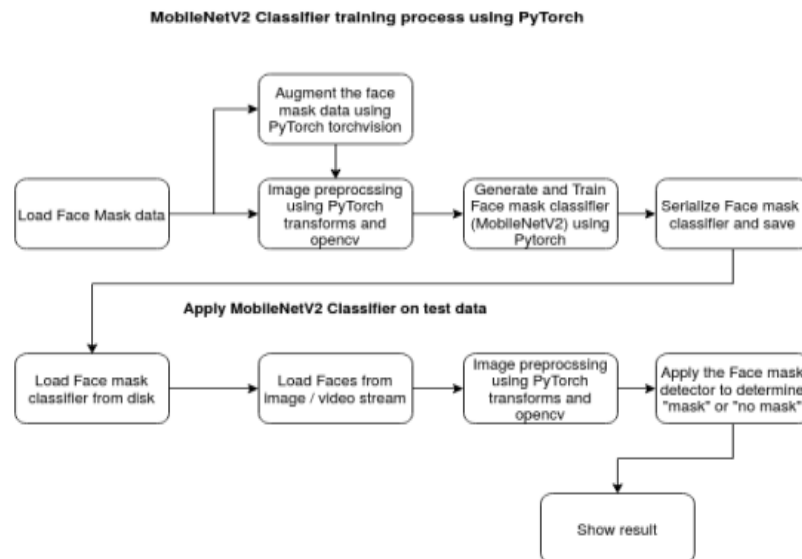


Figure12. Proposed workflow for Mask Detection

V. RESULTS

The results were carried out on different scenarios. The proposed model for SMART AMBULANCE has been implemented in different conditions and the results are studied for various scenarios. The sensors applied for various tasks are working properly and the detection of temperature, oxygen and heart rate are studied and the outcomes are properly seen on the LCD screen. Below figure shows the outcomes for all these three measures.



Figure 13. Temperature, oxygen, heart rate sensor results on LCD screen

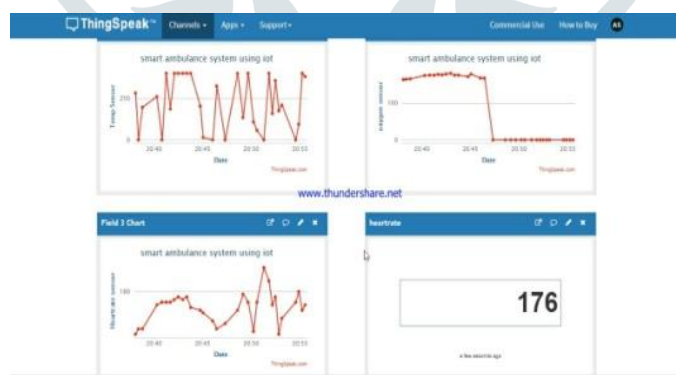


Figure14. ThingSpeak Real time data plotting for GPS system

In next segment we have worked on the sanitizer machine and the sensor for this machine has worked well and below we have presented the figure of this machine. The mask detection technique also worked well and the detection of the mask on face is done properly. Below figure states the results obtained.



Figure 15. Sanitizer Machine and Mask Detection in SMART AMBULANCE

VI. CONCLUSION

The emergency situations can be seen at any time, an example of this can be seen as COVID-19 pandemic. Apart from this the accidents and heart attack scenarios also been seen as emergency conditions. Keeping in mind the COVID-19 pandemic we have proposed a SMART AMBULANCE for taking the patients to the hospitals and tried to provide facility to the patient as well the precautions also kept in this SMART AMBULANCE. In our proposed model we have provided three sensors in the first phase that are temperature, oxygen and heart rate sensor. Apart from this the traffic jam related problems are solved using GPS system and the cloud application as ThingSpeak. The sanitizer machine which is sensor based that the touch to the machine can be avoided and the mask detection for the peoples entering is applied for the special conditions seen in COVID-19 pandemic. The results were carried out on various scenarios and it is seen that the system is working well, all the sensors are able to detect related phenomenon properly and the model can be implemented in future.

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