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A Survey on IOT Based Automated Ambulance and Patient Assistance System Using MTF Algorithm

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ABSTRACT*:* According to the recent survey, due to the delay in ambulance services, thousands of people have lost their lives. If the delay is minimized, more heart attack victims could be saved each year. In the existing system, to go across a traffic signal ambulance should hold back until the signal turns green. Here RSSI technology has been proposed where the distance between the nodes are estimated. By using RSSI technology, during emergency situations when an ambulance enters the range of traffic signal post, fixed with RSSI, the signal automatically changes to Green. In the proposed system, RSSI technology overcomes the delay by Macroscopic Traffic Flow (MTF) theory where the interaction of signals between RSSI and IoT module is avoided. Simultaneously, the health condition of the person is monitored and the information is sent to the specific hospital using IoT technique. Depending upon the injuries and patient's current status, the decision can be made either to reach a specialized hospital or normal hospital nearby. This system saves time and enables to reach the hospital quickly, so the patient's life can be saved. In the experimental tests, an average position estimation by RSSI of about 300m is achieved.

KEYWORDS: RSSI technology, Macroscopic Traffic Flow (MTF), IoT module, Position estimation

I. INTRODUCTION

India stands second in the world's population with a fast-growing economy. In cities, it faces severe road congestion problems every day. In this fast-moving world, the number of vehicles increase rapidly than infrastructure growth. The usage of the vehicle has been increasing due to increased industrialization with an increase in motor vehicle fatalities due to accidents. Thus, in urban cities of India, traffic control is a challenging issue. For example in Chennai, the roads are congested with traffic every day. Most of the time there will be traffic at least for a hundred meters. During this emergency situations, it is difficult for an ambulance to reach the hospital in time. To clear the traffic, it may take hours and the patient's situation may become worse during this time. The possibility for patients to suffer a loss of life is more with the lack of advanced medical procedures in an ambulance. Globally,1.24 million people were injured every year and the survey says that if the ambulance reaches the hospital incorrect time without

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stuck in the traffic,95% of the heart attack cases can be treated[1]. It will become even worse in future. In this case, immediate recovery actions need to be taken. Hence there is a real need for this paper for our overpopulated environment.

II.EXISTING SYSTEM

In the already existing system for Intelligent traffic control system (ITCS) was proposed in [2] for ambulance helps signal change by using IR sensors or RFID technology and cloud. If any of the technology fails, they don't have an alternative approach to control the flow. Another model provides constant assistance to the ambulance at each traffic intersections by turning the light green for the ambulance on its request[3]. Even the simulation results show that the model can reduce the time taken by the ambulance it is not efficient as they don't estimate whether the ambulance is an emergency or not, as the ambulance can also be used in non-emergency situations to facilitate the sick persons. In those cases, time limits are not considered. Hence it is not necessary to change the traffic signal in non-emergency cases. An embedded communication system with high cost is proposed in [4] which identifies emergency vehicles using lights and siren and warning messages are sent to the neighbouring vehicles periodically to inform them about the speed of the emergency vehicle and the current position.

III.PROPOSED METHOD

In the last few decades, traffic management is a vital issue in busy cities. The loss of human life due to ambulance delay is to be avoided. Our proposed system is in huge need to provide free movement of the ambulance without sticking into the traffic and also constant patient assistance. Depending upon the injuries and patient's current status, the decision can be made either to reach a specialized hospital or normal hospital nearby. By this, at emergency situations, the patient can be sent to a local hospital so that first aid can be given and later sent to a specialized hospital. Thus the proposed system consists of two sections in it. As two different sections involves the transmission of different signals, Macroscopic Traffic Flow(MTF) theory is used here to avoid the interaction between those signals.

A.SMART AMBULANCE SYSTEM:

With the help of the Internet of Things (IoT), we can improve traffic efficiency. Moreover, when ambulance has to wait for other vehicles to give way to intersections having traffic signals, the situation gets worse. During these emergency situations, when an ambulance enters the range of the RSSI fixed on the traffic signal post, the signal automatically changes to green and changes other sides to red. RSSI technology is proposed to control the traffic so that the ambulance will reach on time. This proposed system not only deals with the smart ambulance as well as a smart health system that will be discussed in the next section.

