Sudan University for Science and Technology

College of Graduate Studies

A SAFETY SYSTEM FOR AUTOMATIC ACCIDENT DETECTION AND Injured reSCue

منظومة السلامة للكشف الآلي عن الحوادث وإسعاف المصابين

A thesis submitted in partial fulfillment of the requirements for the

M.Sc. Degree in Biomedical Engineering

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Declaration

I, Amna Ahmed confirm that the work presented in this thesis is our own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

……..

AMNA AHMED IBRAHIM DAWOOD

Abstract

With the large increase for vehicles and cars of various kinds and the movement of large development that occur every day on the roads and streets it was natural and realistic to increase traffic accidents by multiple causes, but the real dilemma lies in how to rescue the injured in these accidents.

Accounting for traffic jams and lack of presence of ambulances or cars traffic police near the scene impediments Impedeto the quick access to the accidents location, or even the arrival of ambulances carrying the injured to hospitals, which reduces the probability to survive in case of severe injuries or also doubles the rate of exacerbation of minor injuries.

The model that we are presenting today is an attempt to provide radical solutions to those problems that have been mentioned previously and up to facilitate the access of ambulances to the accident location or to hospitals easily depending on the three electronic circuits, the first one in a civil's cars, the second in the ambulances, and the third one in the traffic light system.

The first circuit situated in civilian's cars and its mission is to inform the ambulances by sending massage contain the location of the accident.

The second is the circuit in the ambulance which controls traffic signals facing the ambulance on its way to either the accident location or to hospitals.

The third circuit is the traffic signal which is connected with the second mentioned circuit (ambulance) by radio frequency, to give a full control on the traffic lights by ambulances system.

All these circuits designed and work together to facilitate the arrival of ambulances to the accident in order to ensure quick access to rescue cases resulting from the incident.

المستخلص

مع التزايد الكبير للمركبات والسيارات بمختلف أنواعها ، وعلى الرغم من حركة التطور الكبيرة الذي تطرأ كل يوم على الطرق والشوارع كان من الطبيعي والواقعي أن تزداد الحوادث المرورية التي تتعدد أسبابها ، ولكن الإشكال الحقيقي يكمن في كيفية إسعاف المصابين في هذه الحوادث ، حيث تشكل الاختناقات المرورية وعدم تواجد سيارات الإسعاف أو سيارات شرطة المرور بالقرب من مكان الحادث عوائق تحول دون الوصول السريع لمكان الحادث أو حتى وصول سيارات الإسعاف التي تحمل المصابين إلى المستشفيات مما يقلل نسبة إحتمال النجاة في حالة لإصابات الخطرة أو يضاعف أيضاً نسبة تفاقم الإصابات الطفيفة ، النموذج الذي نقدمه اليوم هو محاولة لتقديم حلول جذرية لتلك المشاكل التي تم ذكرها سابقاً وصولاً إلى تسهيل وصول مركبات الإسعاف إلى مكان الحادث أو إلى المستشفيات بسهولةإعتماداً علىثلاث دوائر إلكترونية تم تصميمهما .

الدائرة الأولى التي تكون متموضعة في السيارات العادية ومهمتها هو إبلاغ سيارات الإسعاف بواسطة إرسال رسالة تحتوي على موقع الحادث إستناداً إلى خطوط الطول والعرض.

الدائرة الثانية وهي الدائرة الموجودة في سيارة الإسعاف والتي تقوم بالتحكم بالإشارات المرورية الضوئية التي تواجه سيارة الإسعاف في طريقها إما إلى مكان الحادث أو إلى المستشفيات.

الدائرة الثالثة وهي دائرة إشارة المرور والتي تتصل مع الدائرة الثانية التي تم ذكرها بواسطة تردد الراديو، وذلك لمنح التحكم الكامل لدائرة سيارة الإسعاف بإشارة المرور.

وقد صممت هذه الدوائربصورة تكاملية لتسهيل وصول مركبات الإسعاف من وإلى مكان الحادث ومن ثم الي المستشفي وذلك لضمان الوصول السريع وإنقاذ الحالات الناتجة من الحادث.

Acknowledgements

Along life my academic life I was just care about earning degrees and pass through each exam that's was my goal however I wasn't aware that this experiment going the change my direction cause each wall face me and each obstacles pull me down there was a warm wind makes me rise again I thought it's just a luck but I was wrong ,now I realized its god mercy who was always for me even with my shameful sins at the end I'm just want to say "ALLAH guide me to the right path in my life in my death and when I stand alone between your forgiveness". Those from whom I learnt patience, persistence and hard work …….

My Father. Those who have cared for me until I reached this point.

My Mother

Those who have lit my way, those encourage me.

My Family

Those who have watched and guided my steps with his knowledge …. My Teachers

Dedication

This thesis is dedicated to my wonderful parents, who have raised us to be the people we are today .you have been with me every step of the way, through good times and bad. Thank you for all the unconditional love, guidance, and support that you have always given me, Helping me to succeed and instilling in the confidence that I am capable of doing anything I put my mind to. I put it in my mind thank you for anything I love you! And to the people whom their friendship made my life a wonderful experience thanks for given me for amazing memorable years.

Table of Contents

Contents

List of figure

List of Tables

Glossary of Abbreviations

GPS	**G**lobal **P**ositioning **S**ystem
GSM	**G**lobal **S**ystem for **M**obile
GPRS	**G**eneral **P**acket **R**adio **S**ervices
RF	**R**adio **F**requency
TLS	**T**raffic **L**ight **S**ystem
TLC	**T**raffic **L**ight **C**hart
ICSP	**I**n-**C**ircuit **S**erial **P**rogramming
TDMA	**T**ime-**D**ivision **M**ultiple **A**ccess

Chapter 1 Introduction

Every year more than 1.17 million people die in road crashes around the world. The majority of these deaths, about 70 percent occur in developing countries. Sixty-five percent of deaths involve pedestrians and 35 percent of pedestrian deaths are children. Over 10 million are crippled or injured each year. It has been estimated that at least 6 million more will die and 60 million will be injured during the next 10 years in developing countries unless urgent action is taken [1].

The majority of road crash victims (injuries and fatalities) in developing countries are not the motorized vehicle occupants, but pedestrians, motorcyclists, bicyclists and non-motorized vehicles (NMV) occupants. The most serious injuries resulting from traffic accidents are head, spinal, and internal soft tissue damage to vital organs [2].

According to the World Health Organization ,road traffic injuries caused an estimated 1.25 million deaths worldwide in the year 2010. That is one person is killed every 25 seconds. Only28 countries, representing 449 million people (7% of the world's population), have adequate laws that address all five risk factors (speed, drink–driving, helmets, seat-belts and child restraints [3]. The field of medical engineering from those areas cannot be separated in their objectives and fundamentals and theories from other sciences, but that the focus on human safety is greater than the rest of the areas in direct association with the medical field, which is the highest human sciences in terms of his interest in human health and safety and to ensure that it remains intact and safe and healthy.

So it was the most important objectives of this study is to overcome the problems and obstacles faced ambulances and traffic police when accidents happens and make priority to the survival of the human for the risk of further injury or death, and to facilitate this command to those who are doing their best to achieve human safety and survived.

