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Smart Stick for visually impaired persons

العصا الذكية للأشخاص ضعاف البصر

A Project Submitted In Partial Fulfillment for the Requirements of the Degree of B.Sc. (Honor) In Electrical Engineering

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بسم الله الرحمن الرحيم

(قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيم)

صدق الله العظيم

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DEDICATION

As well as everything that we do, we would be honored to dedicate this work to our parents for their emotional and financial support, our brothers, our sisters and our friends, especially our friends have been a constant source of inspiration for us. They have given us the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been made possible.

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First and above all, we praise God, the almighty for providing us this opportunity, and granting us the capability to proceed successfully. Grateful for this opportunity, we would like to give our sincere thanks to our supervisor**; Dr.Awadalla Taifour Ali** for his valuable guidance continues encouragement, suggestions, constructive ideas and advice in assisting us to complete this work.

ABSTRACT

One of the main problems that blind people suffer from is the unavailability of the blind sticks that discovers obstacles and alerts the blind. This Research aims to devise a smart stick to assist the blind in motion by using micro-controllers and ultrasonic sensors The research has two parts: the first part is about simulating the system using proteus program before applying it in real world to ensure system quality and to form an idea about the circuit that will be created .the second part is the implementation where two microcontrollers were used. One of them is the master which detects impediments that face the user by alerting him/her using Buzzer and vibration. The other one is the slave which determines the safety of the road and alerts the user by vibration.

The system had been developed and it achieved its objectives and been able to discover obstacles and alert the blind by a buzzer whistle and vibration in case there were any obstacles, and it will vibrate in case there was the road is not safe.

مستخلص

من المشاكل التي يعاني منها ذوي الإعاقة البصرية في الحركة هي افتقار العصا التي يستخدمونها لخاصية اكتشاف العوائق وتنبيه المكفوف .يهدف هذا البحث إلى ابتكار عصا ذكية لمساعدة المكفوفين في الحركة عن طريق استخدام المتحكمات الدقيقة و الحساسات فوق الصوتية .وينقسم تطبيق هذا البحث إلى جانبين :جانب خاص بمحاكاة النظام على برنامج (Proteus) بروتوس قبل تنفيذه على أرض الواقع وذلك لضمان كفاءة النظام وتكوين فكرة مبدئية عن الدائرة التي سوف يتم صنعها، والجانب الآخر خاص بتنفيذ النظام حيث استخدم متحكمين دقيقين أحدهما يسمى المتحكم المستقل و هو الذي يقوم بالكشف عن العوائق التي تعترض المستخدم وتنبيهه باستخدام الصفارة (Buzzer) والاهتزاز الذي يقوم بالكشف عن الحفر التي تعترض المستخدم و تنبيهه عن طريق اهتزاز العصا.

تم تنفيذ النظام وقد حقق أهدافه حيث أنه قام باكتشاف العوائق وتنبيه الكفيف عن طريق الصفارة في حالة وجود عائق أمامه ، و اهتزاز العصا في حالة الطريق غير آمن.

والآخر يسمى المتحكم التابع و هو الذي يقوم بالكشف عن حالة الطريق اذا كان آمنا أم لا عند حوجتهم للمرور عبر عبور المشاة.

TABLE OF CONTENTS

	Page No.
الآية	I
DEDICATION	II
ACKNOWLEDGEMENT	III
ABSTRACT	IV
مستخلص	V
TABLE OF CONTENTS	VI
CHAPTER ONE **INTRODUCTION**	
1.1 General Concepts	1
1.2 Problem Statement	2
1.3 Objectives	2
1.4 Methodology	2
1.5 Thesis Layout	2
CHAPTER TWO **GENERAL OVERVIEW**	
2.1 Overview	4
2.2 Types of White Cane	6
2.2.1 Straight Cane	6
2.2.2 Folding Cane	7
2.2.3 Telescoping Cane	8
2.3 Control System	8
2.3.1 Open-loop control systems	10
2.3.2 Closed-loop control systems	10
2.4 Microcontroller	11
2.4.1 Microcontroller components	11
2.4.2 Microcontroller application	14
2.5 Sensors	15
2.6 Global position system (GPS)	16
2.7 Global system of mobile (GSM)	17
2.8 Radio frequency (RF)	17
CHAPTER THREE	

HARDWARE AND SOFTWARE CONSIDRATION	
3.1 System Description	19
3.2 System Hardware	20
3.2.1 Arduino microcontroller	20
3.2.2 GPS	24
3.2.3 L293D motor driver IC	25
3.2.4 Ultrasonic sensor	26
3.2.5 GSM	27
3.2.6 RF Module (Radio Frequency Module)	29
3.2.9 Vibration motor	30
3.2.10 Buzzer	31
3.3 System Software	33
3.3.1 Flow chart	33
3.3.2 Code	33
3.3.3 System Simulation	34
CHAPTER FOUR **SYSTEM IMPLEMENTATION AND TESTING**	
4.1 System Implementation	35
4.1.1 The connections of project	35
4.2 System Testing	38
CHAPTER FIVE **CONCLUSION AND RECOMMENDATION**	
5.1 Conclusion	39
5.2 Recommendations	39
References	40
APPENEDIX	42

TABLE OF FIGURES

	Page No.
Figure 3.1: Project circuit description	19
Figure 3.2: Arduino microcontroller board	21
Figure 3.3: The USB and power connectors	21
Figure 3.4: The microcontroller	22
Figure 3.5: The power and analog sockets	22
Figure 3.6: The digital input/output pins	23
Figure3.7 The onboard LEDs	24
Figure 3.8: The RESET button	24
Figure 3.9: GPS module	24
Figure 3.10: L239D Motor driver IC pins	25
Figure 3.11: Ultrasonic sensor	26
Figure 3.12: Operation of Ultrasonic	26
Figure 3.13: timing diagram	27
Figure 3.14: GSM module	28
Figure 3.15: RF Module	30
Figure 3.16: Vibration motor	31
Figure 3.17: Buzzer	31
Figure 3.18: Flow Chart	33
Figure 4.1: Connection of GPS with Arduino	35
Figure 4.2 connection of GSM	36
Figure 4.3: connection of buzzer	36
Figure 4.4: Connection of the main circuit	37
Figure 4.5: connection of TX circuit	37

LIST OF ABBREVIATIONS

WHO	World Health Organization
SISO	Single Input Single Output
PID	Proportional Integral Derivative
MIMO	Multiple Input Multiple out put
CPU	Central processing unit
RAM	Random Access Memory
ROM	Read only Memory
EPROM	Erasable Programmable Read only Memory
OTP	One Time Programmable
LED	Light Emitting Diode
ADC	Analog to Digital Convertor
DAC	Digital to Analog Convertor
GPS	Global Position System
DOD	Department Of Defense
GSM	Global System of Mobile
RF	Radio Frequency
AM	Amplitude Modulation
FM	Frequency Modulation
USB	Universal Serial Bus

CHAPTER ONE

INTRODUCTION

1.1 General Concepts

There are many types of disabilities that are known in today's world for instance, physical disabilities, hearing-impaired, visually-impaired, and etc. Visually impaired people are the people that face the most risks compared to other disabilities.

The eyes are the main part of the body used by humans to avoid obstacles where it performs automatic process with minimum cognitive effort. However, for the visually impaired, their vision needs to be substitute by either tactile sense or auditory.

According to Herman [1], one of the main problems of visually-impaired is that most of these people have lost their physical integrity. They also do not have confidence in themselves. This statement is proved by Bouvrie [2] in an experiment called "Project Prakash". This experiment tested blind people to fully utilize their brain to identify sets of object.

According to World Health Organization (WHO) there are about 314 million people are visually impaired worldwide. The amount consists of 45 million blind and269 millions of low vision. People of 50 years old and above are 82% of all blind. It is said that 45 million visually impaired people depends on other human

For navigation, information dispensation, and ecological analysis. NES II (National Eye Survey) conducted in 2014 in Malaysia, there are 216,000 became blind because of delays in cataract surgery. It also caused 272,000 to be visually impaired. The second commonest cause of blindness in Malaysia is diabetic eye disease where 10% blind, and 6% with low vision. The third commonest cause of blindness would be glaucoma where it caused 7% blind, and 2% with low vision.

1.2 Problem Statement

The visually-impaired people tend to have a problem where they cannot navigate freely in an environment either known or unknown to them the majority of the blind people using along cane, but it has several limitations and difficulties detecting the presence of obstacles such as low-slung signposts, utility boxes, tree branches, overhanging wires, in time to avoid a collision.

1.3 Objectives

- To develop an assistive technology model to help visually-impaired people to navigate in an indoor environment.
- To implement the design of the model into the Smart Cane.
- To test and evaluate whether the Smart Cane is fully functioned

1.4 Methodology

To implement this project used two microcontrollers (Arduino Uno) and three ultrasonic sensors to detect the obstacles in three directions, also used GPS and GSM and RF module

1.5 Project Layout

This project consists of five chapters: Chapter one gives an introduction about the principles of the project, in addition its reasons, motivation and objectives. Chapter two discusses all the data that has been collected such as theories and possible solutions are written in this chapter. This chapter is necessary to enable or verify that this invention is achievable, based on many methods from various Sources of reference. In other words, chapter two is more on comparisons of Researchers, fundamental working principles of the components involved and Formulas. Chapter three explains the components of the project are discussed in a detailed manner by defining the components and describe it and give a review for their operation as well as where they connect in the project and what they do as each one helped to build the project and provide a block diagram for it.

