ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF ELECTRICAL ENGINEERING & COMPUTING

IMPLEMENTATION OF ELECTRONIC MOBILITY DEVICE FOR VISUALLY IMPAIRED PEOPLE

A Thesis /Project Submitted in Partial Fulfillment of the Requirement for the Award of Degree of Master Science in Electronics Communication Technology

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CANDIDATE'S DECLARATION

We hereby declare that the work which is presented in the project entitled **"Implementation of Electronic mobility device for visually impaired people "**in partial fulfillment for the award of the degree of Masters of Science in Electronics and Communication Technology Management is an authentic record of our own work carried out under the supervision of **Dr. Sultan Feisso** in the Department of Electrical and Computer Engineering, Adama Science and Technology University. This project has not been submitted by ours for the award of any other degree or Diploma. All relevant resources of information used in this project have been duly acknowledged.

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This is to certify that the above statement made by the candidates is correct to the best of our knowledge and belief. This has been submitted for examination with our approval.

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ACKNOWLEDGMENT

In the name of greatest All mighty GOD who has always bless us with potential knowledge and success. It gives us great pleasure in presenting the project report of "

Electronic mobility device for visually impaired people. Special thanks to ASTU post graduate coordinator **Dr. Amenu Oljira** for helping us to complete our project. We are highly grateful to the school of electrical engineering dean **Mr. Tafesse Asrat** and as well as department head of electrical and computer engineering **Mr. Milkias Birhanu** for giving us well organized and good encouragement. Last but not the least our thanks also go to post graduate coordinator of Electrical and Computer Engineering Department **Mr. Hinsermu Alemayehu** for arranging the facility for us. With deep sense of gratitude we acknowledge the guidance of our project advisor **Dr.Sultan Feisso.** The time-to-time assistance and encouragement by him has played a vital role in preparation and functioning of our project which helped us in completing the project work in time. Words are inadequate in offering our thanks to our Project guide **Dr.Sultan Feisso** for his encouragement and cooperation in carrying out the project work. All our efforts and hard labor may have gone waste if we were not guided by him; he has guided us all the way and gives us all his support. Besides completing such a project requires hard determination and positive energy and it is only possible if one is blessed by GOD. We also take this opportunity to convey our sincere thanks to the teaching staff of Electronics and communication Department. Also we are thankful to our friends who help us during our hard times when we need their assistance during simulation. Not forget all my friends participating in our study deserve a big thank you. Suggestions and criticisms from my friends have always been helpful in finding solutions to our problems. We are especially thankful to **ASTU** and our **Parents** who had always provided us with their courage, strength, best wishes, moral and financial support during the whole career.

ABSTRACT

An Electronic mobility device is an assistive or guidance for those people who are visually impaired to move from one to another place. The Visually impaired people are more prone to accidents, because, they cannot clearly discern their surrounding environment and trying their best to be normal and comfortable in the surroundings. For this reason, we are implementing an electronic mobility device using infrared sensor in order to identifying the presence and absence of objects in between the device and objects within 150 cm distance range to avoid hitting with obstacles. The implemented device contains 9V rechargeable battery, transmitter for scanning the surroundings object, receiver for receiving the reflected back signal by the objects and output buzzer for warning the user about the surrounding objects. This device will become a great help to them and able to detect the obstacle in the distance range.

Key word: *mobility device, visually impaired, IR Transmitter, IR receiver*

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LIST OF ACRONYM

I/O	Input/ Output
IC	Integrated Circuit
IR	Infrared
LED	Light Emitting Diodes
PCB	Printed Circuit Board
TX	Transmitter
RX	Receiver
CAD	Computer Aid Design

LIST OF SYMBOLS

A	Ampere
C	Capacitance
cm	Centimeter
F	Farad
K	Kilo
m	milli
n	Nano
R	Resistance
V	Volt
Ω	Ohm
μ	micro
λ	Wavelength
$\emptyset$	Phi
θ	Teta
α	Alpha