This study has focused on avoiding the shortcomings which contained in the previous efforts and studies and models that have been looking at this side, so it was very necessary to study those efforts and get to know their results and their impact and their effectiveness in order to launch from them to provide a model beyond the problems that hinder the smooth and rapid access to the scene and to hospitals.

1.1 Problems

In the location of car accidents, ambulances and traffic police cars face many traffic obstacles, which are often due to the density of cars on the roads and the presence of traffic lights that regulate the movement of vehicles on roads. This often results in delayed access of ambulances and paramedics to the scene or to hospitals. This delay often causes many deaths that could have been saved if they arrived without delay and with the necessary speed which is called golden hour.

1.2 Objective

Rapid response for traffic accidents Reduce the number of traffic accident victims by facilitating the movement of ambulances and avoiding all the traffic obstacles that were present during the rescue operation. Shorten and reduce the time required for the arrival of ambulances to the scene and from it to hospitals to receive the necessary health care which is known as golden hour. Giving priority to ambulances in the traffic jams and giving paramedics time to perform their duties. The provision of first aid and medical care to the victims at location of accident before carry them to hospital. The subsequent provision when the victims arrive to hospital.

1.3 Methodology

In this proposal we used three circuits, the first one consisting of sensors(fire sensor and vibration sensor) Arduino,LCD, GPS and GSM, which it link between vehicles and ambulances for sending notification alarms when the accidents is happened.

The second one is the link between ambulances and traffic lights by radio frequency, it consisting of four Switches (four directions) and encoder in the ambulance and the traffic lights consisting of decoder, microcontroller and 16 leds and Radio Frequency (transmitter and Receiver) for remote control of traffic lights.

Integration between the three circuits would solve the problem of delays in the arrival of ambulances and to the accident location and from there to the hospitals.

1.4 Result

Integration between the three circuits would solve the problem of delays in the arrival of ambulances to the accident location and from there to the hospitals.

1.5 Layout of research

This research consist of seven chapters, chapter one is an introduction of the research, chapter two represent the theoretical background and literature review, chapter three discus the methodology that followed in the study, chapter four show the circuit design, chapter five discuss result, chapter six is for discussion, finally chapter seven contain the conclusion & the recommendations followed by a list of references.

Chapter 2 Theoretical Background and Literature Review

2.1 Theoretical Background

The theoretical basis of this proposal is based on the establishment of three basic units that are linked to each other to achieve the basic idea of the project.

The main idea of this project is to reduce the length of time taken by the rescue of traffic accident victims. The time is a very important factor, The delivery of the patients from the scene of the accident to the hospital is the factor that determines whether the life of the victims can be saved or not, so there were three main parts integrated to accomplish this task, partial location identification, access path to the scene and Access from the scene to the hospital.

For the first theoretical basis for determining the location of the accident, the ideal choice for positioning was to create a circle containing the GPS and GSM, the ideal tool used geometrically and technically in positioning in general.

The GPS devices vary from application to another. The size of the transmission, the search for a small device and the ability to send signals should be strong and can be placed in all types of vehicles without any damage or impact in other parts of the vehicle.

GSM networks operate in a number of different carrier frequency ranges, with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead.

In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

Regardless of the frequency selected by an operator, it is divided into timeslots for individual phones. This allows eight full-rate or sixteen half-rate speech channels per radio frequency.

These eight radio timeslots (or burst periods) are grouped into a TDMA(Time-Division Multiple Access) frame. Half-rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms.

The transmission power in the handset is limited to a maximum of 2 watts in GSM 850/900 and 1 watt in GSM 1800/1900.

As for how to determine the occurrence of the accident from the ground, the theoretical basis for this is to rely on means to measure large vibrations or monitor the high temperatures caused by combustion or monitoring the escalation of gases, and the best way is to integrate certain sensors in the system of cars such as vibration sensor and sensors of gases known as Temperature), where the basic theory is that the sensor alerting to violent vibration or alarm at high temperature or the rise of gases caused by combustion.

The Vibration Sensor Detector is designed for the security practice When Vibration Sensor Alarm recognizes movement or vibration, it sends a signal to either control panel Developed a new type of omni-directional high sensitivity Security Vibration Detector with omni-directional detection. Vibration sensor specification as follow:

- Sensitivity: Height adjustable.
- Consistency and Interchangeability: Good.
- Reliability and Interference: Accurate triggering strong anti-interference.
- Automatic Reset: Automatic reset is strong.
- Signal Post-processing: Simple.
- Output Signal: Switch signal.
- No External Vibration Analysis of Plates: Product design vibration analysis of the internal amplifier circuit.

- Detection Direction: Omni-directional.
- Signal Output: Switch signals.
- Output Pulse Width: The vibration signal amplitude is proportional to Operating Voltage: 12VDC (red V + shield V-).
- Sensitivity: Greater than or equal 0.2g.
- Frequency Range: 0.5HZ ~ 20HZ.
- Operating Temperature Range: -10 ~ 50.

The theoretical basis for the application of the proposed model depends mainly on the rate of movement of traffic in the main and secondary roads and the possibility of finding a way to facilitate the passage of ambulances and overcome obstacles and congestion traffic and others, in view of the importance of time spent in the arrival of critical cases resulting from traffic accidents Places of emergency and urgent medical care. Therefore, because the traffic awareness of the various segments of society and its various groups may not be sufficient to make the work of ambulances easier and more flexible, the basic idea and the theoretical basis depends on Proceeded to control the traffic lights encountered ambulances on their way while carrying out their tasks in all the different ways and traffic conditions of altered those streets.

In order to make this idea feasible, there must be a direct link between ambulances and traffic lights. This is done by connecting two non-wire circuits between ambulances and traffic light signals. This means that these circuits must have transmitters and receivers.

The use of radio frequency (RF) devices, where there is RF receiver and RF transmitter.

Radio frequency (RF) refers to alternating (AC) electric current or radio waves, oscillating in the frequency range used in radio, extending from around twenty thousand times per second (20 kHz) to around three hundred billion times per second (300 GHz), roughly between the upper limit of audio frequencies and the lower limit of infrared frequencies. The term does not have an

official definition, and different sources specify slightly different upper and lower bounds for the frequency range. RF usually refers to electrical rather than mechanical oscillations, the radio spectrum of frequencies is divided into bands with conventional names designated by the International Telecommunications Union (ITU).