Chapter four shows the system implementation also shows the experimental results. Finally, chapter five provides the conclusion and recommendations.

CHAPTER TWO

GENERAL OVERVIEW

2.1 Overview

The term blindness is used for complete or nearly complete vision loss [3].Visual impairment may cause people difficulties with normal daily activities such as driving, reading, socializing, and walking. People with complete blindness or low vision often have a difficult time self-navigating outside well known environments. In fact, physical movement is one of the biggest challenges for blind people, explains World Access for the Blind.

Traveling or simply walking down a crowded street may pose great difficulty. Because of this, many people with low vision will bring a sighted friend or family member to help navigate unknown environments. As well, blind people must learn every detail about the home environment. Large obstacles such as tables and chairs must remain in one location to prevent injury. If a blind person lives with others, each member of the household must diligently keep walkways clear and all items in designated locations.

Blindness causes considerable social challenges, usually in relation to the activities in which a blind person cannot participate. All too frequently, blindness affects a person’s ability to perform many job duties, which severely limits the blind employment opportunities. Blindness may also cause difficulties with participating in activities outside of a workplace, such as sports and academics. Many of these social challenges limit a blind person’s ability to meet people, and this only adds to low self-esteem.

There are an estimated 285 million visually impaired people, 39 million of which are blind (“Visual Impairment,” 2014). Visual impairment indicates that a person has vision 20/40 or worse in his or her better eye when the eye is corrected (“Blindness and Vision Impairment,” 2011). A person with

20/40vision can read a line of letters at 20 feet that a normal person can read at 40feet.

A person is legally blind if his or her corrected vision in his or her best eye is20/200. A visual field less than or equal to 20 degrees in diameter in a person's best, corrected eye also constitutes legal blindness. (“Blindness and Vision Impairment,” 2011). The most common causes of visual impairment globally are uncorrected refractive errors (43%), cataracts (33%), and glaucoma (2%).

Refractive errors include near sighted, far sighted, presbyopia, and astigmatism. Cataracts are the most common cause of blindness. Other disorders that may cause visual problems include age-related macular degeneration, diabetic retinopathy, corneal clouding, childhood blindness, and a number of infections. Visual impairment can also be caused by problems in the brain due to stroke, premature birth, or trauma among others [4]. These cases are known as cortical visual impairment. Screening for vision problems in children may improve future vision and educational achievement screening adults without symptoms are of uncertain benefit [5]. Diagnosis is by an eye exam.

Visual impairments may take many forms and be of varying degrees. Visual impairments may take many forms and be of varying degrees. Visual acuity alone is not always a good predictor of the degree of problems a person may have. Someone with relatively good acuity (e.g., 20/40) can have difficulty with daily functioning, while someone with worse acuity (e.g., 20/200) may function reasonably well if their visual demands are not great. The American Medical Association has estimated that the loss of one eye equals 25% impairment of the visual system and 24% impairment of the whole person. Total loss of vision in both eyes is considered to be 100% visual impairment and 85% impairment of the whole person. Some people who fall into this category can use their considerable residual vision – their remaining sight – to complete daily tasks without relying on alternative methods. The role of a low vision specialist (optometrist or ophthalmologist) is to maximize the functional level of a patient's vision by optical or non-optical means. Primarily, this is by use of magnification in the form of telescopic systems for distance vision and optical or electronic magnification for near tasks.

People with significantly reduced acuity may benefit from training conducted by individuals trained in the provision of technical aids. Low vision rehabilitation professionals, some of whom are connected to an agency for the blind, can provide advice on lighting and contrast to maximize remaining vision. These professionals also have access to non-visual aids, and can instruct patients in their uses.

2.2 advantages and disadvantages in previous Types of White Cane

There are many advantages and disadvantages in previous types of white cans that can be mentioned as follow:

2.2.1 Straight Cane

Straight cane is fiberglass or carbon graphite cane. it has several advantages and disadvantages can be mentioned as follows. The advantages of the straight cane that it is the best type of cane for visually impaired individuals (first time users) learning to travel for both children and adults and provides the most information/feedback of upcoming surface to a visually impaired traveler also it is the best cane for traveling long distances because cane is Durable yet lightweight and considered a cheap product because they use metal tip – the cheapest form of cane tip.

The disadvantages of the straight cane can be mentioned as it is difficult to use when traveling – examples; using the straight cane in a crowded restaurant, placing cane into a car. Taxicab or airplane – unable to fold and put away and inflexible making the cane susceptible to snapping or cracking also uses metal tip that can be difficult for some individuals to replace – Note: A straight cane has a screw inserted into the end of the cane that requires a person to slip a stiff rubber material encased by metal over the head of the screw requiring considerable strength for a proper fit.

2.2.2 Folding Cane

Folding cane is fiberglass, carbon graphite and aluminum canes it has several advantages and disadvantages can be mentioned as follows. The advantages of the folding cane that it is the best cane for active person – easier to use when entering or exiting buildings such as a restaurant, cabs or airplanes – easy to put away by folding and works great for short travel distances plus it is considered durable sturdy and long lasting cane – elastic cord running through cane not easy to break and the cane tip available in different shapes made from hard plastic that lasts longer than metal tips.

The disadvantages of the straight cane can be mentioned as the construction of cane uses more material resulting in a heavier cane that can cause problems for people with wrist, arm, shoulder or back issues. Cane tip is also heavier.

Folding process of cane takes practice and wrapping the elastic cord around the folded cane requires hand strength. Folded cane requires a large area for storing or large bag for carrying while folded. Cane tip although longer lasting is more expensive and requires effort to replace when connecting tip to an elastic cord running through the length of the cane.

Folding cane when unfolded becomes ridged and susceptible to snapping. purchased an aluminum folding cane and went out to test my new cane when the tip caught in a crack in the sidewalk causing my bodyweight to push against and down onto the cane snapping the cane at one of the connection areas making it impossible to repair.

2.2.3 Telescoping Cane

It has several advantages and disadvantages can be mentioned as follows. The advantages of the straight cane that it is a perfect for active traveler – easy to collapse and folds up into short length and easily placed into a backpack or hooked to belt. Very easy to put away before entering a cab or sitting down to a meal. The lightweight carbon graphite material causes less stress or strain for a person with the wrist, arm, shoulder or back issues. It is easy to fold up simply tap the cane while holding the top pushing down until the cane slides into one section and pop the rubber plug into place securing the cane and provides good feedback to a person concerning upcoming surface and uses the cheaper metal tip.

The disadvantages of the telescoping cane can be mentioned as the light weight material with hollow sections makes the cane susceptible to cracking or breaking. Replacing the metal tip is more difficult because securing the tip requires tapping the cane, which is also the way the cane collapses. The tip fits over the head of a screw placed into the end of the cane with pressure applied to secure the tip. After continued use, the rubber plug on the cane becomes less effective at securing the cane in the folded up position.

2.3 Control System

There are two major divisions in control theory, namely, classical and modern, which have direct implications over the control engineering applications. The scope of classical control theory is limited to Single-Input and Single-Output (SISO) system design, except when analyzing for disturbance rejection using a second input. The system analysis is carried out in the time domain using differential equations, in the complex-s domain with the Laplace transform, or in the frequency domain by transforming from the complex-s domain. Many systems may be assumed to have a second order and single variable system response in the time domain. A controller designed using classical theory often requires on-site tuning due to incorrect design approximations. Yet, due to the easier physical implementation of classical controller designs as compared to systems designed using modern control theory, these controllers are preferred in most industrial applications. The most common controllers designed using classical control theory is Proportional-Integral-Derivative (PID) controllers. A less common implementation may include either or both a lead and lag filter [6].

Ultimate the end goal is to meet requirements set typically provided in the time-domain called the Step response, or at times in the frequency domain called the Open-Loop response. The Step response characteristics applied in a specification are typically percent overshoot, settling time, etc. The open-loop response characteristics applied in a specification are typically Gain and Phase margin and bandwidth. These characteristics may be evaluated through simulation including a dynamic model of the system under control coupled with the compensation model. In contrast, modern control theory is carried out in the state space, and can deal with Multiple-Input and Multiple-Output (MIMO) systems. This overcomes the limitations of classical control theory in more sophisticated design problems, such as fighter aircraft control, with the limitation that no frequency domain analysis is possible. In modern design, a system is represented to the greatest advantage as a set of decoupled first order differential equations defined using state variables. Nonlinear, multivariable, adaptive and robust control theories come under this division. Matrix methods are significantly limited for MIMO systems where linear independence cannot be assured in the relationship between inputs and outputs [7].

A control system is a device, or set of devices, that manages, commands, directs or regulates the behavior of other devices or systems. Industrial control systems are used in industrial production for controlling equipment or machines [8]. There are two common classes of control systems, open loop control systems and closed loop control systems. In open loop control systems output is generated based on inputs. In closed loop control systems current output is taken into consideration and corrections are made based on feedback. A closed loop system is also called a feedback control system.

2.3.1 Open-loop control systems

In an open-loop control system, the controller independently calculates exact voltage or current needed by the actuator to do the job and sends it. With this approach, however, the controller never actually knows if the actuator did what it was supposed to because there is no feedback. This system absolutely depends on the controller knowing the operating characteristics of actuator [9].