B.SMART HEALTH:

This section has a device in which different sensors such as heartbeat sensor and temperature sensor are used. The heartbeat sensor will sense the heartbeat and temperature sensor will sense the body temperature.These are displayed in a LCD kept within the ambulance. Also, the respective data from the sensors will be sent to the microcontroller which will be further connected with IOT cloud. From the cloud, patient 's data can be collected by the hospital for further medication. If the patient in the ambulance reaches a critical condition, the buzzer alerts the driver to reach the hospital nearby.

IV.MTF ALGORITHM

The macroscopic traffic-flow model includes three key characteristics: 1) flow rate; 2) mean speed; and 3) density [5]. In evaluating the quality of a trip, drivers tend to consider the mean speed more than the flow rate or density. Therefore, in this paper, the mean speed is also used as a performance metric. A set of roads embedded in a predefined

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geographical location forms a road network. A node is an intersection. A link is a road segment between two intersections. A road consists of several ordered links, all of which share the same road name.

In general, a pair of data p(s, t_1 , t_2) consecutively sampled by the same sensor is defined as

$$p(s, t_1, t_2) = \{s, t_1, \psi_1, t_2, \psi_2\} \quad (1)$$

where ψ_1 and ψ_2 are obtained by map matching from the consecutive data samples at $t_1$and t_2, respectively. The process of locating sensing data onto a road network map due to the well-known error of GPS devices is called map matching. A sensor s has its average mobile speed during an interval (t_1, t_2), which is denoted as

$$v(s, t_1, t_2) = r(\psi_1, \psi_2) / (t_2 - t_1) \quad (2)$$

where r (ψ_1, ψ_2) is the length of road travelled between ψ_1 and ψ_2.

The data collected from a group of associated sensors is utilized to estimate the traffic status around time t_k. More precisely, we use the data pair p(s, t_1, t_2) as input for the traffic estimation algorithm. For link Li with length li, let(t_1, t_2) is used to compute the MTS of Li around t_k, we say that v(s, t_1, t_2) is a speed element (SE) for Li. The definition of MTS is given as follows:

$$V_i(t_k) = \sum_{v \in Oi(t_k)} \left(\frac{l_i^v}{\sum_{v \in Oi(t_k)} l_i^v} \times v \right) \quad (3)$$

where $V_i(t_k)$ denotes the MTS of Li around time t_k obtained by traffic status estimation algorithms with sensor data, v represents an SE, Oi(k) is the set of SEs, and lvi denotes the length of the segment of Li that v covers. In addition, for calculation of $V_i(t_k)$ to handle asynchronous data sample timing we aggregate sensor data from ($t_k - \tau, t_k + \tau$). More, p(s, t_1, t_2) can be used to calculate $V_i(t_k)$ when(t_1, t_2)$\subseteq$ ($t_k - \tau$, $t_k + \tau$), where τ is a predefined constant. In addition, we analyse the real traffic flow by videotaping to get the measurement of MTS, which is regarded as the real value of MTS (RMTS). The formula used is as follows:

$$v_i^R(t_k) = \frac{l_i}{\frac{1}{|C_i(t_k)|} \sum_{c \in C_i(t_k)} \Delta t_c}$$

where c denotes a vehicle that travels link Li with the time cost Δtc around time t_k. A vehicle that enters link Li between ($t_k - \tau$, $t_k + \tau$) is included in a set of vehicles $C_i(t_k)$, and $|C_i(t_k)|$ is the size of $C_i(t_k)$.

We use camcorders to capture the video of the traffic flow of the tested link. Then, we begin to analyze the traffic flow. As we mentioned, for a specific link, we sample vehicles from the video, with and without traffic lights delays, to calculate RMTS by (4). Thus, these vehicles often have different time costs for travelling the link, which may result in a large standard deviation (SD) of the value of RMTS. Considering such a property, the RMTS calculated by (4) is a statistical metric that describes the entire traffic flow.

