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SMART DEVICE FOR AMBULANCE FOR CONTROLLING TRAFFIC

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ABSTRACT: *Transportation plays a key role in the human life style, people uses various mode of transport to satisfy their basic needs and to yield knowledge about their field of work. Amid all transports, the road transport is most widely used by the people. In accordance with that the major crisis people faces in their day to day life is the congestion of vehicles which results in traffic jam. There are rules and guidelines to avoid traffic collapse but those are exceptional for the ambulance which acts as a main median to save millions of lives. In case of emergency, they cannot travel along the same path to reach the hospital, they must take a short path to reach the hospital in such situation the traffic light control must work according to the ambulance's motion. So the ambulance can travel in a high speed without any delay and can reach the hospital within a short span. Multiple cases can be handled at the same time based on their criticalness and distance of destination. During the travelling period a nurse must be available to provide the first aid and further frequent medications under the guidance of the physician with live interaction. In order to achieve all these ailments, an ambulance with XBee transmitter and receiver with RSSI module, PIC16F1526 Microcontroller, USB to Serial Interfacing Cable, LED Lamps (Red, Yellow, Green), LCD Display, GSM Module, Temperature sensor, Heart beat sensor and other vital sign monitors.*

Key words: Temperature sensor, heart rate sensor, USB to serial interfacing cable, PIC16F1526 Microcontroller, XBee transmitter and receiver, GSM module, LED lamps, LCD display, RSSI model.

Abbreviations- GSM (Global system for mobile communications), RSSI (Received signal strength indication), LED (Light emitting diode), LCD (Liquid crystal display), UART (Universal asynchronous receiver transmitter).

I. INTRODUCTION:

A traffic light is a signalling device which is positioned at the road intersections, pedestrian crossing, or any other major locations in order to indicate the pedestrians to cross or not and to acknowledge the direction of the vehicles to be driven via a universal colour code. In common, the traffic lights for vehicles have three main lights. They are: the red light, green light and the yellow light. The red light denotes to stop, green for go and yellow for to get ready. However for the pedestrians, they have only two lights, a red light and a green light that denotes to stop and go respectively. The traffic lights have given many benefits to all the road users. Besides reducing the number of accidents, it made the vehicles to move without any flaws, and helped in saving people's time. The world's first traffic light was emerged before the automobile was in use, and the traffic at that time consists of only pedestrians, buggies, and wagons. In 1868, the installation of a revolving lantern with red and green signals was made at an intersection in London. They used a code of Red means "stop" and green means "caution." The lantern, illuminated by a gas, was turned by means of a lever at its base so that the appropriate light will be faced towards the traffic. On January 2 1869, this crude traffic light was exploded, by injuring a policeman who was operating it. After the arrival of automobiles, the situation got even worse. Police Officer William L. Potts of Detroit, Michigan, decided to do something about the problem. Then he came up with the idea of figuring out a way to adapt railroad signals for street use. The railroads were already utilizing automatic controls. But railroad traffic travelled along parallel lines. Street traffic travelled at right angles. Potts used red, amber, and green railroad lights and about thirty-seven dollars of wire and electrical controls to make the world's first 4-way three colour traffic light. It was installed in 1920 on the corner of Woodward and Michigan Avenues in Detroit. Within a year, Detroit had installed a total of fifteen of the new automatic lights. At about the same time, Garrett Morgan of Cleveland, Ohio realized the need to control the flow of traffic. A gifted inventor and reportedly the first African American to own an automobile in Cleveland, Ohio, he invented the electric automatic traffic light. Though it looked more like the semaphore signals you see at train crossings today. Many others had obtained US Patents for Traffic Signals, some as early as 1918. But Morgan's Patent was purchased by General Electric Corporation and provided the protection they needed to begin building a monopoly on traffic light manufacture.

II. DIFFERENT SCENARIOS OF TRAFFIC LIGHT ISSUE:

The traffic jam is the common problem faced in most of the cities in the world. One of the main cause of this problem is accident. To find the way to maximize the traffic flow smoothly the government has stated out many rules to overcome this problem. Instead of providing punishments to all the traffic offenders, the traffic warning boards have been incorporated at the high risk accident sites. However, increasing the number of traffic lights has caused some problems:

(a) Increased number of vehicles:

Increasing the number of vehicle transportation in road, causes heavy traffic jams. This happens usually at the main junctions commonly at the morning, before office hour and at the evening, after the office hour. The main effect of this theme ends in air pollution.