The actuator on the process is very repeatable and reliable. Relays and stepper motors are devices with reliable characteristics and are usually open-loop operations. Actuators such as motors or flow valves are sometimes used in open-loop operation, but they must be calibrated and adjusted at regular intervals to ensure proper system operation [10].

2.3.2 Closed-loop control systems

In a closed-loop control system, the output of the process (controlled variable) is constantly monitored by a sensor; the sensor samples the system output and converts this measurement into an electric signal that it passes back to the controller. Because the controller knows what the system is actually doing, it can make any adjustment necessary to keep the output where it belongs. The signals from the controller to the actuator are the forward path, and the signal from the sensor to the controller is the feedback. The feedback signal is subtracted from the set point at the comparator [11].

The self-correcting feature of closed-loop control makes it preferable over open-loop control in many applications, despite the additional hardware required. This is because closed-loop system provides reliable, repeatable performance even when the system components themselves are not absolutely repeatable or precisely known [12].

2.4 Microcontroller

A microcontroller is a single-chip computer .Micro suggests that the device is small, and controller suggests that it is used in control applications. Another term for microcontroller is embedded controller, since most of the microcontrollers are built into or embedded in the devices that controlling. Microcontrollers have traditionally been programmed using the assembly language of the target device. Although the assembly language is fast, it has several disadvantages. An assembly program consists of mnemonics, which makes learning and maintaining a program written using the assembly language difficult. Also, microcontrollers manufactured by different firms have different assembly languages, so the user must learn a new language with every new microcontroller he or she uses. Microcontrollers can also be programmed using a high-level language, such as BASIC, PASCAL, or C. High-level languages are much easier to learn than assembly languages and also facilitate the development of large and Complex programs.

Microcontroller is a highly integrated chip that contains Central Processing Unit (CPU), Random Access Memory (RAM), Read Only Memory (ROM) and Input/output (I/O) ports. Unlike general-purpose computer, which also includes all of these components, microcontroller is designed for a very specific task to control a particular system. As a result, the parts can be simplified and reduced, which cuts down on production cost.

2.4.1Microcontroller components

A microcontroller basically contains one or more following components:

1. Central processing unit CPU

Microcontrollers contain a central processing unit (CPU), CPU is the brain of a microcontroller, CPU is responsible for fetching the instruction and executes it that perform the basic logic, math, and data-moving functions of a computer To make a complete computer, CPU connects every part of a microcontroller into a single system a microprocessor requires memory for storing data and programs, and input/output (I/O) interfaces for connecting external devices like keyboards and displays

2. Memory

Memory in a microcontroller is same as microprocessor. It is used to store data and program. A microcontroller usually has a certain amount of RAM and ROM (EEPROM, EPROM, etc.) or flash memories for storing program source codes. There are many types of memory inside the microcontroller, these memories can be found all of them or some of them in microcontroller chip. The main types of memory are:

- **Random access memory**

Random Access Memory (RAM) is a general-purpose memory which usually stores the user data used in a program. RAM is volatile, i.e. data is lost after the removal of power. Most microcontrollers have some amount of internal RAM. 256 bytes is a common amount, although some microcontrollers have more, some less. In general it is possible to extend the memory by adding external memory chips.

- **Read only memory**

Read Only Memory (ROM) is a type of memory usually holds program or fixed user data. ROM memories are programmed at factory during the manufacturing process and their contents cannot be changed by the user .ROM memories are only useful if you have developed a program and wish to order several thousand copies of it.

- **Erasable programmable read only memory**

Erasable Programmable Read Only Memory (EPROM) is similar to ROM, but the EPROM can be programmed using a suitable programming device. EPROM memories have a small clear glass window on top of the chip where the data can be erased under UV light. Many development versions of microcontrollers are manufactured with EPROM memories where the user program can be stored. These memories are erased and re-programmed until the user is satisfied with the program. Some versions of EPROMs, known as one Time Programmable (OTP), can be programmed using a suitable programmer device but these memories cannot be erased. OTP memories cost much less than the EPROMs. OTP is useful after a project has been developed completely and it is required to make many copies of the program memory.

- **Flash EPROM**

is electrically erasable, like EEPROM, but most Flash devices erase all at once, rather than byte-by-byte like EEPROM.

3. Parallel input/output ports

Parallel input/output ports are mainly used to drive/interface various devices such as LCD'S, LED'S, printers, memories, etc. to a microcontroller.

4. Serial interfacing ports

Serial ports provide various serial interfaces between microcontroller and other peripherals like parallel ports.

5. Timers and counters

This is the one of the useful function of a microcontroller. A microcontroller may have more than one timer and counters. The timers and counters provide all timing and counting functions inside the microcontroller. The major operations of this section are perform clock functions, modulations, pulse generations, frequency measuring, making oscillations, etc. This also can be used for counting external pulses.

6. Analog to digital converter

Analog to Digital Converter (ADC) converters are used for converting the analog signal to digital form. The input signal in this converter should be in analog form (e.g. sensor output) and the output from this unit is in digital form. The digital output can be used for various digital applications (e.g. measurement devices).

7. Digital to analog converter

Digital to Analog Converter (DAC) perform reversal operation of ADC conversion. DAC convert the digital signal into analog format. It usually used for controlling analog devices like DC motors, various drives, etc.

8. Interrupt control

The interrupt control used for providing interrupt (delay) for a working program. The interrupt may be external (activated by using interrupt pin) or internal (by using interrupt) instruction during programming.

2.4.2 Microcontroller application

Microcontrollers are widely used in modern electronic equipment. Some basic applications of microcontroller are given below:

- Used in biomedical instruments.
- Widely used in communication systems.
- Used as peripheral controller in Personal Computer (PC).
- Used in robotics.

Used in automobile fields. Microcontroller applications found in many lives filed, for example in Cell phone, watch, Microcontroller applications found in many lives filed, for example in Cell phone, watch, recorder, calculators, mouse, keyboard, modem, fax card, sound card, battery charger, door lock, alarm clock, thermostat, air conditioner, TV Remotes, in Industrial equipment like Temperature and pressure controllers, counters and timers [13].

2.5 Sensors

A sensor is a device that converts a physical phenomenon into an electrical signal. As such, sensors represent part of the interface between the physical world and the world of electrical devices, such as computers. The other part of this interface is represented by actuators, which convert electrical signals into physical phenomena. In recent years, enormous capability for information processing has been developed within the electronics industry.

The most significant example of this capability is the personal computer. In addition, the availability of inexpensive microprocessors is having a tremendous impact on the design of embedded computing products ranging from automobiles to microwave ovens to toys. In recent years, versions of these products that use microprocessors for control of functionality are becoming widely available. In automobiles, such capability is necessary to achieve compliance with pollution restrictions. In other cases, such capability simply offers an inexpensive performance advantage.

All of these microprocessors need electrical input voltages in order to receive instructions and information. So, along with the availability of inexpensive microprocessors has grown an opportunity for the use of sensors in a wide variety of products. In addition, since the output of the sensor is an electrical signal, sensors tend to be characterized in the same way as electronic devices. The data sheets for many sensors are formatted just like electronic product datasheets. However, there are many formats in existence, and there is nothing close to an international standard for sensor specifications. The system designer will encounter a variety of interpretations of sensor performance parameters, and it can be confusing. It is important to realize that this confusion is not due to an inability to explain the meaning of the terms rather it is a result of the fact that different parts of the sensor community have grown comfortable using these terms differently [14]

2.6 Global position system (GPS)

GPS is a satellite based system that can be used in navigation to locate the positions anywhere on the earth. GPS is designed & operated by U.S. Department of Defense (DOD).GPS consists of satellites, control & monitor stations and GPS receivers. GPS receivers take information which is transmitted from the satellites and uses triangulation to calculate a uses exact location. GPS is used in a variety of ways:

- To determine the position of locations.
- To navigate from one location to another.
- To create digitized maps.
- To determine distance between two points.

The basis of GPS is a constellation of satellites that are continuously orbiting around the earth. These equipped with atomic clocks & transmit radio signals that contain their exact location, time and other information. The radio signals which are transmitted from the satellites are monitored & corrected by control stations which are sent back to satellites using ground antenna. The radio signals from satellites are picked up by the GPS receiver. A GPS receiver needs only 3 satellites to plot a rough, 2D position, which will not be very accurate. Ideally, 4 or more satellites are needed to plot a 3D position, which is more accurate than

Three Segments of GPS

1. Space Segment

2. Control Segment

3. User Segment [15]

2.7 Global system of mobile (GSM)

AGSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. Generally, computers use AT commands to control modems. Reading of message from the SIM card inserted into the modem is done by sending the appropriate AT command to the modem. In addition to the standard AT commands, GSM modems support an extended set of AT commands for sending/receiving SMS messages. The whole system is basically divided into two sections: Transmitting and Receiving. Transmitting section consists of just a mobile. Any type of user (sum number) can be used, as users are assigned password for accessing the system. Authorized users send the message that they want to display on the notice board to the receiving section’s mobile number and the message will be displayed only if the users have the authentication password. Receiving section on the other hand consists of a GSM modem to receive message.

2.8 Radio frequency (RF)

RF wireless communication systems, radio waves are used to transfer information between a transmitter (TX) and a receiver (RX).