V.HARDWARE REQUIREMENTS

- Arduino UNO(2)
- RSSI
- Traffic signals
- LCD(2)
- Heartbeat sensor
- Temperature sensor
- Buzzer

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VI.RSSI TECHNOLOGY

The Received Signal Strength Indication (RSSI) is the measurement of the power present in a received radio signal. It is commonly used to estimate the distance between nodes. It is an approximate value for signal strength received on an antenna. Measuring the signal strength at the receiving antenna is one way of determining the quality of a communication link. To determine the position of a node using distance estimation from multiple reference points various techniques are discussed. The distance estimation is processed through the radio signal velocity and the time spent by the signal to reach its target. If a distant transmitter is moved closer to a receiver, transmitted signal strength at the receiving antenna increases and vice versa. The RSSI is measured in dBm. A greater negative value (in dBm) indicates a weaker signal. Therefore, -50 dBm is better than -60 dBm. In the RSSI-distance relation experiment, the RSSI value decreases with the increase of the distance between the nodes, and the distance between nodes can be reflected by RSSI value.

VII.BLOCK DIAGRAM

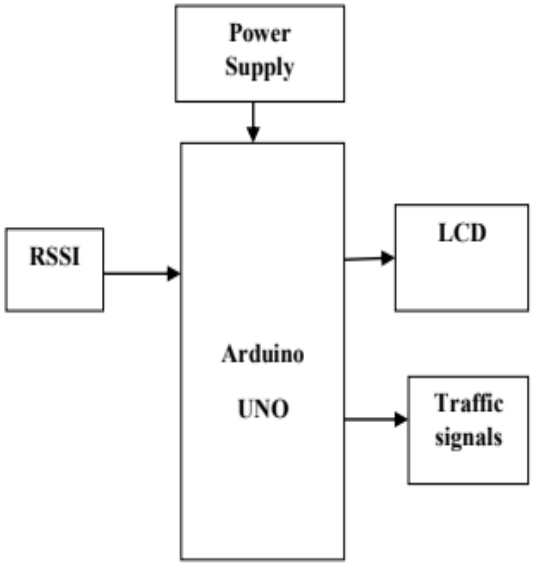

Fig 1.1 Block diagram of traffic section

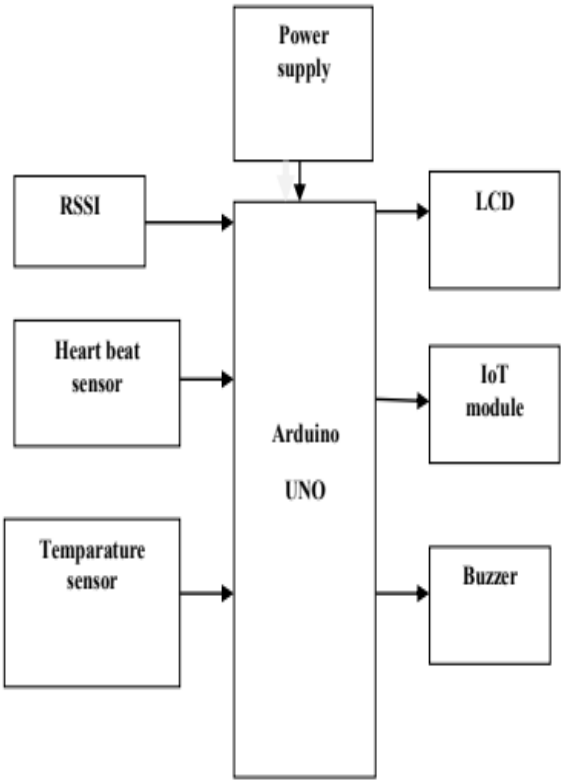

Fig 1.2 Block diagram of ambulance section

In a wireless network, data which is collected by sensor nodes is transmitted in a hop-by-hop manner. While data get transmitted through networks, congestion may occur. Hence, various protocols are used to reduce congestion. An approach called Macroscopic Traffic Flow theory (MTF) is implemented to minimize congestion. **Fig 1.3** represents the transmission and reception of RSSI signals. The transmitter and receiver of RSSI are fixed in the ambulance and the

