

A Smart Approach to Make Way for Ambulance Using IoT

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Abstract— Road traffic has become the major challenge in current urban cities, which made inconvenient for ambulance if it is carrying any emergency patient. The ambulance has to wait for clearing the traffic, which may take several minutes to hours sometimes. Due to this ambulance reaches hospital with much delay, and there may be condition that patient undergoes hazardous problems or may die. The embedded technology has been used to avoid such road traffic congestion by controlling road traffic signal which automatically turns the red signal to green whenever the ambulance reaches near to traffic light control. The system also monitors the patient health present in ambulance and maintains two way communication with the concerned doctor in hospital. It also opens the hospital gate automatically whenever the ambulance reaches the hospital.

Index Terms— Radio Frequency Identification (RFID), Internet of Things (IoT), Traffic management, ambulance, Patient health.

I. INTRODUCTION

Traffic management on road has become the greatest problem in the current scenario because of faster growth in population, industrialization and urbanization. This paper is in concern of cities with heavy traffic. For example, in Bangalore many roads will be jammed for so much of time. With the increase in traffic there occur so many problems like traffic rule violation in some areas with heavy traffic signal, accidents, traffic jams, etc. This increase in traffic length in turn has an adverse effect on lives of people and also it affects the economy of the country.

Traffic signals play major role in traffic light management system. The traffic light signals are the devices which will be at the intersection of two or more roads and are used to control the traffic flow on the road. Usually, the traffic signal lights are programmed for particular time period. There were several attempts made to design the traffic signal, such that it operates based on the density of vehicles at the traffic. But this in turn has the limitation that this principle calculates the density based on counting all the vehicles at the traffic without any priority. Where even the emergency vehicles like fire brigade, ambulance and VIP vehicles will be treated as ordinary vehicles.

If the distance of traffic lasts for 100 meters or more, the traffic police will not be able to hear the ambulance siren, and ambulance will be made to wait for clearance of traffic which may take half an hour sometimes. By this time the patient's condition may become critical or he may die, due to lack of proper treatment at

proper time. The embedded technology has been used to avoid such road traffic congestion by controlling road traffic signal which automatically turns the red signal to green whenever the ambulance reaches near to traffic light control and continuously monitor the patient's health in ambulance and send message to the concerned doctor so that he can make arrangement for proper treatment at earlier times and informs if any measures has to be taken.

This scenario is carried out by using the technology called "Internet of Things". IoT is basically connecting the physical world to the internet world, where the physical devices will be connected to the controller through sensors, Radio Frequency Identification (RFID) or Bluetooth networks. IoT gives higher efficiency of things with reduction in wastage of time and energy. RFID have been used in various applications like security, medical science, access control, electronic toll collection system, etc. Fig 1 shows the traffic control model. In this design RF reader will be placed at the intersection of roads so that it detects the ambulance from 100-200 meters away from the traffic signal and sends signal to the traffic control board, which in turn will alter the signal to green if it is red and makes way for the ambulance.

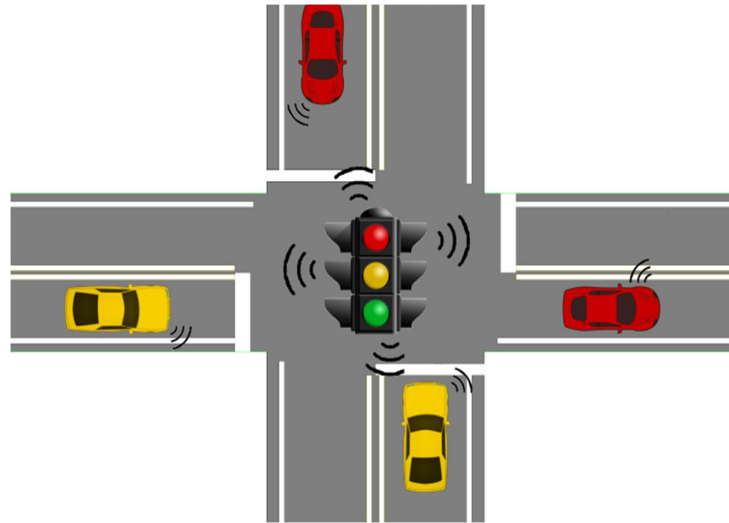


Figure 1: Traffic control model

Usually blood pressure, heartbeat and body temperature of the patients will be measured by the doctor whenever any patient arrives the hospital. In this system the BP sensor and the temperature sensor placed in the ambulance will monitor the patient health continuously and saves the status of patient in cloud and intimates the doctors through mail. So that the doctor can know the situation of patient and makes arrangements for further treatments before the ambulance reaches the hospital so as to save time and patient life. If that patient is in serious condition and any measures have to be taken immediately means he will send message through mail so that the patient gets first aid and escapes from danger.

Sometimes it may be situation that the watchman at the gate will not be there at the gate and if the ambulance arrives at that time means it still has to wait for opening the gate. Either the watchman has to notice that ambulance has arrived and comes and opens gate else the driver has to open gate in case of emergency. So as to avoid time wastage for opening the gate the IR sensor will be placed neat to hospital gate such that it recognizes the ambulance arrival before some 50 meters of the gate and opens the gate automatically.