In the early years of RF wireless communication, radio broadcasting was the most deployed wireless communication technology. The invention of the vacuum tube and vacuum triode hastened the advancement in radio transmission of voice signals. Radio broadcast by way of amplitude modulation (AM) and, later by frequency modulation (FM), was made possible. Amplitude modulation of the radio frequency was used to carry information until FM in wireless communication, radio waves are used to transfer information, and because radio waves propagate in space, they are susceptible to some security risks. An intruder can intercept the signal or gain access to network services, without being an authorized user.

CHAPTER THREE

HARDWARE AND SOFTWARE CONSIDRATION

3.1 System Description

This chapter will discuss the components used to complete the project. Each of the hardware devices that helped to design a smart white cane that can help the Blind people in many various ways is discussed in a detailed manner to fully understand the Functionality of the components.

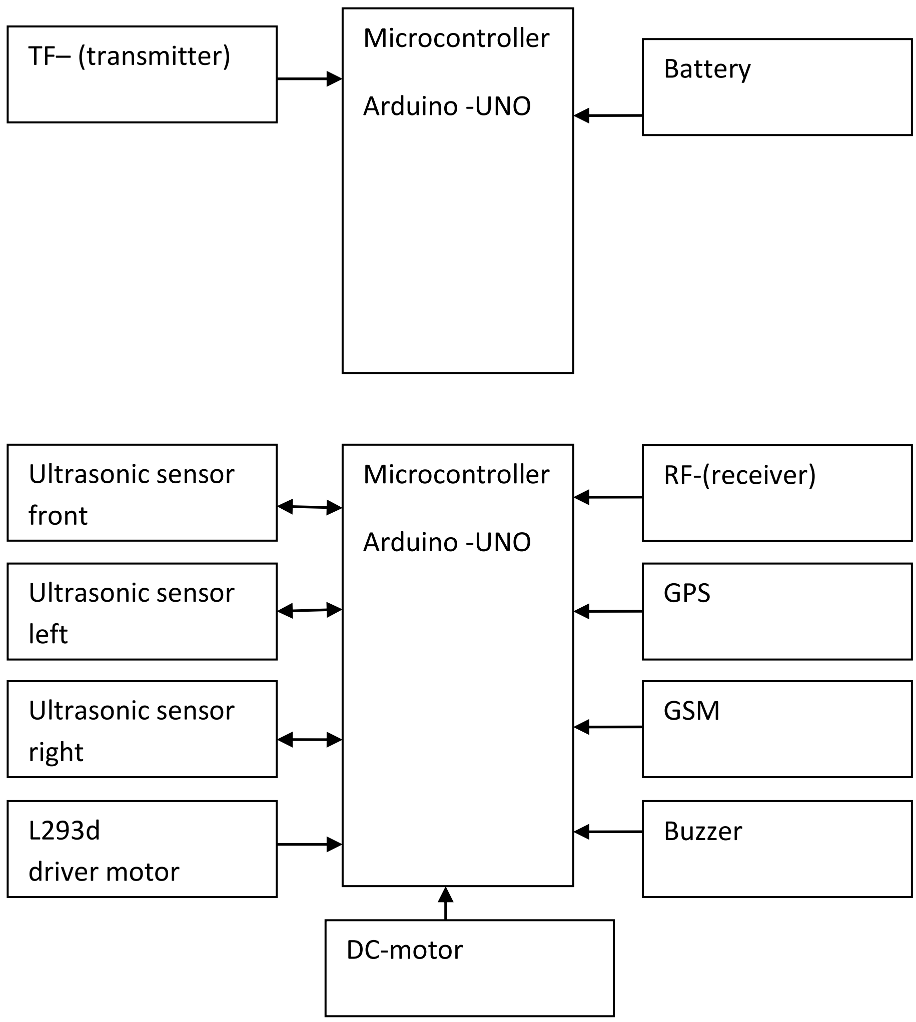


Figure 3.1: Project circuit description

3.2 system Hardware

The system Hardware of the project is:

3.2.1 Arduino microcontroller

Arduino is a small microcontroller board with a USB plug to connect to the computer and a number of connection sockets that can be wired up to external electronics, such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, etc. Arduino can either be powered through the USB connection from the computer or from a 9V battery. Arduino can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently.

- **The Arduino board**

It is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments in simple terms, the Arduino is a tiny computer system that can be programmed with instructions to interact with various forms of input and output. The current Arduino board model, the Uno, is quite small in size compared to the average human hand.

Although it might not look like much to the new observer, the Arduino system allows creating devices that can interact with the world. By using an almost unlimited range of input and output devices, sensors, indicators, displays, motors, and more, the exact interactions required to create functional device can be programmed.

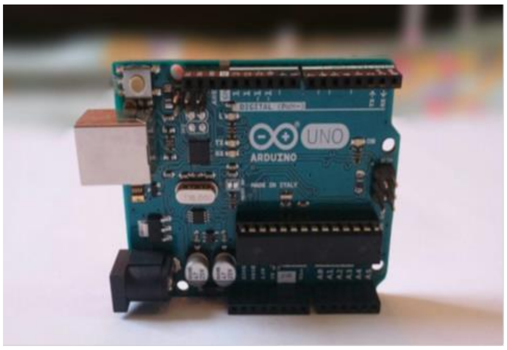


Figure 3.2: Arduino microcontroller board

For example, artists have created installations with patterns of blinking lights that respond to the movements of passers-by, high school students have built autonomous robots that can detect an open flame and extinguish it, and geographers have designed systems that monitor temperature and humidity and transmit this data back to their offices via text message. In fact, there are infinite numbers of examples with a quick search on the Internet. By taking a quick tour of the Uno Starting at the left side of the board there are two connectors, as shown in Figure 3.3

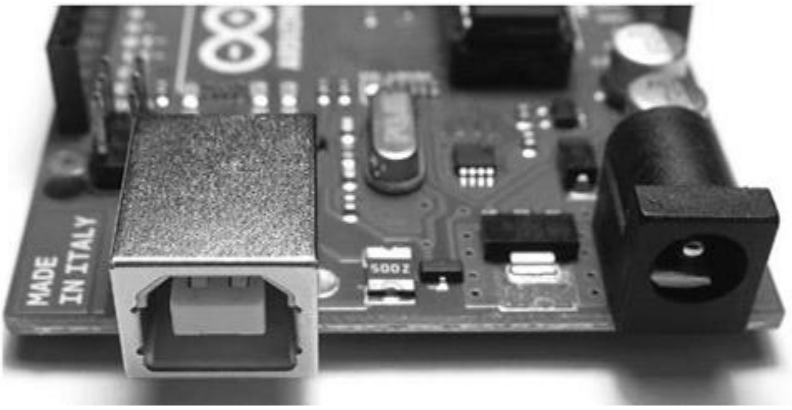


Figure 3.3: The USB and power connectors

On the far left is the Universal Serial Bus (USB) connector. This connects the board to the computer for three reasons; to supply power to the board, to upload the instructions to the Arduino, and to send and receive from a computer. On the right is the power connector, this connector can power the Arduino with a standard mains power adapter.

At the lower middle is the heart of the board: the microcontroller, as Shown in Figure3.4

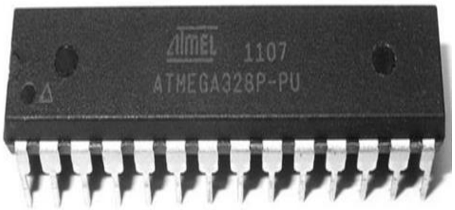


Figure 3.4: The microcontroller

The microcontrollers represent the “brains” of the Arduino. It is a tiny computer that contains a processor to execute instructions includes various Types of memory to hold data and instructions from the sketches, and provides various avenues of sending and receiving data. Just below the microcontroller are two rows of small sockets, as shown in Figure3.5.

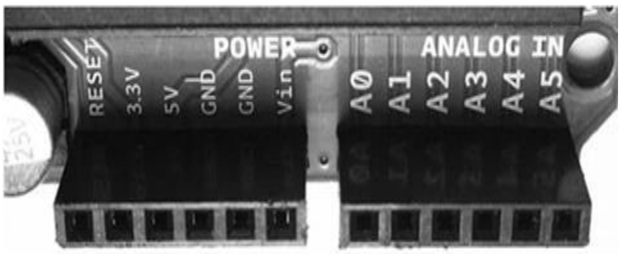


Figure 3.5: The power and analog sockets

The first row offers power connections and the ability to use an external RESET button. The second row offers six analog inputs that are used to measure electrical signals that vary in voltage. Furthermore, pins A4 and A5 can also be used for sending data to and receiving it from other devices.

Along the top of the board are two more rows of sockets, as shown in Figure 3.6.

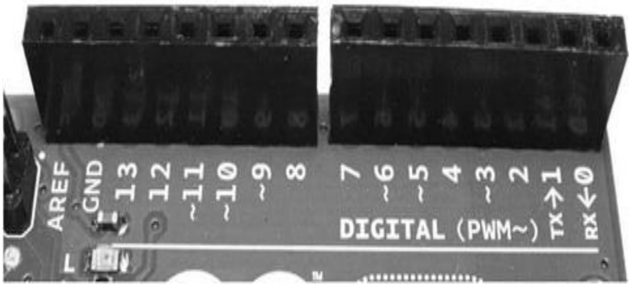


Figure 3.6: The digital input/output pins

Sockets (or pins) numbered 0 to 13 are digital input/output (I/O) pins. They can either detect whether or not an electrical signal is present or generate a signal on command. Pins 0 and 1 are also known as the serial port, which is used to send and receive data to other devices, such as a computer via the USB Connector circuit. The pins labeled with a tilde (~) can also generate a varying electrical signal, which can be useful for such things as creating lighting effects or controlling electric motors.