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traffic signal post respectively. The signal from RSSI propagates within a coverage range of about 300m. When the ambulance in emergency enters into the range, source nodes in the ambulance send data to the destination node. After the reception of data, the traffic signal immediately changes to green. **Fig 1.4** illustrates the data flow from sensors to the hospital database via the cloud. Pulse rate sensor and the temperature sensor is connected with the Arduino pins(A0 and A1) of the Arduino. Using serial to USB converter, Arduino is connected with IoT module. Using Arduino software (IDE) simulation is done. Then the data is uploaded to Arduino hardware (Arduino UNO)[6] and it will be connected with the internet with the help of the IOT module. So that the information of the patient will be upload to the cloud.

Fig 1.3 Representation of transmission and reception Of RSSI signal

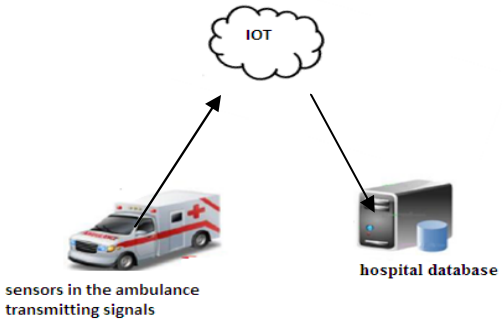

Fig 1.4 Data flow from sensors to the hospital database via the cloud

VII.RESULT

This simulation result shows the working of temperature and heart beat sensor .Here , temperature sensor is connected to A0 pin and heart beat sensor to A1 pin at the Arduino board. The respective details of the patient are shown in LCD display at the same time uploaded to the cloud. The threshold value for both the sensor are programmed if the value displayed in LCD exceeds the threshold limit ,buzzer will alert the driver .When the ambulance enters the coverage area of RSSI fixed in the traffic signal post, the signal changes to green and turns other side to red .

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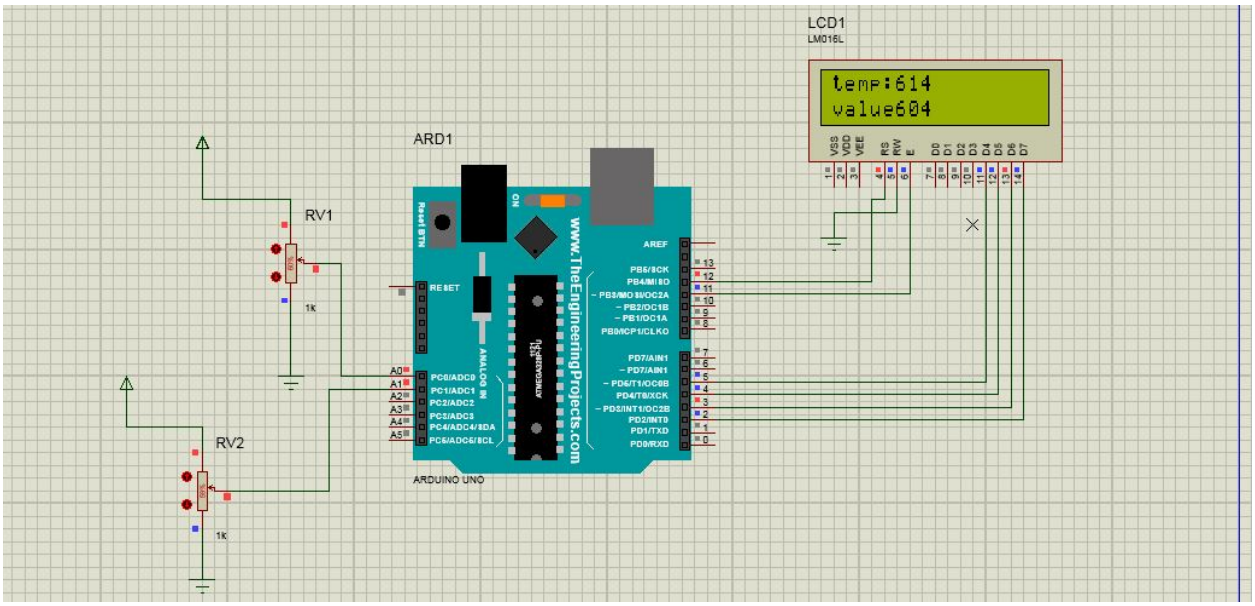
Fig . simulation results of temperature and heart beat sensor shown in LCD display