CHAPTER ONE

INTRODUCTION

1.1 Background

An infrared is used to convert electrical energy to imperceptible light energy. These components are used in different applications in home industry, and other areas. The application depends up on the internal circuitry. In our system we are used for obstacle detection system by classifying as a transmitter and receiver system. The detection of the obstacle depends up on the light reflection and direction of the detections. A blind mobility device senses the presence or absence of obstacle and reacts according to the device output with these components. These reflection systems depend up on the objects. Reflection is nothing without any hindrances. In the reflection process there is a triangulation System, This triangulation is processed in between the source of the infrared emitters and the front object. The triangulation has its own angle to reflect the light on the proper direction. An infrared diode is the best transmission and reception system in what we have developed system.

Therefore, the new electronic mobility device is constricted with these optical components to solve the problems of visually impaired people by continuously sensing and monitoring obstacle conditions and warning the user through the buzzer according to the actual distance. This device is desired to serve as many visually impaired people as possible, or in other words, to maximize their survival life. This device is used to detect the presence or absence of obstacles by sensors to warn the user through the buzzer. The presence and absence of obstacles are depending up on the sensors outputs and object reflection to change or continue to their walking on the direction. In this system, the receiver takes the reflected signal from the object and determines various obstacles based on distance of the user on a line. After that receiver provides signal to buzzer as outputs. As well as it provides the incoming signal for amplification according to the distance of objects. So those, the user can take any decision accordingly. The Electronic mobility device consists of two important parts.

These are transmitter (Tx) and receiver (Rx) part and used to check the presence or absence of obstacles and passes signals to the signal conditioning circuit for amplification. The signal-conditioning circuit is used for amplifying the incoming signal from a receiver. The final circuit of the output system is the buzzer, which intern to produce the outputs sound signals. The more sound alarm through the buzzer indicates, the near obstacle to the user, while the minimum sound alarm indicates the distance is far away from the user. Additionally, this system uses any 9V battery for activating the whole system.

The main aim in developing and implementing of the electronic mobility device is to reduce the risk and associated accidents of the visually impaired people, who live in rural and urban areas of our country. Because, those people can use easily, offer within a reasonable price and it has a good efficiency.

1.2 Statement of the Problem

The traditional walking stick has its own problems for the user of blind people. These problems are failure to detect obstacles outside of its reach, detection range is limited and the user has to tap the ground or the object to detect the obstacle to warn the user about the surroundings. Even this traveling aid is unavailable to buy in our country and it is an expensive to import from other country. In this case, different walking sticks imported by Non Governmental organizations (NGOs) for people who have low incomes. For this reason, we will face to implement an electronic mobility device using infrared sensor to avoid the existing problems.

1.3 Objectives of the project

1.3.1 General Objectives of the project

The objective of this project is:

- To implement an obstacle detector for saving the user life from an accidents.

1.3.2 Specific Objectives of the project

- To reduce certain kind of hitting with object.
- To take decision and change the direction of moving according to the distance of object from the device.
- To provide the required movement from one to another place.
- To make the user productive than beggars.
- To attain the device free from current exchange in our country.
- To access the road easily without delaying their time than previous device.

1.4 Significance /Purpose of the project

The importance of this project:

- It can be used in every rural and urban area of the country without any problem.
- It can be used by those people who have low income and for those who lost their eye due to different reasons.
- It minimizes accident and risk of colliding with objects.
- To reduce dependency on others and maximizing labor forces.
- To avoid import and make easy to offer with reasonable price.
- Improves the problems of conventional mobility device currently used.
- It will help as an input for other interested researchers who want to make further investigation on the project.

1.5 Scope of the project

The system detects an object with in between 150cm maximum distance range at a day time as the user required direction. The system can't detect all the surrounding objects except the front, glass, due to penetration of transmitted light. Although, the system is difficult to detect an object on the highway, due to high speed of the car. This kind of technologies will be implemented and mostly important for those people who are visually impaired and unable to use other advanced technologies with reasonable price especially in our country.