Next are some very useful devices called light-emitting diodes (LEDs); these very tiny devices light up when a current passes through them. The Arduino board has four LEDs: one on the far right labeled ON, which indicates when the board has power, and three in another group, as shown in Figure 3.7

The LEDs labeled TX and RX light up when data is being transmitted or received between the Arduino and attached devices via the serial port and USB.

The L-LED connected to the digital I/O pin number 13. The little black square part to the left of the LEDs is a tiny microcontroller that controls the USB interface that allows Arduino to send data to and receive it from a computer.

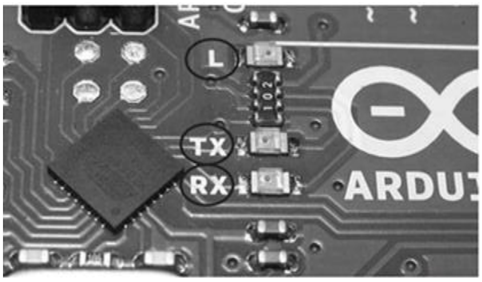


Figure3.7 The onboard LEDs

And, finally, the RESET button is shown in Figure 3.8:

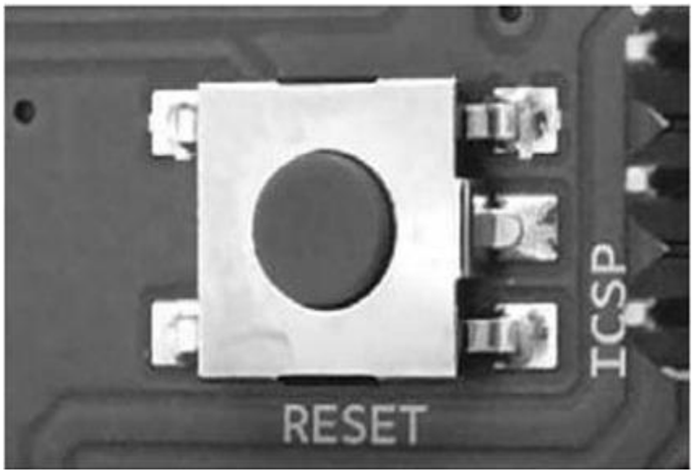


Figure 3.8: The RESET button

3.2.2GPS

A GPS Receiver capable of solving the navigation equations in order to determine the user position, velocity and precise time (PVT), by processing the signal broadcasted by GPS satellites.

Figure 3.9: GPS module

The GPS receiver module consists of a micro strip antenna that detects the electromagnetic wave signal transmitted by GPS satellites and converts the wave energy into electric current and amplifies the signal strength and sends them to receiver electronics. RF Section with Signal Identification and Processing convert the incoming GPS signals to a lower frequency and processed within one or more channels. The microprocessor controls the operation of a GPS receiver, and it is essential for acquiring the signals, processing the signal and decoding the broadcast message. Precision Oscillator generates a reference frequency in the receiver.

3.2.3L293D motor driver IC

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC, as shown in Figure 3.10

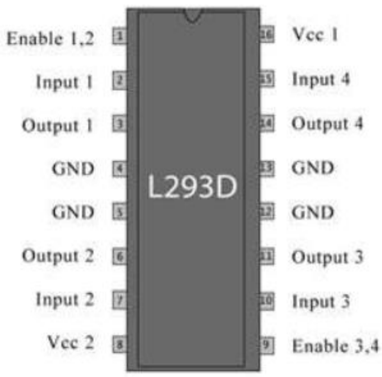


Figure 3.10: L239D Motor driver IC pins

The L293D can drive small and quite big motors as well. It works on the concept of H-bridge. In a single L293D chip there are two h-Bridge circuit inside the IC this can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors and relay. In this study used to control of speed in DC motor and controlling in relay points.

3.2.4 Ultrasonic sensor

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400cm or 1 feet to 13 feet. As shown in Figure 3.11

Figure 3.11: Ultrasonic sensor

Wire connecting direct as following:

i. 5V Supply
ii. Trigger Pulse Input
iii. Echo Pulse Output
iv. 0V Ground

The ultrasonic transmitter emits a short burst of sound in a particular direction. The pulse bounces off a target and returns to the receiver after a time interval. The receiver records the length of this time interval, and calculates the distance travelled based on the speed of sound **c** as showing in Figure 3.12

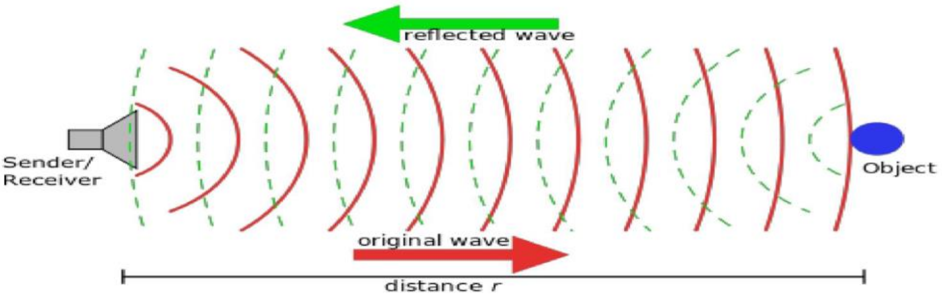


Figure 3.12: Operation of Ultrasonic

The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

Using IO trigger for at least 10us high level signal, The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time × velocity of sound (340M/S) / 2.

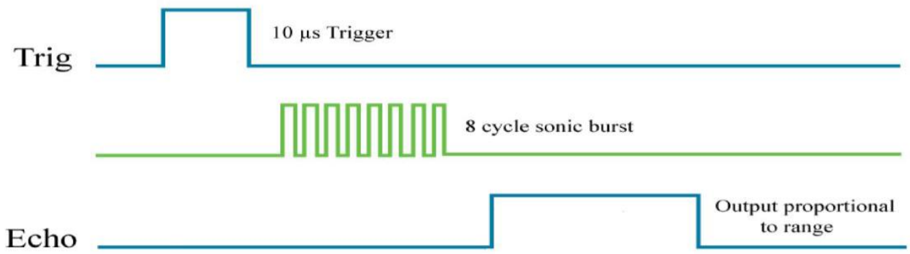
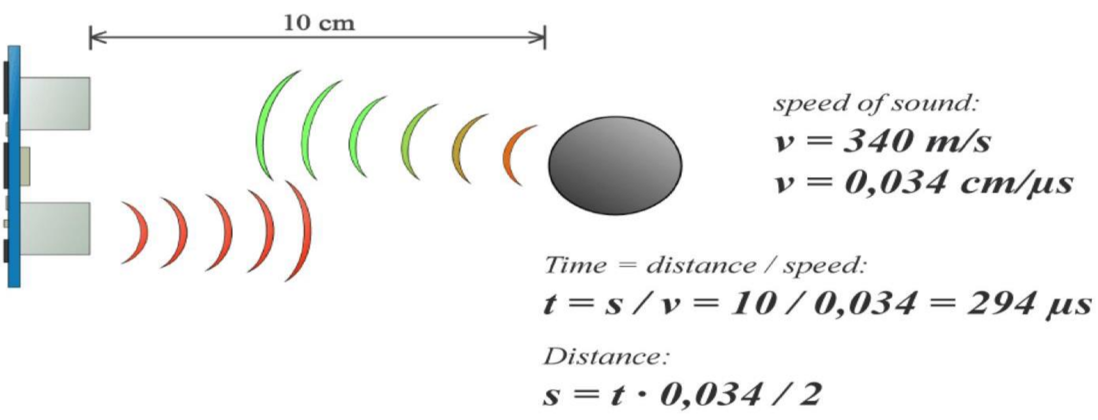


Figure 3.13: timing diagram



3.2.5 GSM

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. The modem (modulator-demodulator) is a critical part here as shown in figure 3.13

Figure 3.14: GSM module

These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces for the computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities. A mobile Station is a mobile phone which consists of the transceiver and the processor and is controlled by a SIM card operating over the network. A Base Station Subsystem acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of 34 the Base Station

Controller which controls the Base Transceiver station and acts as an interface between the mobile station and mobile switching center. And a network Subsystem provides the basic network connection to the mobile stations. The basic part of the Network Subsystem is the Mobile Service Switching Centre which provides access to different networks like ISDN, PSTN etc. It also consists of the Home Location Register and the Visitor Location Register which provides the call routing and roaming capabilities of GSM. It also contains the Equipment Identity Register which maintains an account of all the mobile equipment wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity. Wireless modems generate, transmit or decode data from a cellular network, in order to establish communication. A GSM/GPRS modem is a class of wireless modem, designed for communication over the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card to activate communication with the network. Also, they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. The MODEM needs AT commands, for interacting with processor or controller, which is communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by the MODEM can be sent by the processor/controller/computer to interact with the GSM and GPRS cellular network. The GSM TX pin is connected to Arduino in pin 8 and the RX is connected to pin 7. It is used in this project to send SMS with the location of the user to a specific number that stored in the Arduino when the user needs an urgent help.