(b) Improper light emission:

Sometime there won't be any traffic. But because of the traffic light is still red, the road users should wait until the light turns to green. If they cross the signal during red light, unfortunately they should pay the penalty fine amount.

(c) Emergency stuck in traffic jam:

Usually, during traffic jam the emergency vehicles, such as an ambulance, fire brigade and police might stuck especially at the traffic light junction. This is because the road users wait for the traffic light to turn to green. This is a very critical problem because the emergency case can become more complicated, especially when life is involved.

III. METHODOLOGY:

The module is designed with the XBee module it is provided with RSSI (Received Signal Strength Indication) in order to detect the ambulance under emergency condition based on the received signal strength. The XBee transmitter is fitted in the ambulance and is activated only when the ambulance is under emergency condition. The XBee receiver is fitted in the traffic signals. The microcontroller controls the flow of the traffic signal lights. The ambulance subsequently sends the datum of the patient like blood pressure level, heart beat rate, glucose level and other datum which may be useful for maintaining the health of the patient while he is still in the ambulance.

When the ambulance under emergency condition it reaches within the range of the signal strength, the traffic lights of that particular lane automatically changes to green (if red) by the microcontroller, and the traffic lights of other lane(s) change to red. Due to this process, the vehicles blocking the way of the ambulance will move so that the

Ambulance also moves. Once the ambulance crosses the traffic signal, the traffic light changes back to red and the normal sequence of operation continues.

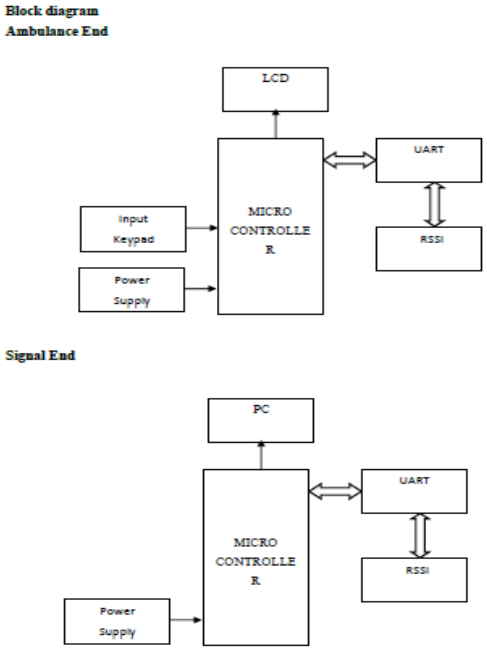

Fig 1. Block diagram of the hardware setup

IV. HARDWARE SETUP:

1. XBee module :

XBee is the brand name of a family of form factor compatible radio modules from Digi International. It has both the transmitter and the receiver. The first XBee radios were introduced under the **Max Stream** brand in 2005 and were based on the IEEE 802.15.4-2003 standard designed for point-to-point and star communications at over-the-air baud rates of 250 kbps. The XBee radios can all be used with the minimum number of connections — power (3.3 V), ground, data in and data out (UART), with other recommended lines being reset and Sleep. Additionally, most XBee families have some other flow control, input/output (I/O), analog-to-digital converter (A/D) and indicator lines built in. A version called the programmable XBee has an additional on-board processor for user's code. The programmable XBee and a surface-mount version of the XBee radios were both introduced in 2010.

Fig 2. XBee module

2. RSSI :

RSSI stands for Received Signal Strength Indication. In an IEEE 802.11 system, RSSI is the relative received signal strength in a wireless environment, in arbitrary units. RSSI is an indication of the power level being received by the receive radio after the antenna and possible cable loss. Therefore, the higher the RSSI number, the stronger the signal. Thus, when an RSSI value is represented in a negative form (e.g. −100), the closer the value is to 0, the stronger the received signal has been. RSSI can be used internally in a wireless networking card to determine when the amount of radio energy in the channel is below a certain threshold at which point the network card is clear to send (CTS).Once the card is clear to send, a packet of information can be sent.