II. RELATED WORK

Yi Shang, et al [1] proposed a system which uses Wireless Sensor Networks (WSN) to collect the information about flow of traffic on particular road at particular time period. WSN installed at the road is used to control the traffic loads on roads.

Shrivasta D Perur, et al[6] proposed the use of ARM7 processor to control the flow of traffic. GSM,GPS and RF transmitter modules are used in ambulance. So that ambulance driver tracks the location by making use of

GPS which is connected to ARM processor and sends the message to control board through GSM. This system is not sufficient if the GPS is unable to track the location.

Suraj B, et al[8] proposed a system which serves the purpose of accident detection and ambulance management. Vehicle accident detection module will be placed in the vehicle, which detects if any accidents occur and sends signal to the main server which automatically routes the nearest ambulance to that location, and this system is also provided with android app for the ambulance driver to guide him in reaching the destination. It saves the time, but is also having limitation that if the ambulance got stuck in any of the traffic congestion it has to wait for long time till the traffic clears.

Amnesh Goel, Sukanya Ray [2] proposed a system which uses Wireless Sensor Network technology to develop dynamic traffic light system, which minimizes the waiting time and also traffic load at the intersections. Here, neighbor the traffic light intersections will communicate with each other by using each other by using Wireless Sensor Network technology and clears the traffic based on priorities of vehicles.

Bhor Madhuri, et al[4] proposed an intelligent traffic control system, designed for reducing the traffic on road by measuring the density at the traffic. The road with higher traffic density than other roads will be made green signal and all other roads will be made red. This technique tries to reduce the traffic at roads with higher density which in turn leads to wasting of time and fuel.

M.Ramya, et al[5] proposed an automated traffic signal to provide easy flow of higher priority vehicles by designing dynamic traffic signal. The density on each road will be calculated by using RFID.

Varaprasad Golla, et al[3] proposed a system to [ass emergency vehicles smoothly over the traffic signal. Here each vehicle will be provided with RFID tag. It determines density based on counting number of vehicles passed at traffic control at specified time interval. It also helps in finding stolen vehicle by reading its RFID tag when it passes through that location and sends message to the police control room. It also makes way for ambulance by using ZigBee module for wireless communication between the traffic controller and the ambulance and informs the traffic controller at the junction to switch green signal for the ambulance way.

Ruthvik Gautam, et al[7] proposed a system which automatically control traffic and traces the location of emergency vehicles by using GPS and sends message to traffic control board. This system takes longer time and is also inefficient, since the GPS can not track the vehicle location all the time.

To summarize, the earlier proposed methodologies are not enough to control the traffic flow and pass emergency vehicles smoothly. So this approach is designed to detect the emergency vehicle i.e ambulance and send signal to traffic control board, so that it turns traffic signal to green till it passes through traffic. It also serves great purpose of informing the doctor about patient's health at earlier stage.

III. PROPOSED SYSTEM

Fig 2 shows the proposed system, the main idea is to develop a system to make way for ambulance and monitor the patient's health, store it in cloud and inform the concerned doctor.

The controller used in the system is Raspberry Pi 3 model B. It is the third generation of Raspberry Pi model, which is of credit card size. It is a highly powerful processor with 10 times faster than first model of Raspberry Pi. It contains bluetooth, wireless LAN, WiFi on board which is the advanced feature to connect with the cloud, micro SD card, USB ports, etc. RFID reader, BP sensor, temperature sensor, BP sensor and IR sensor will be connected to the controller.

RFID makes use of electromagnetic fields to identify the object containing RFID tag. Electronic information will be stored in the RFID tag. And these are used in many industries to see the product's progress, in theft control system, etc. In this embedded system the RFID tag will be attached to ambulance which can not be removed and whenever it approaches traffic the RFID reader will read tag and makes way for ambulance.

Cloud computing technology is used to store the patient's health condition so that the doctor can access the data easily from cloud. Here it also provides two way communication between the doctor and ambulance. BP sensor and temperature sensor are used in this module to monitor the patient health.

A. Making way for ambulance

RFID reader will be placed at the place such that it can detect the ambulance whenever it approaches the traffic around 100 meters near the traffic control system and will be connected to the controller. When the ambulance RFID tag will be read the RF transmitter will send signal to RF receiver which changes the traffic signal from red to green and makes way for the ambulance. Fig 3 below shows the flow diagram of making way for ambulance

B. Monitoring patient health

BP sensor and temperature will be placed in the ambulance which will be connected to the controller as shown in the proposed model. These sensors will monitor the patient health and store it in cloud using IoT and will send mail to the concerned doctor so that he will arrange for the proper treatment earlier and informs if any immediate measures has to be taken in case of serious condition . Fig 4 below shows the flow diagram to monitor the patient health.