3.2.6 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 and a receiver.

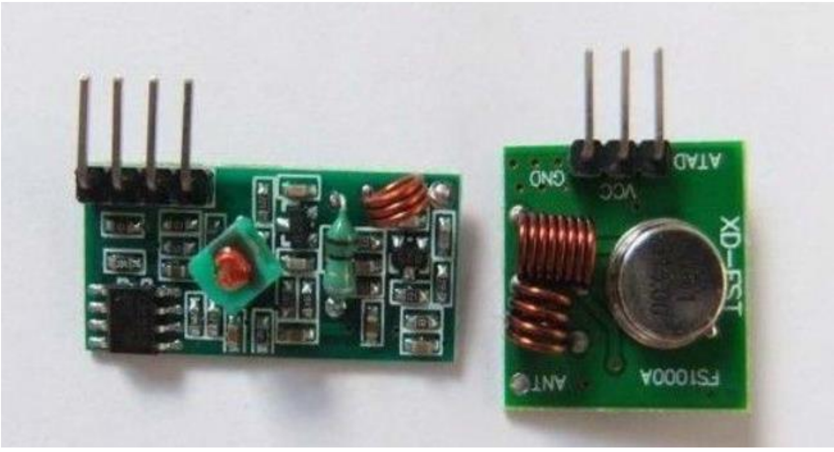


Figure 3.15: RF Module

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 microcontroller 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. 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. The RF receiver module is connected to pin 12 on the Arduino. And the RF transmitter is connected with push button The RF module used in the project to help find the stick if it is far and the blind cannot find it.

3.2.9 Vibration motor

A vibration motor is a mechanical device to generate vibrations. The primary function of the vibration motor is to alert the user. Vibration motors are normally classified into cylinder type and button type. A coreless motor is a DC motor with a rotor that does not have an iron core. Instead, it has a permanent magnet inside and a coil outside. An offset counterweight is fitted to the end of the motor shaft. When the shaft turns, the imbalance in the counterweight causes the handset to vibrate. There are two vibration motors connected in 6 and 7 pins of the Arduino. They are used to alert the blind and direct the user of the blind stick to the desired path.

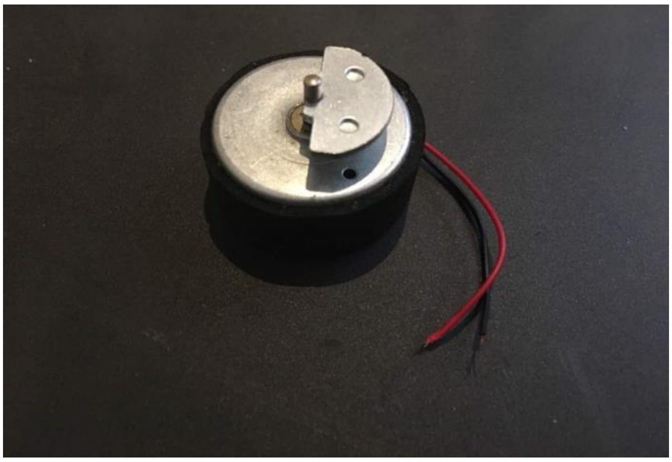


Figure 3.16: Vibration motor

3.2.10 Buzzer

Piezo buzzer is an electronic device commonly used to produce sound. Piezo buzzer is based on the inverse principle of piezo electricity. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are materials.

Figure 3.17: Buzzer

Piezo electric materials are either naturally available or manmade. Piezo ceramic is the class of manmade material, which poses piezo electric effect and is widely used to make a disc, the heart of piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound. The electronic components are a resistor, a transistor, and an inductor. The input to the transducer is a low voltage DC signal, however in order to produce sound the piezo ceramic disc needs oscillations of high voltage. The transistor and resistor combination works as an oscillator circuit to produce low amplitude oscillations from the DC voltage. The magnitude of these oscillations is amplified by the inductor. When a small DC voltage is applied to the input pins, it is first converted to an oscillating signal using the combination of resistor and transistor. These oscillating signals are amplified using the inductor coil. When high voltage alternating signals are applied to the piezo ceramic disc, it causes mechanical expansion and contraction in the radial direction. This causes the metal plate to bend in opposite direction. When metal plate bends and shrinks in opposite direction continuously it produces sound waves in the air. The buzzer is connected to the Arduino in pin 40. It is used in the project to generate a buzzer sound to alert the user of the blind stick.

3.3 System Software

3.3.1 Flow chart

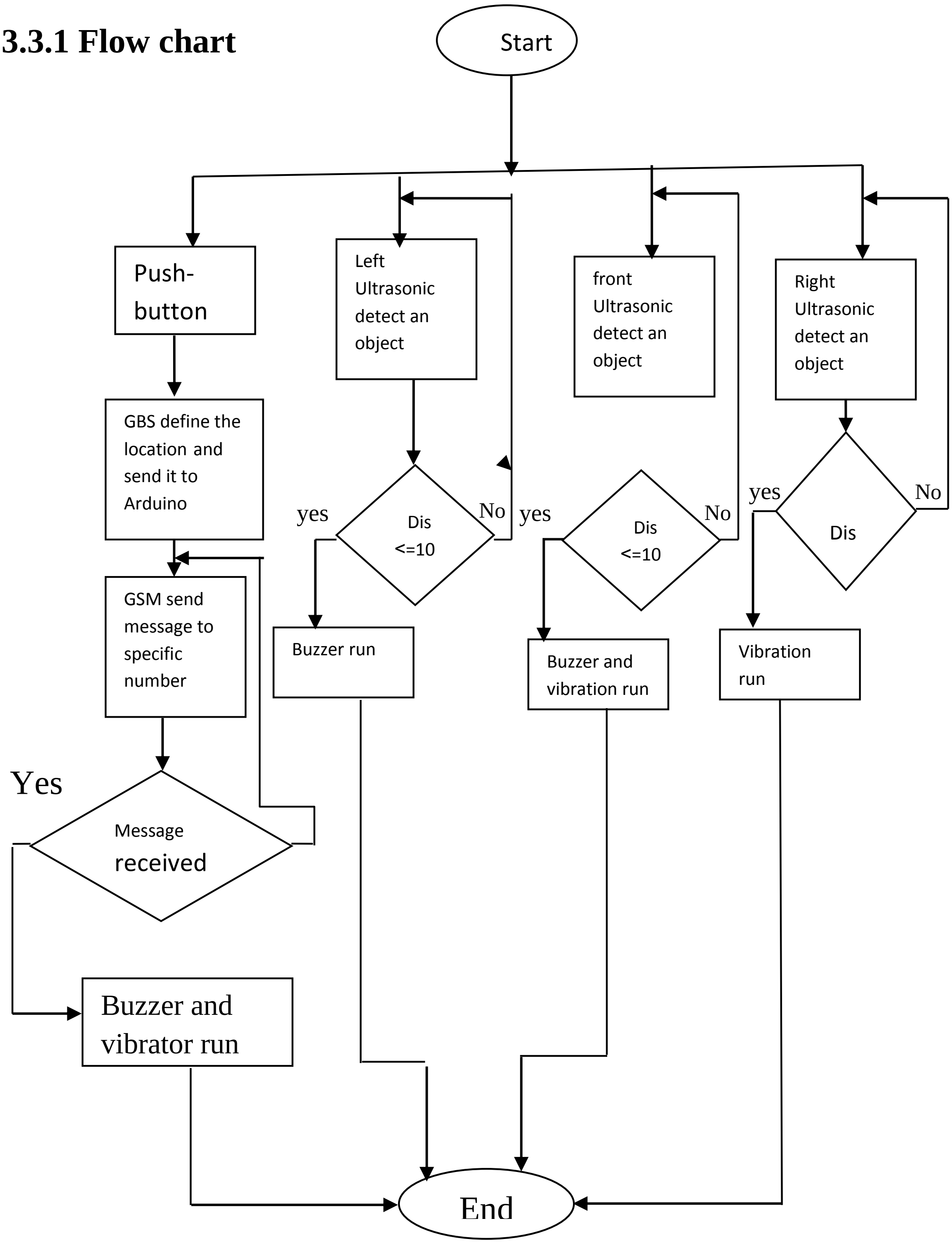


Figure 3.18: Flow Chart

3.3.2 Code

The Arduino UNO is programmed in Arduino software. This is an open Source .software that is written in Arduino C language.