1.6. Outline of the project

The project is organized in to six chapters accordingly. The first chapter concerned with the introductory part of the study, the second chapter were present the detail of the related literature review of the study, the third chapter deals with system description and methodology of the project, the forth chapter analysis and system implementation of the project, the fifth chapter result and discussion and finally, in the sixth chapter conclusion are drawn based on analysis and possible recommendation was forward based on the final result.

CHAPTER TWO

LITRATURE REVIEW

2. 1 Reviews of the literature

Author [1] constricting the first visually impaired mobility device from aluminum .In that period, this device very important because there is no another advanced technologies. But the device has the disadvantages concerning heavy and did not conduct information well. In our system the problem encountered above is solved. However, his starting technologies helps us the input of our project.

Author [2] improves somewhat the technologies done by the author [1] by designing this device from fiber glass with metal trip at the one end for a person to hold. But still the range of object detection still limited with in the short distance and the user not failure to detect. This [2] minimizes the weight of the device, but the range of detection still not improved. There for, the people will sweep the device and step on the place they tapped and losing their balance due to disport ion of the floor or stepping on the object. The mobility device which is developed by us solves such kind of technologies using electronic optical system before they are hit to the objects.

The [3] designs different mobility device for different visually impaired peoples. This technology is the same with the above authors except this device used for different age, length peoples. He considers only the length of the mobility device instead of the distance detection ranges. That means, his goals was it depends only about the height of the users. The [1 and 4] a little changes their design of their mobility device a little, but does not provide total protection for visually impaired people. Because still they are not gave attention about the distance of the object to be detected. In addition to the distance of object, it is heavy and difficult to folding in crowded area. The system what we are develops is more light and cost effective than the designed by different authors.

Author [5] is designs the mobility tools which are improved only the height of the device. This device much shorter than other developed device. But designed for visually impaired kiddies and do not provide total protection for them. Another mobility device, identification cane was developed by [6].This device designed to remain public that the user is visually impaired. This device has its own problems to support these people about the object. It cannot support /avoided hitting with objects except announcing the blindness of that person to public. The good side of this author is only improving the weight of the mobility device. The electronic mobility device which is implemented by us solves such kind of problems by optical detection of the obstacles. An electronic mobility device which is 46 inches long, but it was noted that the length. This authors some emphasis to the distance, but this distance not enough to detect the object. Author [8, 9] are minimized the detection of distance from 46 inches to 1.5 inches instead of improving.

An important function of the cane is to preview environmental information. Longer canes offer more-advanced warning of environmental hazards, since they contact environmental features before a shorter cane would. However, the length of the cane is not as important as the angle at which the cane contacts the ground [10]. Bending of the length of the cane was not appreciably changed, but the angle of contact with the ground altered significantly, the detection of obstacles, but not of drop offs, was changed [11]. Hoover intuitively observed that the weight of a cane could affect the performance of a cane user, reasoning that a heavier cane would logically increase fatigue over time. Aluminum was used for the new canes to lower the weight to less than 7 ounces [1], yet maintain their durability and the conductivity of vibrations [12].

The motion of the cane tip over a surface transmits vibration from its tip to the hand that is holding the grip. If a cane is made heavier without increasing its size, by constructing the cane from denser material, the inertia that must be overcome to impart motion to it will increase. Other characteristics being equal, the heavier of two canes should transmit less vibration than the lighter cane. [13] Found limited evidence of this point in a pilot study that reported a significant effect of a cane's weight on the ability to detect differences in the roughness of surfaces. [14] Supported this finding, who noted that the lighter and more rigid a cane was, the better it was at transferring information to the user.