Frequency range	Wavelength range	ITU designation		IEEE bands[4]
		Full name	Abbreviation[5]	
3–30 Hz	10^5–10^4 km	Extremely low frequency	ELF	N/A
30–300 Hz	10^4–10^3 km	Super low frequency	SLF	N/A
300–3000 Hz	10^3–100 km	Ultra low frequency	ULF	N/A
3–30 kHz	100–10 km	Very low frequency	VLF	N/A
30–300 kHz	10–1 km	Low frequency	LF	N/A
300 kHz – 3 MHz	1 km – 100 m	Medium frequency	MF	N/A
3–30 MHz	100–10 m	High frequency	HF	HF
30–300 MHz	10–1 m	Very high frequency	VHF	VHF
300 MHz – 3 GHz	1 m – 10 cm	Ultra high frequency	UHF	UHF, L, S
3–30 GHz	10–1 cm	Super high frequency	SHF	S, C, X, Ku, K, Ka
30–300 GHz	1 cm – 1 mm	Extremely high frequency	EHF	Ka, V, W, mm
300 GHz – 3 THz	1 mm – 0.1 mm	Tremendously high frequency	THF	N/A

Table 2-1: the International Telecommunications Union (ITU) division of radio spectrum of frequencies

So that ambulances and traffic lights can be connected so that the latter can be controlled so that paramedics can gain time and deliver patients to hospitals in a timely manner.

In view of the complexity of such a system, it was necessary to use sophisticated software and modern programs to connect the parts of the circuit and programming as needed. The theoretical basis of this proposal was to distinguish between a number of electronic circuit programming devices such as Matlab and Java and the quality of auxiliary microcircuits such as Arduino, The theoretical preparation of this proposal is to create precise and clear algorithms for how each of these circuits and micro circuits work.

2.2 Literature Review

2.2.1 First study

The first study, which was entitled Automatic Traffic Accident Detection and Notification with Smartphones. Which prepared by Jules White, Chris Thompson, Hamilton Turner, Brian

Dougherty, and Douglas C. Schmidt.[4]The paper describes how smartphones, such as the iPhone and Google Android platforms, can automatically detect traffic accidents using accelerometers and acoustic data, immediately notify a central emergency dispatch server after an accident, and provide situational awareness through photographs, GPS coordinates, VOIP(Voice Over Internet Protocol) communication channels, and accident data recording. The paper also provides the following contributions to the study of detecting traffic accidents via smartphones:

Present a formal model for accident detection that combines sensors and context data.

Show how smartphone sensors, network connections, and web services can be used to provide situational awareness to first responders. Provide empirical results demonstrating the efficacy of different approaches employed by smartphone accident detection systems to prevent false positives. Actually using of smart phones and services provided by the Internet is a smart and effective idea, But it may also be accompanied by some of the obstacles that are related to technical problems and Internet coverage that may hinder or cause delays in the process, additionally the absent of responder that has to be addressed and resolved in our proposal study by making full control in the hands of ambulances drivers and we didn’t need internet.

2.2.2 Second study

The third study, which was entitled Automatic Vehicle Accident Detection and Messaging System Using GPS and GSM Modems. Which prepared (Sri Krishna Chaitanya Varma, Poornesh, Tarun Varma, Harsha)[5]. The main purpose is to provide security to the vehicle in very reasonable cost using the basic microcontroller AT89C52 for cost effective and also for easy understanding.

In this study used assembly programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to the remote devices (mobile phones) using GSM modem. This study did not address the subject of response technology for the notification of the incident.

2.2.3 Third study

The third study, which was entitled AUTOMATIC ACCIDENT DETECTION AND AMBULANCE RESCUE WITH INTELLIGENT TRAFFIC LIGHT SYSTEM, Which is prepared by Mr.S.Iyyappan (P.G Scholar, Dept. of EEE, Ganadipathy Tulis's Jain Engineering College, Vellore, India) and Mr.V.Nandagopal (AssistantProfessor, Dept. of EEE, Ganadipathy Tulis's Jain Engineering College, Vellore,

India)[6]. "The ambulance is controlled by the control unit which furnishes adequate route to the ambulance and also controls the traffic light by traffic section according to the ambulance location and thus reaching the hospital safely."

Here we have same idea. but The different between our proposed system and previous study that the ambulance drivers have a full control traffic light they face on the route to the hospital or to the accident location, the thing that will offer more time than waiting for a signal from the control unit, which could be delayed for several factors most notably poor Internet network coverage or any technical difficulties you may encounter network.

STUDY NAME	STUDY TECHNIQUE	NOTIFICATION TECHNIQUE	NOTIFICATION RESPONDER	TRAFFIC LIGHT CONTROL
Automatic Traffic Accident Detection and Notification with Smartphones	detect traffic accidents by Smartphone's, such as the iPhone and Google Android platforms, automatically using accelerometers and accoustic data, immediately notify a central emergency dispatch server after an accident.	provide situational awareness through photographs, GPS coordinates, , and accident data recording.	This study did not address the subject of response technology for the notification of the incident	Not addressed
Automatic Vehicle Accident Detection And Messaging System Using GPS and GSM Modems	Detect traffic accidents by finding the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system.	The exact location of the vehicle is sent to the remote devices (mobile phones) using GSM modem	This study did not address the subject of response technology for the notification of the incident	Not addressed
AUTOMATIC ACCIDENT DETECTION AND AMBULANCE RESCUE WITH INTELLIGENT TRAFFIC LIGHT SYSTEM	Study is fully automated, thus it finds the accident spot, controls the traffic lights, helping to reach the hospital in time.	when vehicle has met accident, vibration sensor or fire sensor gives the electric signal to microcontroller through signal conditioner. Then GPS provides latitude and longitude information about vehicle location to control section through GSM.	In control section GSM modem receives message about accident and send it to PC which identifies the nearest ambulance and ambulance is instructed to pick up the patient. Control section transmits the control signal to all the signals in between ambulance and vehicle by RF transmission.	Whenever the ambulance reaches near to the traffic signal(approximately 100m), the traffic signal will be made to green through RF communication
Safety system for automatic accident detection and ambulance rescue system (the proposal)	It proposed a two systems, one that identifies the place of the accident and the other system car involved in facilitating the ambulance by direct control traffic lights, which coincides with the movement of ambulances on their way to the scene and then to the hospital to rescue the injured	The vehicle circuit which contains vibration sensor, , fire sensor, Arduino, and the GPS SYSTEM to find out the data of current position of the vehicle and GSM MODULE , which it sends this data to the ambulance	the ambulance receive short massage contain the location of the accident from the vehicle to help ambulance to reach to the scene location .	Whenever the ambulance reaches near to the traffic signal(100 to 120m), transmit RF which in the ambulance will interrupt the traffic and connect automatically with receiver RF which in traffic light , and by using the Four switches ambulance's driver get a full ,manually and direct control all traffic light in the domain, then and by the switching also removed the interrupt and get normal

Table 2-2: Comparison table between the proposal some studies

Chapter 3 Methodology

The proposed system consists of three main units Vehicle unit, ambulance unit and traffic light system unit. These three units work together as system to help the ambulance to reaches the hospital without any delay in the time.

3.1 Vehicle unit

Before we begin to detail this module, we should initially explain all mentioned elements, The vehicle unit is installed in the vehicle, It contains vibration sensor, which it sense the accidents (high vibration), fire sensor, Arduino, GPS SYSTEM to find out the data of current position of the vehicle and GSM MODULE (Global System for Mobile), which it sends notification massages if accidents is happened to the ambulance.