3.3.3 System Simulation

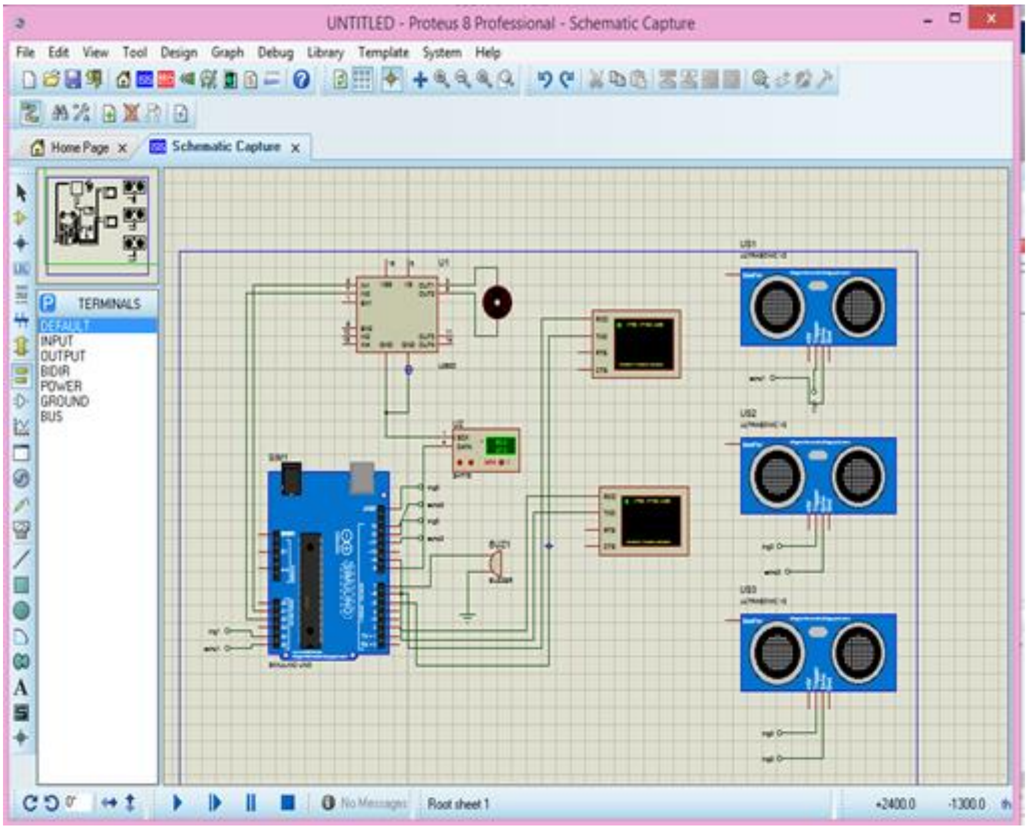


Figure 3.19: System Simulation

CHAPTER FOUR

SYSTEM IMPLEMENTATION AND TESTING

4.1 System Implementation

This chapter describes the implementation of the project in steps below.

4.1.1 The connections of project

Firstly every circuit connected separately then all the circuits connected to work with each other the following steps explain that.

- The RX pin in GPS connected with pin6 in Arduino and TX pin in GPS connected with pin7 in Arduino, figure 4.1 Show connection of GPS, figure4.2 Show connection of GSM.

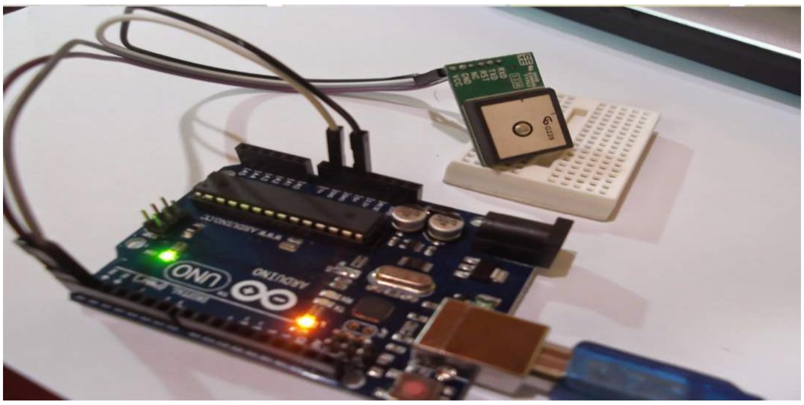


Figure 4.1: Connection of GPS with Arduino

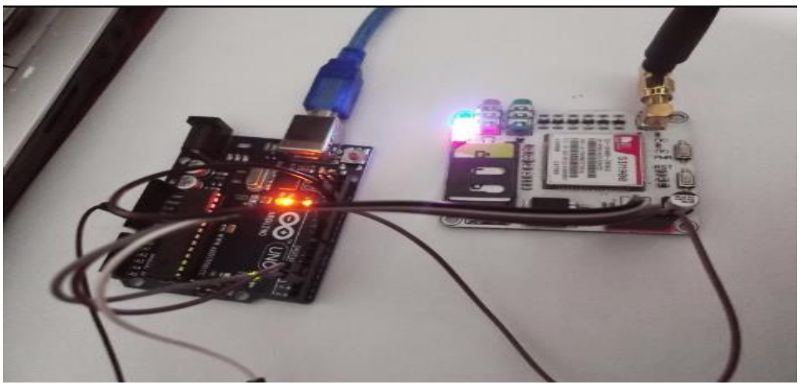


Figure 4.2: Connection of GSM

We connected Buzzer with Arduino in pin3 as shown in figure below

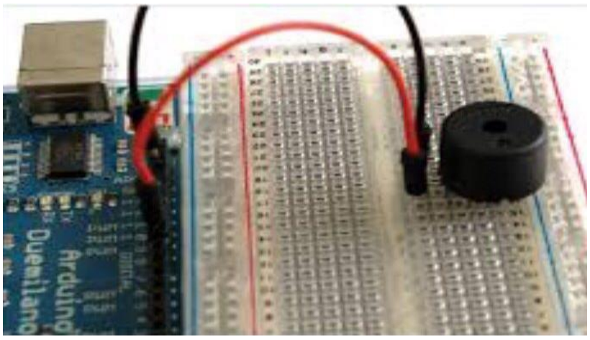


Figure 4.3: Connection of buzzer

secondly all the components of the project are connected in two circuits one of them representing the main circuit ,it contains three ultrasonic sensors to detect obstacles in three directions ,also contains GPS and GSM and motor driver and RX receiver all them connected with Arduino UNO.

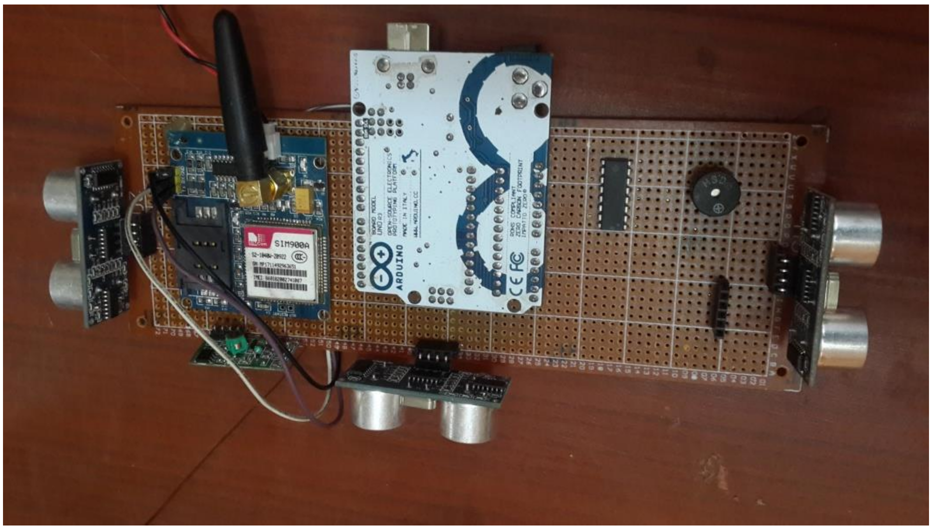


Figure 4.4: Connection of the main circuit

The second circuit containing TX connected with Arduino UNO to send the data to the RX in the main circuit as shown in Figure 4.5 below

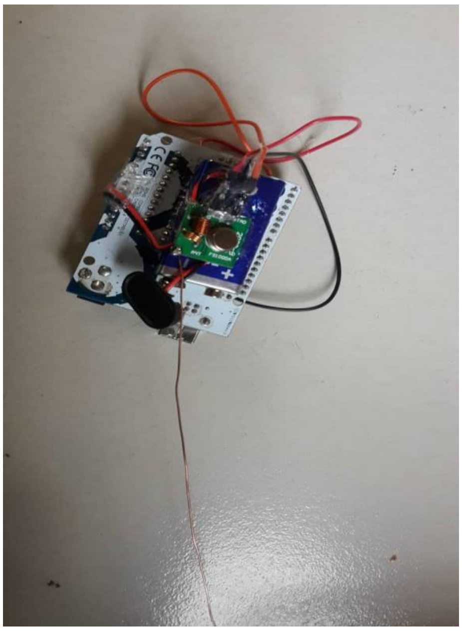


Figure 4.5: connection of TX circuit

4.2 System Testing

Once the system starts operating the controller (Arduino UNO) starts the code, the external power source feeds the sensors and the actuators and start sending the signals. The Arduino UNO runs the setup code and identify the pins, The three ultrasonic start operations when the in front ultrasonic detected obstacle at specific rang (10 cm or less) it sends this data to Arduino and the buzzer and vibrator run and when ultrasonic in the right side detected obstacle in the same range the buzzer alerts the blind person. And when ultrasonic in the left side detected obstacle the vibration will alerts the blind person, the Arduino will read the condition of the Push button if it is pressed Arduino will read the location of the person by using the GPS module and get the latitude and longitude and save them in a string and send them by using the GSM module (SIM900A) in SMS message to the number in the code and open it in Google Maps.