Fig 3. XBee with RSSI module at receiver side

The end-user will likely observe a RSSI value when measuring the signal strength of a wireless network through the use of a wireless network monitoring tool. There is no standardized relationship of any particular physical parameter to the RSSI reading. The 802.11 standard does not define any relationship between RSSI value and power level in milliwatts or decibels referenced to one milli watt. Vendors and chipset makers provide their own accuracy, granularity, and range for the actual power (measured as milliwatts or decibels) and their range of RSSI values (from 0 to RSSI maximum). One subtlety of the 802.11 RSSI metric comes from how it is sampled—RSSI is acquired during only the preamble stage of receiving an 802.11 frame, not over the full frame. As early as 2000, researchers were able to use RSSI for

Coarse grained location estimates. More recent work was able to reproduce these results using more advanced techniques. Nevertheless, RSSI does not always provide measurements that are sufficiently accurate to properly determine the location. However, RSSI still represents the most feasible indicator for localization purposes as it is available in almost all wireless nodes and it does not need any additional hardware requirements.

3. PIC16F1526:

This microcontroller consists of 64 pins. It comprises of 49 instructions and 16 stack levels with a flash memory of self read/ write capability. The internal oscillator ranges of 16 MHZ and Ten CCP (Capture Compare Pulse width Module) it has 30 Channel 10b ADC (Analog to digital converter) with Voltage Reference. The operating voltage ranges from 1.8 to 5.5 v and can withstand a temperature range of -40 to 125 in degree Celsius.

Fig .4 PIC16F1526 micro controller

4. UART:

A universal asynchronous receiver transmitter is a physical hardware connecting median for the computer device. It doesn't follow any protocol. It does the function of asynchronous serial communication in which the data format is transmitted and received. The trans-receptional speed is configurable. The data format will be in a parallel form which is received from the controller the UART converts it into in a serial data communicatio then it will be transmitted to the receiver end and again to the system it will convert the serial commnunication into a parallel form. Only two wires are used for data transmission and reception.

5. GSM:

The Global system for mobile communication is a digital mobile network used for communication. GSM 900 A is a 2g based module where a call and an alert message can be made. It works on the different frequencies, in case of EGSM it is about 900MHz and in DCS it is about 1800MHz.

This module can be operated just like a mobile phone with its own unique number. It has RS232 serial port communication so it can commit a voice call and a textual message. It has an external supply of 12 v and can draw up to 2A of current at its peak.

V. PROPOSED METHOD:

This project is based on RSSI technique. RSSI stands for Received Signal Strength Indication. In an IEEE 802.11 system, RSSI is the relative received signal strength in a wireless environment, in arbitrary units. RSSI is an indication of the power level being received by the receive radio after the antenna and possible cable loss. Therefore, the higher the RSSI number, the stronger the signal. Thus, when an RSSI value is represented in a negative form (e.g. −100), the closer the value is to 0, the stronger the received signal has been.

VI. RESULTS AND DISCUSSION:

As mentioned in the methodology, the XBee is incorporated in the ambulance when an emergency exits and the sufferings of the patient will be informed to the physician via UART and RSSI module. By receiving the signal the physician provides the necessary treatments which can be provided before reaching the hospital. In addition to that the traffic signal will be controlled by the ambulance by using the controllers. This approach will reduce the time and the severity of the patient. In accordance with the existing techniques, the ambulance that consists of a PIC microcontroller and a Li-Fi transmitter, when the traffic signal receives an alert regarding an emergency vehicle, the traffic signal would immediately turn green. Thus, it decreases the waiting time of emergency vehicles in traffic dense lanes. Li-Fi uses visible light spectrum for communication which is almost 10000 times than that of radio spectrum. It has more efficiency than radio based system as rating of vehicle lamps are very less than a cellular base station.

VII. CONCLUSION:

As discussed, the ambulance serves as a lifesaving vehicle. In order to ensure the patient's life the rapid driving of the ambulance must be mandatory to reach the hospital within a short span of time. So the traffic lights will be controlled by the ambulance by using this smart device. This enhances decreased traffic congestion that an ambulance faces.

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