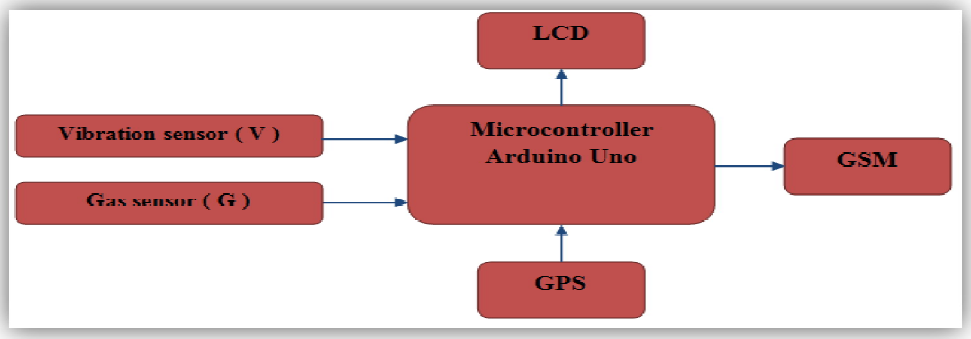

Figure 3-1BLOCK DIAGRAM OF VEHICLE CIRCUIT

3.1.1 Vibration sensor

The vibration sensor is used for testing the impact force． It has high vibration detection sensitivity and the environmental of sound signal suppression, which has strong ability to engage in interference [7][8].

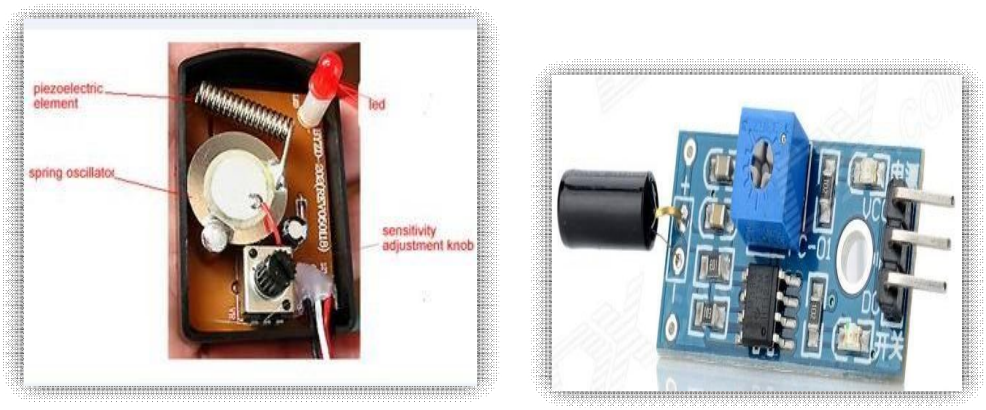

Figure 3-2VIBRATION SENSOR A: ENTIRE DESIGN B: SHAPE OF V.S

3.1.2 Gas sensor

This Gas Sensor Module can detect alcohol, carbon monoxide, smoke and other harmful gases [7].

Figure 3-3GAS SENSOR

The gas sensor is a versatile gas sensor capable of detecting a wide range of gases including: alcohol, carbon monoxide, hydrogen, isobutene, liquefied petroleum gas, methane, propane and smoke. This module has both a 3 pin male header interface and a "grove" style connector.

3.1.3 Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP (In-Circuit Serial Programming) header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

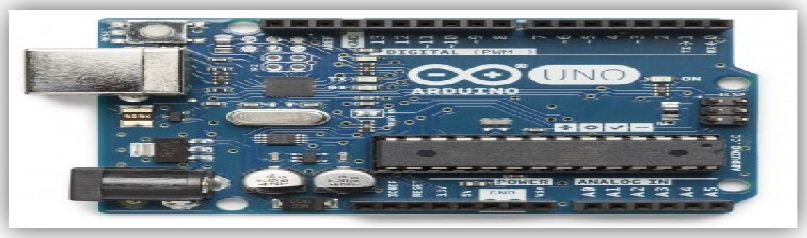

Figure 3-4microcontroller Arduino Uno

3.1.4 GPS

A GPS tracking unit is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. The recorded location data can be stored within the tracking unit or it may be transmitted to a central location database or Internet connected computer, using a cellular (GPRS (General Packet Radio Service) or SMS), radio, or satellite modem embedded in the unit. This allows the asset's location to be displayed against a map backdrop either in real time or when analyzing the track later, using GPS tracking software [10].

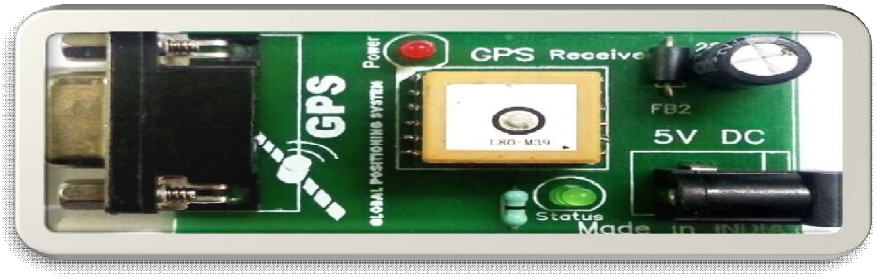

Figure 3-5GPS DEVICES USED IN CIRCUITS

3.1.5 GSM

Is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones.

As of 2014 it has become the de facto global standard for mobile communications – with over 90% market share, operating in over 219 countries and territories.

2G networks developed as a replacement for first generation (1G) analog cellular networks, and the GSM standard originally described as a digital, circuit-switched network optimized for full duplex voice telephony.

This expanded over time to include data communications, first by circuit switched transport, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS.

Figure 3-6GSM DEVICE

Subsequently, the 3GPP developed third-generation (3G) UMTS (Universal Mobile Telecommunications System) standards followed by fourth-generation (4G) LTE (Long Term Evolution) advanced standards, which do not form part of the ETSI (European Telecommunications Standards Institute) GSM standard.