When the blind person needed to cross the road, TX that is connected with pedestrian crossing sends the data to RX which connected with Arduino UNO.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The smart stick provided with two circuits. Where the first circuit consists of Arduino Uno and three ultrasonic sensors are used to detect obstacles by alarm using a buzzer or vibrator or two together. GPS is used to locate the position of the person and GSM is used to send a message in the event of danger or loss of the person to the nearest relatives using Bush-button switch. And the receiver in the first circuit receives the signal from the second circuit which consists of Arduino UNO and transmitter to alert the blind person when the road is safe to cross.

5.2 Recommendations

- The navigation system can be improved by using speech recognition to control the function of the smart cane.
- The ultrasonic sensor can be adjusted to detect fast moving objects and detect objects properly while it is swept.
- The vibrating strength and sound should be more obvious for a blind person to feel a large difference between near and far obstacle .
- Use of camera and more sensors to detect objects by the blind person.

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APPENEDIX

ARDUINO CODE

```
#include <VirtualWire.h>

// TRAFFIC LIGHT

const int datain = 12;

#include <SoftwareSerial.h>      // GPS

#include <TinyGPS.h>

TinyGPS gps;

SoftwareSerial ss(2,3);

static void smartdelay(unsigned long ms);

static void print_float(float val, float invalid, int len, int prec);

static void print_int(unsigned long val, unsigned long invalid,
int len);

static void print_date(TinyGPS &gps);

static void print_str(const char *str, int len);

      const int trigPin = 3;            // ultrasonic

      const int echoPin = 2;

       const int trigPin_2 = 9;

      const int echoPin_2 = 8;

       const int trigPin_3 = 12;

      const int echoPin_3 = 13;
```

```
  long duration;
 int distance;
 int distance_2;
 int distance_3;
void setup() {
  vw_set_ptt_inverted(true);
  vw_set_rx_pin(datain);
  vw_setup(4000);
  vw_rx_start();
   ss.begin(9600);   // GPS
    Serial.begin(115200);
   pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin, INPUT); // Sets the echoPin as an Input
 pinMode(trigPin_2, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin_2, INPUT); // Sets the echoPin as an Input
 pinMode(trigPin_3, OUTPUT); // Sets the trigPin as an Output
 pinMode(echoPin_3, INPUT); // Sets the echoPin as an Input
 pinMode(5,OUTPUT);      // buzzer
  pinMode(6,OUTPUT);     // motor
  pinMode(7,OUTPUT);
 pinMode(4,OUTPUT);
```

```
  pinMode(8,INPUT);
}
void destance_1()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);
distance =  duration*0.034/2 ;
}
void destance_2()
{
digitalWrite(trigPin_2, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin_2, HIGH);
```

```
delayMicroseconds(10);
digitalWrite(trigPin_2, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin_2, HIGH);
distance_2 =  duration*0.034/2 ;
}
void destance_3()
{
digitalWrite(trigPin_3, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin_3, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin_3, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin_3, HIGH);
distance_3 =  duration*0.034/2 ;
}
 void get_pos()
    {
```

```
float flat, flon;
unsigned long age, date, time, chars = 0;
unsigned short sentences = 0, failed = 0;
static const double LONDON_LAT = 51.508131, LONDON_LON = -0.128002;
print_int(gps.satellites(), TinyGPS::GPS_INVALID_SATELLITES, 5);
print_int(gps.hdop(), TinyGPS::GPS_INVALID_HDOP, 5);
gps.f_get_position(&flat, &flon, &age);
print_float(flat, TinyGPS::GPS_INVALID_F_ANGLE, 10, 6);
print_float(flon, TinyGPS::GPS_INVALID_F_ANGLE, 11, 6);
print_int(age, TinyGPS::GPS_INVALID_AGE, 5);
print_date(gps);
print_float(gps.f_altitude(), TinyGPS::GPS_INVALID_F_ALTITUDE, 7, 2);
print_float(gps.f_course(), TinyGPS::GPS_INVALID_F_ANGLE, 7, 2);
print_float(gps.f_speed_kmph(), TinyGPS::GPS_INVALID_F_SPEED, 6, 2);
print_str(gps.f_course() == TinyGPS::GPS_INVALID_F_ANGLE ? "*** " : TinyGPS::cardinal(gps.f_course()), 6);
```

```
  print_int(flat == TinyGPS::GPS_INVALID_F_ANGLE ? 0xFFFFFFFF : (unsigned long)TinyGPS::distance_between(flat, flon, LONDON_LAT, LONDON_LON) / 1000, 0xFFFFFFFF, 9);

  print_float(flat == TinyGPS::GPS_INVALID_F_ANGLE ? TinyGPS::GPS_INVALID_F_ANGLE : TinyGPS::course_to(flat, flon, LONDON_LAT, LONDON_LON), TinyGPS::GPS_INVALID_F_ANGLE, 7, 2);

  print_str(flat == TinyGPS::GPS_INVALID_F_ANGLE ? "*** " : TinyGPS::cardinal(TinyGPS::course_to(flat, flon, LONDON_LAT, LONDON_LON)), 6);

  gps.stats(&chars, &sentences, &failed);

  print_int(chars, 0xFFFFFFFF, 6);

  print_int(sentences, 0xFFFFFFFF, 10);

  print_int(failed, 0xFFFFFFFF, 9);

  Serial.println();

    smartdelay(1000);

}

static void smartdelay(unsigned long ms)

{

  unsigned long start = millis();

  do

  {
```

```
    while (ss.available())
      gps.encode(ss.read());
  } while (millis() - start < ms);
}
static void print_float(float val, float invalid, int len, int prec)
{
  if (val == invalid)
  {
    while (len-- > 1)
      Serial.print('*');
    Serial.print(' ');
  }
  else
  {
    Serial.print(val, prec);
    int vi = abs((int)val);
    int flen = prec + (val < 0.0 ? 2 : 1); // . and -
    flen += vi >= 1000 ? 4 : vi >= 100 ? 3 : vi >= 10 ? 2 : 1;
    for (int i=flen; i<len; ++i)
      Serial.print(' ');
  }
```

```
  smartdelay(0);
}
static void print_int(unsigned long val, unsigned long invalid, int len)
{
  char sz[32];
  if (val == invalid)
    strcpy(sz, "*******");
  else
    sprintf(sz, "%ld", val);
  sz[len] = 0;
  for (int i=strlen(sz); i<len; ++i)
    sz[i] = ' ';
  if (len > 0)
    sz[len-1] = ' ';
  Serial.print(sz);
  smartdelay(0);
}
static void print_date(TinyGPS &gps)
{
  int year;
```

```
  byte month, day, hour, minute, second, hundredths;
  unsigned long age;
  gps.crack_datetime(&year, &month, &day, &hour, &minute,
&second, &hundredths, &age);
  if (age == TinyGPS::GPS_INVALID_AGE)
    Serial.print("********** ******** ");
  else
  {
    char sz[32];
    sprintf(sz, "%02d/%02d/%02d %02d:%02d:%02d ",
        month, day, year, hour, minute, second);
    Serial.print(sz);
  }
  print_int(age, TinyGPS::GPS_INVALID_AGE, 5);
  smartdelay(0);
}
static void print_str(const char *str, int len)
{
  int slen = strlen(str);
  for (int i=0; i<len; ++i)
    Serial.print(i<slen ? str[i] : ' ');
```

```
  smartdelay(0);
      }
void SendMessage()
{
   gsm_Serial.println("AT+CMGF=1");                    //  Sets the GSM Module in Text Mode
     delay(1000);
  gsm_Serial.println("AT+CMGS=\"+249928688778\"\r");      // Replace x with mobile number
     delay(1000);
  gsm_Serial.println("the location of me : V");      // The SMS text you want to send
     delay(100);
  gsm_Serial.println((char)26);                        // ASCII code of CTRL+Z
     delay(1000);
  Serial.println("message was send ... ");
}


void loop() {
  destance_1();
   destance_2();
```

```
 destance_3();
 if(distance <=20)
{
  Serial.println(distance);
  digitalWrite(5,HIGH);
    delay(3000);
 digitalWrite(5,LOW);
    delay(1000);
}
if(distance_2 <= 10)
{
   Serial.println(distance_2);
  digitalWrite(5,HIGH);
   digitalWrite(6,HIGH);
    digitalWrite(7,HIGH);
        delay(30);
     }
if( distance_3 <=10)
{
  Serial.println(distance_3);
  digitalWrite(5,HIGH);
```

```
 delay(30);
}
digitalWrite(5,LOW);
  digitalWrite(6,LOW);
    digitalWrite(7,LOW);
 uint8_t buf[VW_MAX_MESSAGE_LEN];        // TRAFFIC
LIGHT
 uint8_t buflen = VW_MAX_MESSAGE_LEN;
 if (vw_get_message(buf, &buflen))
 {
  if(buf[0]=='1')
  {
     // BUZZER
   }
  if(buf[0]=='0')
  {
   // BUZZER
        }
 }
     if(analogRead(0)<=200)     // ldr sensor
 {
```

```
    digitalWrite(4,HIGH);
  }
   if(analogRead(0)>=200)     // ldr sensor
  {
    digitalWrite(4,LOW);
  }
   if(digitalRead(8)==1)   // GPS
          {
            get_pos();
              delay(100);
            SendMessage();
             delay(100);
          }
}
```