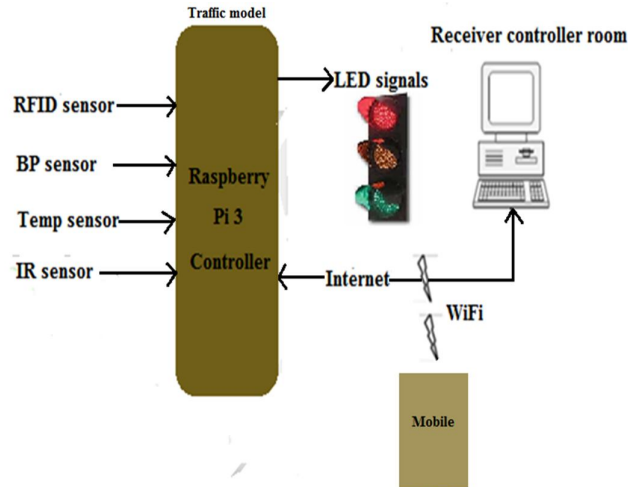


Figure 2: Proposed system

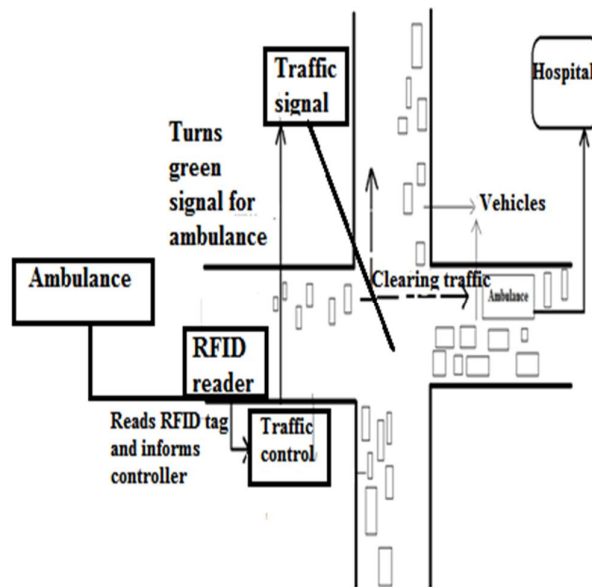


Figure 3: Making way for ambulance

C. Automatic opening of hospital gate

The IR sensor will be placed near the hospital gate such that it detects the ambulance when it about 50 meters away from the gate and will open the gate automatically without any human interruption. IR sensor will be connected to the controller as shown in the proposed model.

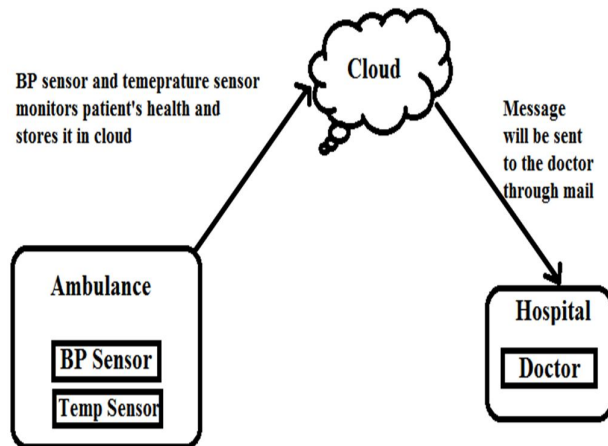


Figure 4: Patient's health monitoring

IV. CONCLUSION

This proposed system helps to save the life a patient by making way for the ambulance, if there is huge traffic at the traffic signal board. It also monitors the patient's health regularly and informs the respective doctor so that he can make arrangements for further treatment at an earlier time.

The fig 5 shows the comparative results. As shown in the figure the wastage of time will be reduced compared to earlier models because the ambulance gets notified before 100 meters of the traffic signal so that the traffic will be cleared faster and reduces waiting time. Even the doctor will be ready with his arrangements for the treatment when the patient arrives the hospital. And there is no need to wait for the watchman at the gate to open it, the gate automatically opens when ambulance reaches near to hospital and contributes to reduction of time wastage.

Raspberry Pi3 model B is built in with the WiFi model, where as for other modules we must connect separate hardware for that, so hardware will be reduced with this model and cost will also be reduced with having advanced features and also gives higher performance compared to other systems.

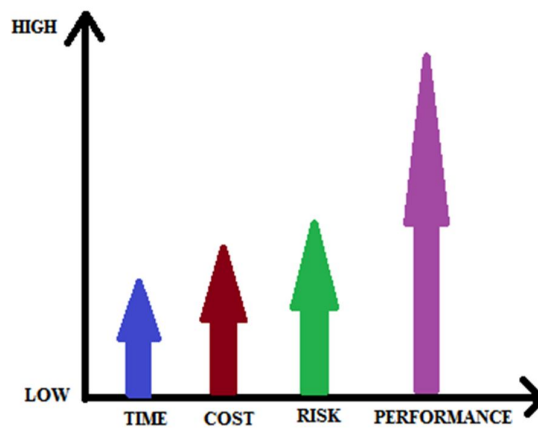


Figure 5: comparative results

The proposed architecture ensures the reliable traffic management system. So that emergency vehicles will be passed easily from the traffic and reaches the destination at an earlier time without any human interruption and minimizes the criticality or mortality rate of patient.

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