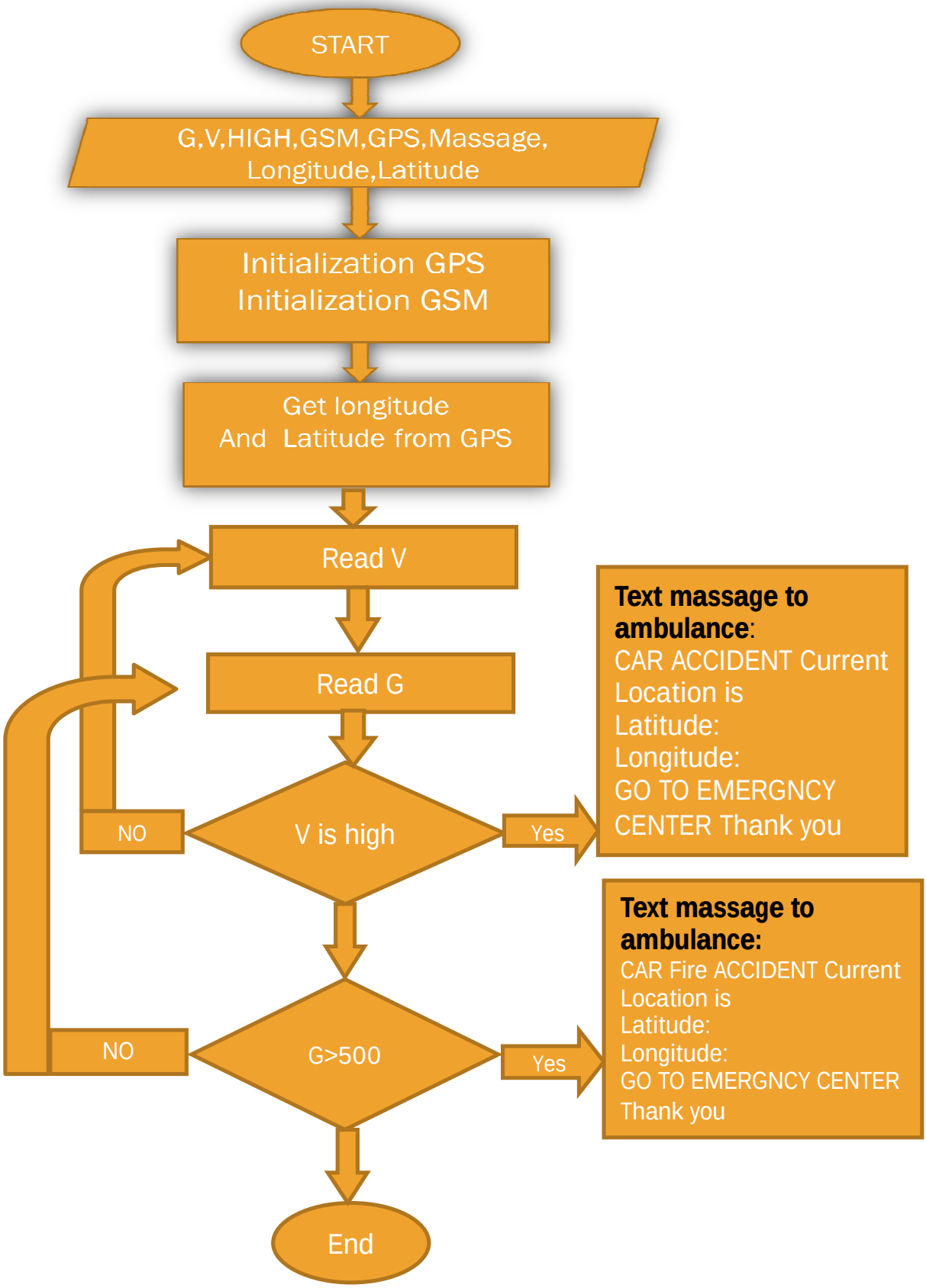

Figure3-7 Car unit Algorithm

3.2 Ambulance unit

Ambulance unit which contains switch with four keys, Encoder and RF transmitter. The switch contains four keys, representing the known four directions and represent also the largest possible number of traffic light that can exist in one area, an intersection area

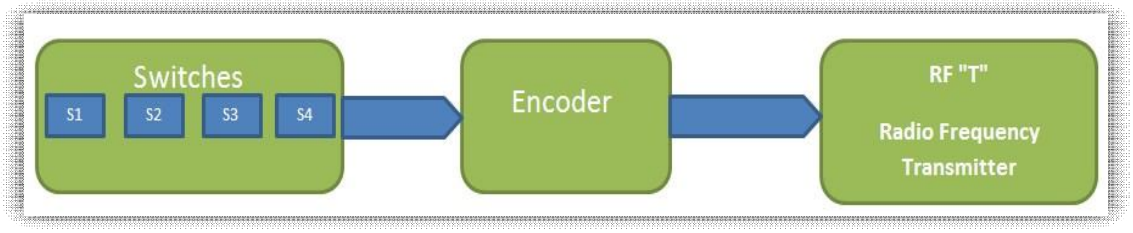

Figure 3-8AMBULANCE UNITDIAGRAM

When ambulance driver pressing on one of the four switches and electrical signal will pass to the encoder which will encode it and pass it to the transmitter RF. This frequency is received by traffic light system which is mentioned in the traffic light unit. When an ambulance approaching from the traffic light (5kilometers) by 120 meters or less directly there are Contact occurs between Transmitter RF which in the ambulance unit and receiver one which in the traffic light unit .

3.2.1 RF

An RF module (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication.

For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter or receiver. [11]

Types of RF modules:-

- Transmitter module
- Receiver module
- Transceiver module
- System on a chip module

We will focus on the first two types RF transmitter and RF Receiver

3.2.2 RF transmitter

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

Figure 3-9RF TRANSMITTER

3.2.3 Encoder

An encoder is a device, circuit, transducer, software program, algorithm or person that converts information from one format or code to another, for the purposes of standardization, speed or compressions**.**

Software for encoding audio, video, images, or text into standardized formats:

- A compressor encodes data (e.g., audio/video/images) into a smaller form.

- An audio encoder converts analog audio to digital audio signals.
- A video encoder converts analog video to digital video signals.
- An email encoder secures online email addresses from email harvesters.
- A PHTML encoder preserves script code logic in a secure format that is transparent to visitors on a web site.
- A multiplexer combines multiple inputs into one output.
- 8b/10b encoder used for fast speed in communication system.[12]

3.3 Traffic lights system (TLC)

traffic lights requires more than slight control and coordination to ensure that traffic moves as smoothly and safely as possible and that pedestrians are protected when they cross the roads.

A variety of different control systems are used to accomplish this, ranging from simple clockwork mechanisms to sophisticated computerized control and coordination systems that self-adjust to minimize delay to people using the road. This units is consists of RF receiver, decoder, microcontroller and traffic light leds.

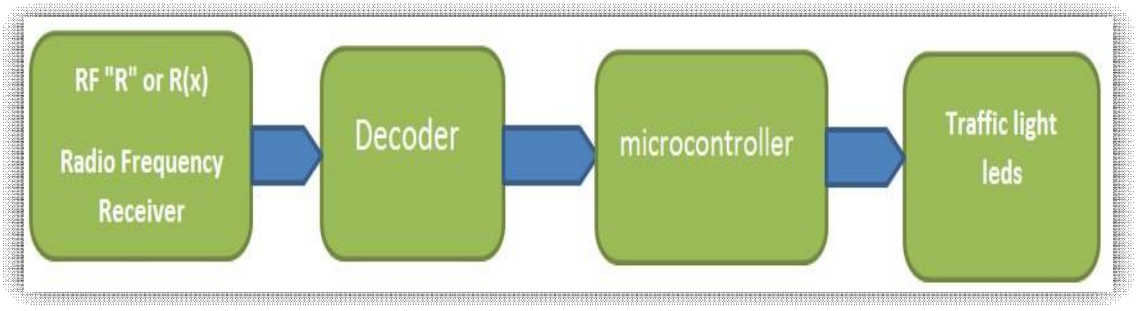

Figure 3-10TRAFFIC UNITDIAGRAM

3.3.1 Decoder

Decoders are simply a collection of logic gates which are arranged in a specific way so as to breakdown any combination of inputs to a set of terms that are all set to '0' apart from one term. Therefore when one input changes, two output terms will change.