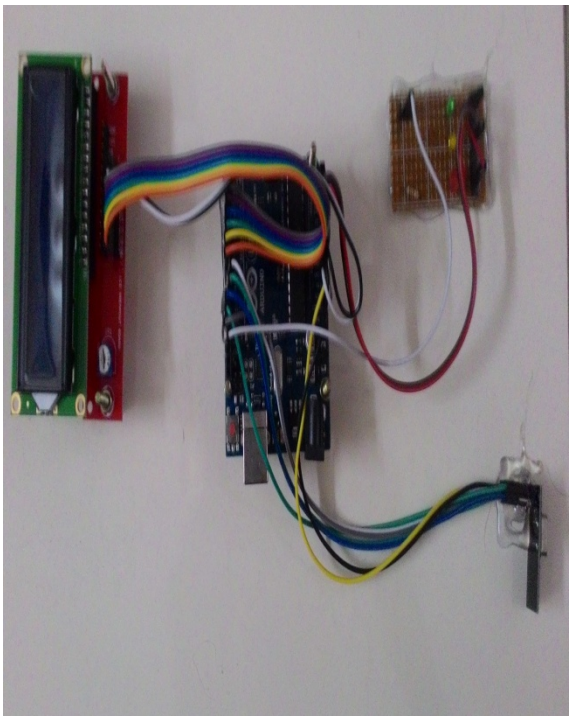


Fig. Traffic section kit

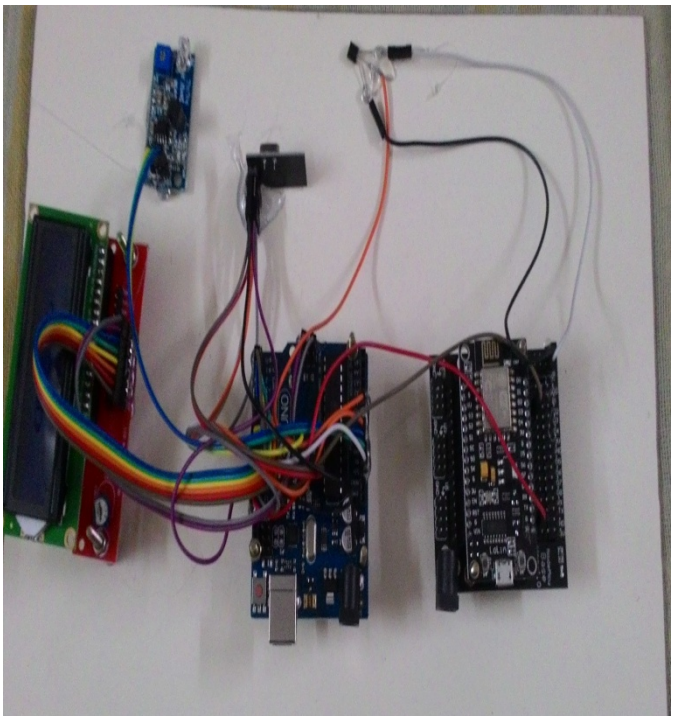


Fig. An Ambulance section kit

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VIII.CONCLUSION

In this paper, the proposed system aims at pursuing patient's safety by using an automated ambulance and patient assistance system. The need of the present situation can be fulfilled easily. It can be easily implemented as there is no requirement for newer ambulance design.Just a separate system is created and placed in the ambulance. The path clearance for ambulance along with continuous patient assistance is provided. Simulation results ensure that our model yield accurate distance estimation This is cost effective system and has a multiple usages which makes the system more efficient. In future, We will extend our idea by additionally implementing the shortest path estimation and way to the hospital.

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