3.3.2 RF receiver

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: super heterodyne receivers and super regenerative receivers.

Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage [13].

Super heterodyne receivers have a performance advantage over super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product.

Figure 3-11RF RECIEVER

3.3.3 Microcontroller - atmega 32

Atmega32 has got 40 pins, Two for Power (pin no.10: +5v, pin no. 11: ground), two for oscillator (pin 12, 13), one for reset (pin 9), three for providing necessary power and reference voltage to its internal ADC, and 32 (4×8) I/O pins. It is capable of handling analogue inputs. Port A can be used as either DIGITAL I/O Lines or each individual pin can be used as a single input channel to the internal ADC of ATmega32, plus a pair of pins AREF, AVCC & GND together can make an ADC channel[9].

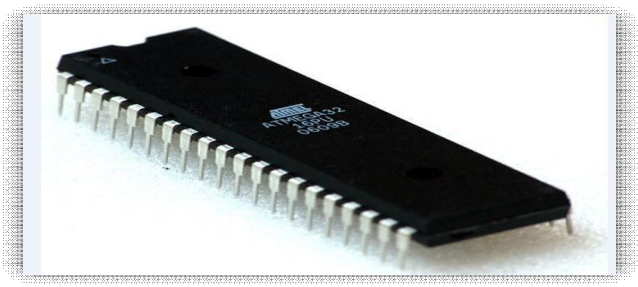

Figure 3-12MICROCONTROLLER ATmega32

ATmega32 has 32 pins (4portsx8pins) configurable as Digital I/O pins, 3 inbuilt timer/counters, two 8 bit (timer0, timer2) and one 16 bit (timer1). ATmega32 has three data transfer modules embedded in it.

3.3.4 16 LEDs

A light-emitting diode (LED) is a semiconductor device that produces light from electricity. LEDs last a long time and do not break easily (compared to incandescent lightbulbs). They can produce many different colors. They are efficient - most of the energy turns into light, not heat.

An LED is a type of diode that makes one color of light when electricity is sent through it in the expected direction (electrically biased in the forward direction). This effect is a kind of electroluminescence.

The color of the light depends on the chemical composition of the semiconducting material used, and can be near-ultraviolet, visible or infrared.The color affects how much electricity is used by the LED. A white LED has either two or three LEDs inside, of different colors. Some white LEDs have one single-color LED inside, combined with a phosphor that converts that single color to white.[10]

Figure 3-13Blue, green and red LEDs.

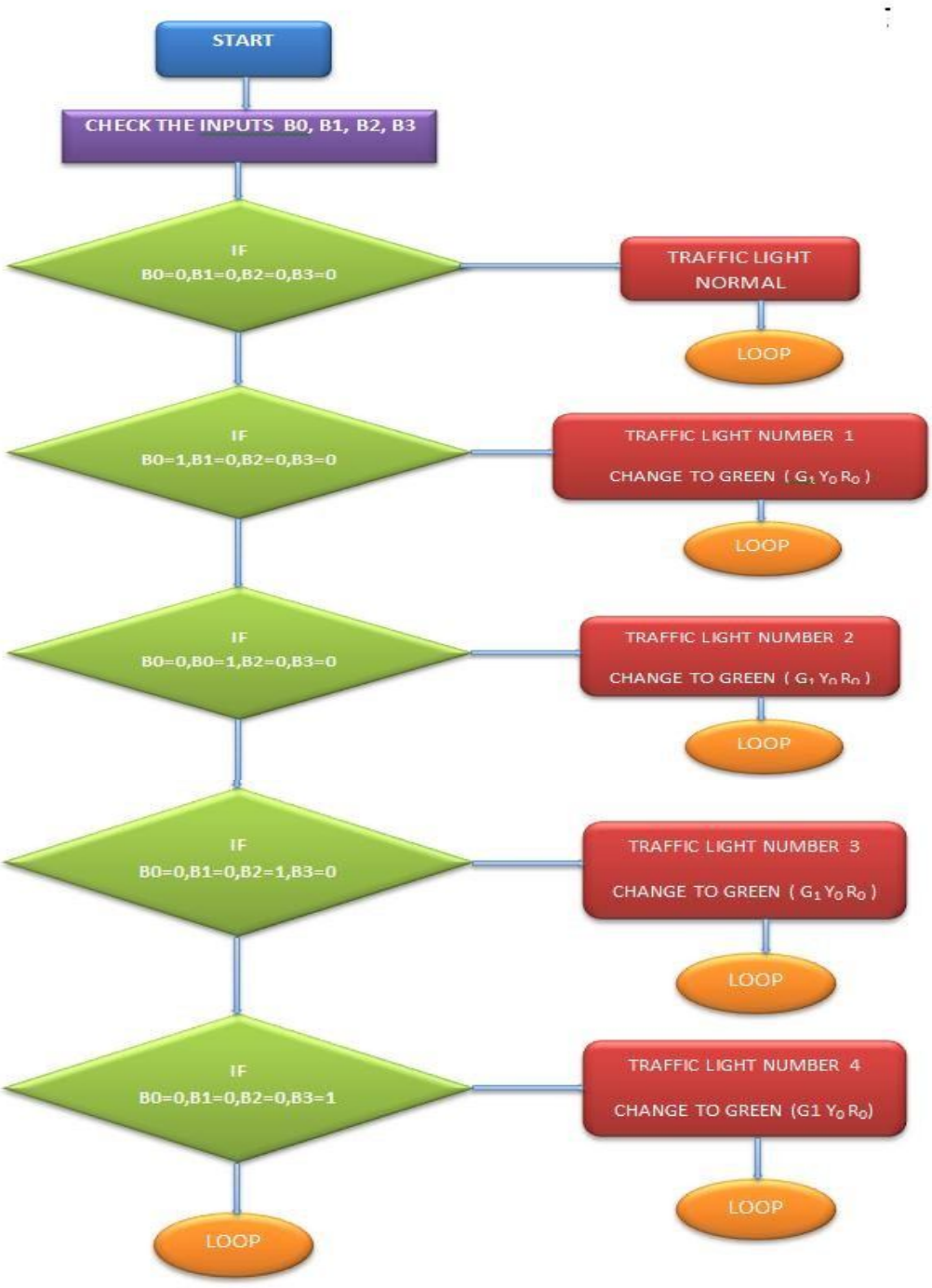

Figure 3-14: traffic lights system algorithm (TLC)

3.4 How the proposal system works?

In proposed system if a vehicle has met accidents, immediately an alert two messages with the car location and the nearest hospital is sent from Vehicle unit which installed in a vehicle to the nearest available ambulance, according to the latitude and longitude using GPS system.

Where the system in the ambulance will search for a traffic signal and then direct controlled it to open the road ahead with the closure of the rest of the other associated traffic light.

And then the traffic light return to what it was before the passage of ambulances going to the accident location, are the same as the previous operation after the arrival of ambulances to the accident location and driven to the hospital.

Chapter 4 CIRCUITSDESIGN

The proposed system consists of two circuit were designed as follows:

Vehicle circuit, Ambulance circuit and Traffic signal circuit

4.1 Vehicle circuit: -

The circuit shown below is the vehicle circuit, as shown in this circuit it consists of the following: Vibration sensor, Gas sensor, Microcontroller (ArduinoUno), GPS, GSM and LCD.

Figure 4-1: Vehicle circuit design

The basic task of this circuit is to alarm and inform the ambulance that the vehicle faced a traffic accident, and then locate the vehicle.

4.2 Ambulance circuit:

The circuit shown below is the ambulance circuit, as shown in this circuit it consists of the following: Four SWITCHES, ENCODER (HT 12) and TRANSMITTER RF

Figure 4-2: Ambulance circuit design

The circuit mission is to contact the traffic light circuit, and full control to give priority to ambulances and give them enough time to get to the place of traffic accident or to hospitals for Saving Lives.

4.2.1 TLS circuit:

The circuit shown below is the Traffic Light System circuit, as shown in this circuit it consists of the following: RECIEVER RF, DECODER (HT 12), 16 LEDS, and MICROCONTROLLER (ATMEGA 32)

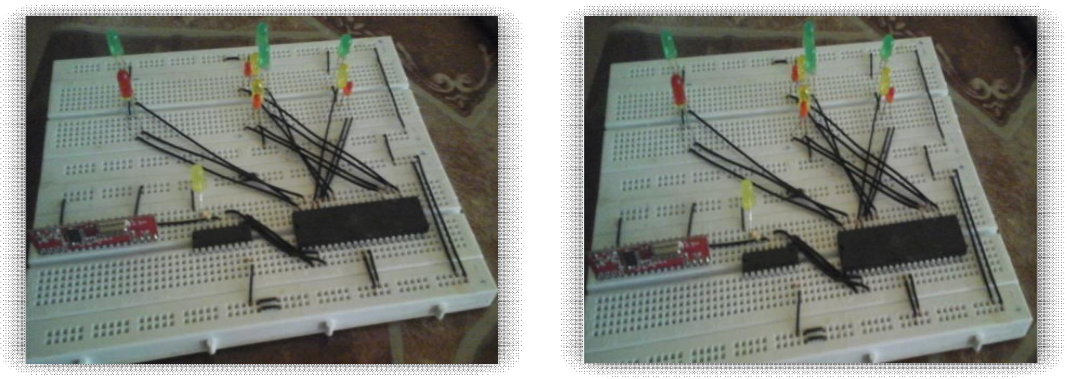

Figure 4-3: TLS circuit design

The mission of this part of system is coming from the reception signals ambulances to give it full control of signals and priority at traffic at any time.

Chapter 5 RESULTS

5.1 Vehicle circuit result:-

After turning on the vehicle circuit, sensors turning on, the circuit determines the location based on latitude and longitude and as shown on LCD (See fig below below)

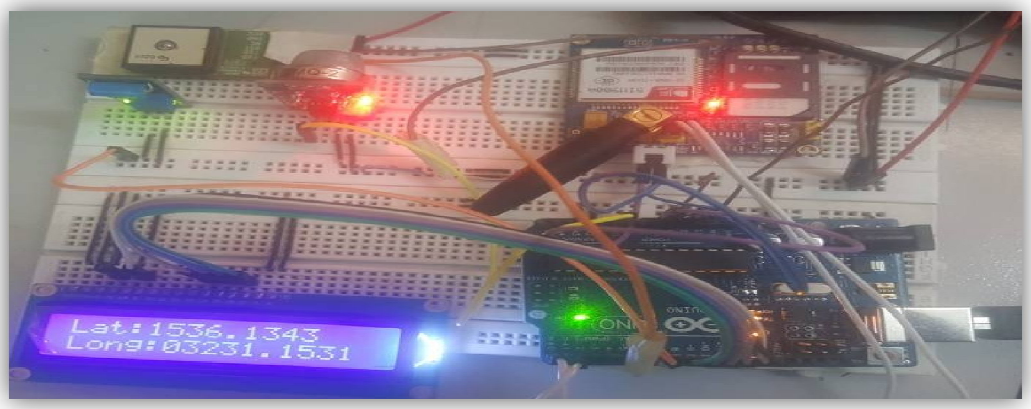

Figure 5-1:Vehicle circuit result

The figure below shows the form of the message sent by the vehicle circuit containing the location.

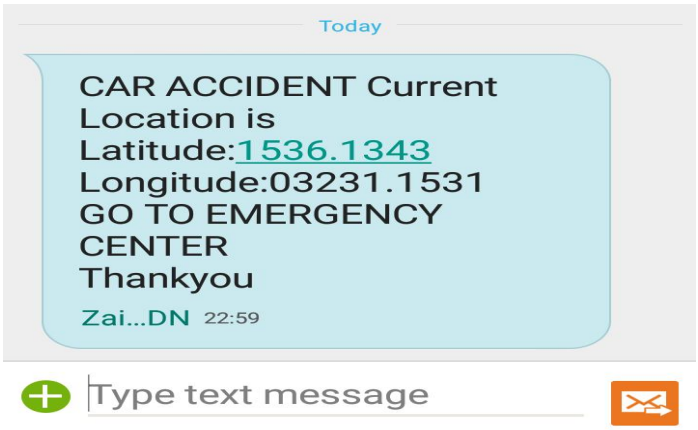

Figure 5-2: form of the messagewhich sent by the vehicle circuit

5.2 Ambulance and TLC circuits result:-

After connecting the ambulances and the TLC circuit and operating them, we found that when pressing one of the switches in the ambulance circuit, one of the LEDs light turn the green light while the rest is running the red light - which symbolizes four traffic signals distributed in the form of signals in the intersections of four ways - Another key occurs the same process but from a different direction as shown in the pictures below

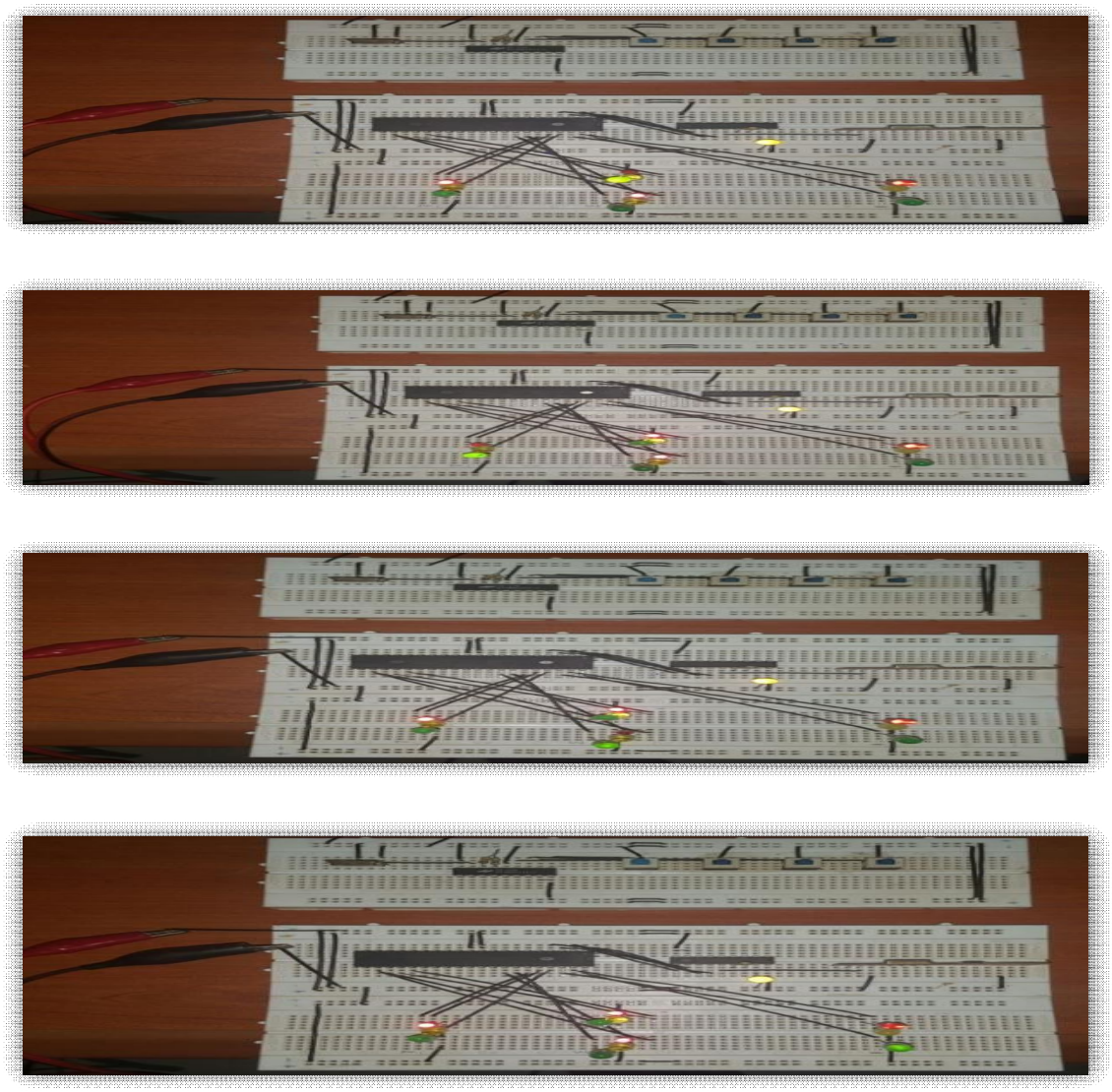

Figure 5-3: Ambulance& TLS circuits results, the four pictures above present the four state of traffic light in the cross road and the control of the system with it.

Chapter 6 Discussion

Through the results achieved and explained previously, the importance of the proposal is shown by giving the opportunity and priority and control of ambulances to enable them to exploit the golden hour in the best way and to provide the opportunity to save critical cases that are dealt with after the collision of traffic, In the previous chapter that the proposal represents a good opportunity to reduce the time of arrival of ambulances to hospitals and emergency units, which is an important factor among other factors that negatively affect or respond to the rescue in cases of traffic accidents.

We have determined through the experiments that giving priority to ambulances is one of the most important factors that must be dealt with great attention, because it is related to the time of arrival appropriate to the centers of receiving the ambulance service and avoidance of danger to life. it also explained to us the importance of addressing the concept of the golden hour and its direct association with the survival of the patients.

Chapter 7 CONCLUSION AND RECOMMENDATION

All applied and pure human sciences agree that the ultimate goal of research, studies, inventions and innovations is to facilitate the daily life of human and to preserve his life. The value of preserving and protecting human beings is the first of all human values and the great goals of science. On this general path, through which we have reached an innovative way to facilitate the task of ambulance personnel and give them priority and time to save the injured during traffic accidents, and as shown from the above results, this proposal contributes effectively to reduce the number of loyal Resulting in traffic accidents by giving ambulances and paramedics priority and reducing their travel time Therefore, we recommend that this proposal be applied to the Khartoum state in a preliminary manner, and then circulate it to all states with high population density and traffic congestion.

Also we recommend to deal seriously with the concept of golden hour because it present an important time and maybe it take some human life in critical zone and can change the future of people, Also we recommend that to support all researches of biomedical engineering that developing the concept of saving life’s by the new technologies and support the process of applying of these projects in the field.

We also recommend that the field of research in the field of traffic safety and awareness of the concept of the Golden Hour is being one of the broad research fields in the field of medical engineering tasks and other similar fields.

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13. EMERGENCY ASSISTANCE TO ROAD ACCIDENT VICTIMS

Appendix(A)

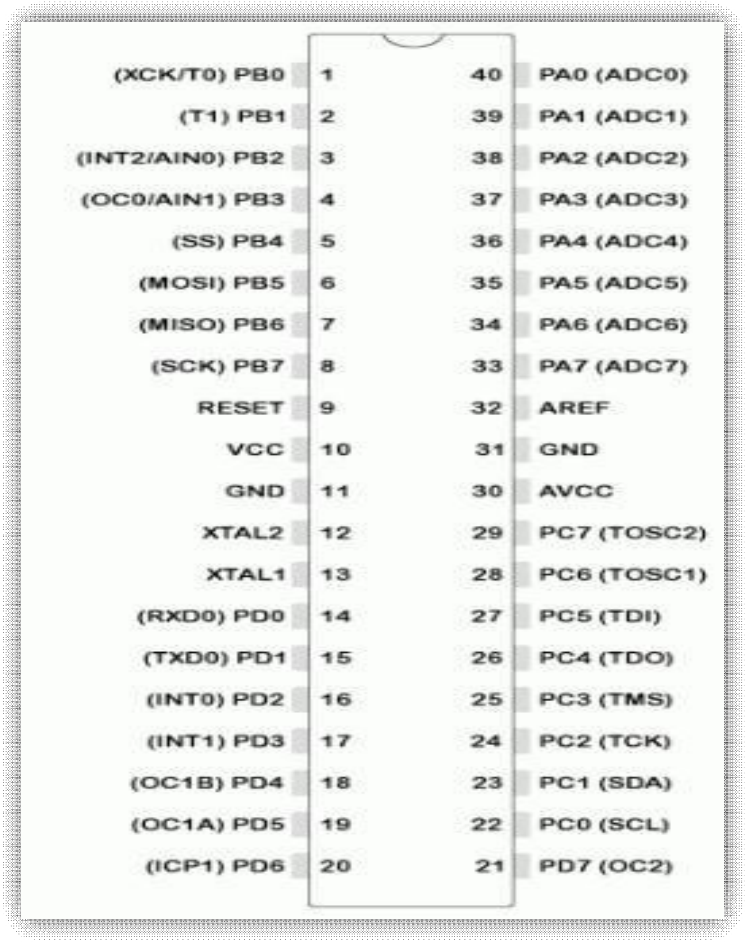

Figure 7-1: Appendix (A): Block-Diagram-ATmega3

Appendix (B)

Figure 7-2: Appendix (B): LCD SCREEN