How weight is distributed along the shaft may also affect the use of a cane. To give the shaft of the long cane balance, Hoover tapered the aluminum tube from the crook to the tip [11]. Moving from the large to the small end of a tapered shaft, each inch of it weighs less than the preceding inch, and its center of gravity is closer to the large end. [13] Found that altering the distribution of mass along the cane shaft did not affect the detection of gaps in the walking surface. Note that the inclusion of a cane tip that is heavier than others would change the weight distribution of a cane. Such a tip would be most beneficial, all other parameters aside, if a counterbalancing weight was added on the other end of the cane, so that although the cane would be heavier overall, the user would not be taxed by wielding a cane with a center of gravity that was too far from the grip.

Previous choices for alterations of the long cane have been guided, for the most part, by hunches, rather than experimental results, with the basic design of the long cane changing little [15]. More recently, there has been an increase in interest in developing quantifiable improvements in the design of canes [16].

The cane is regarded as world's most widely used navigation aid for blinds. It can detect obstacles present on the ground, pits, puddles, uneven surfaces and also steps. White canes are made up of very light materials and provide an ease of carrying it as it is foldable and easily fits into ones pocket. As a result, the initial cost for white cane is very less. But speaking of overall cost, the case is not the same. A user requires a practice session of about 100 hours to get comfortable with the device so that he can walk safely and properly. Now the "100 hours" investment is considered the extra cost, which is very high [17].

Apart from this device, several other advanced electronic mobility devices, such as ultrasonic, wearable &GPS based have been developed over the years and are still developed for a better support to the blind people. These advanced devices are unused for the people which have low income due to their cost, unavailability, problem of satellite network in developing country especially in Ethiopia. Nevertheless, still these devices are not solving for the visually impaired people who live in our country due to the above problems. Even, the traditional mobility device in our country not effective in the number of objects/obstacles increased on the rod, heavy traffic congestion has substantially increased. This overcomes difficulty of tapping in such kind of crowded area losing their energy and time on the road. Such kind of problems should be minimized for effective utilization of their time, energy etc. Additionally, this device is unavailable Not only this, but also, such kind of technology itself unavailable to use in our country.

For these problems, we are going to develop an electronic mobility device using infrared sensor. Because, the visually challenged people can avoid the object better if an electronic mobility device can produces audible warning, when there is an object in the specific range of distance. Additionally, they can use in every rural and urban areas by using 9V battery without any difficulty. This kind of mobility device is the most effective than the above-mentioned traditional walking device to detecting the object in front of the visually impaired people within the specific distance and of to inform how it is far trough the buzzer.

The major component of this system is IR emitters, which scans a predetermined area around the blind person by emission of light ray to the obstacles. The reflected signal, which is received from the obstacles, is used as inputs signals to a photo receiver.

The concept behind it is that the system must take action whenever it encounters an obstacle. The system dedicated to specific tasks. The blind navigator uses infrared sensors. The importance of our system is that the system used for both indoor and outdoor. In this respect, a simple, inexpensive, user friendly, quick responsive blind guidance systems designed and implemented in order to improve the mobility and efficiency of movement of both visually impaired people and the blind.

The advantage of this system is that it is fast, cheap, easy to use and affordable for the visually impaired people in our country. Thus, we implement a cost effective and low power dissipation device that helps in proper locomotion of blind people by detecting problematic or erroneous outputs in critical conditions. In addition, we make to use the natural sun light to solve the scarcity of power in urban and rural areas.

CHAPTER THREE

SYSTEM DESCRIPTION AND METHODOLOGY

3.1 System description

The system contains a 9V battery, transmitter, receiver and output blocks. This transmitting and receiving blocks are contains different components according to their functions. The transmitter section of the system used to emit the modulated ray by using infrared emitter to the object with generating the required 39 kHz carrier frequency by the timer oscillator. Besides, the receiving section of the system also contains an infrared receiver to receive the reflected ray back by the object. Finally, the received signal from the object amplified through two stages of amplifiers to warn the users. Additionally, the 9V rechargeable battery used to activate the system in every rural and urban area of the country. The system contains different types of the components that can be selected according to their specifications and connected together to build the complete system effectively. The block diagram of an electronic mobility device for visually impaired is shown in figure 3.1.

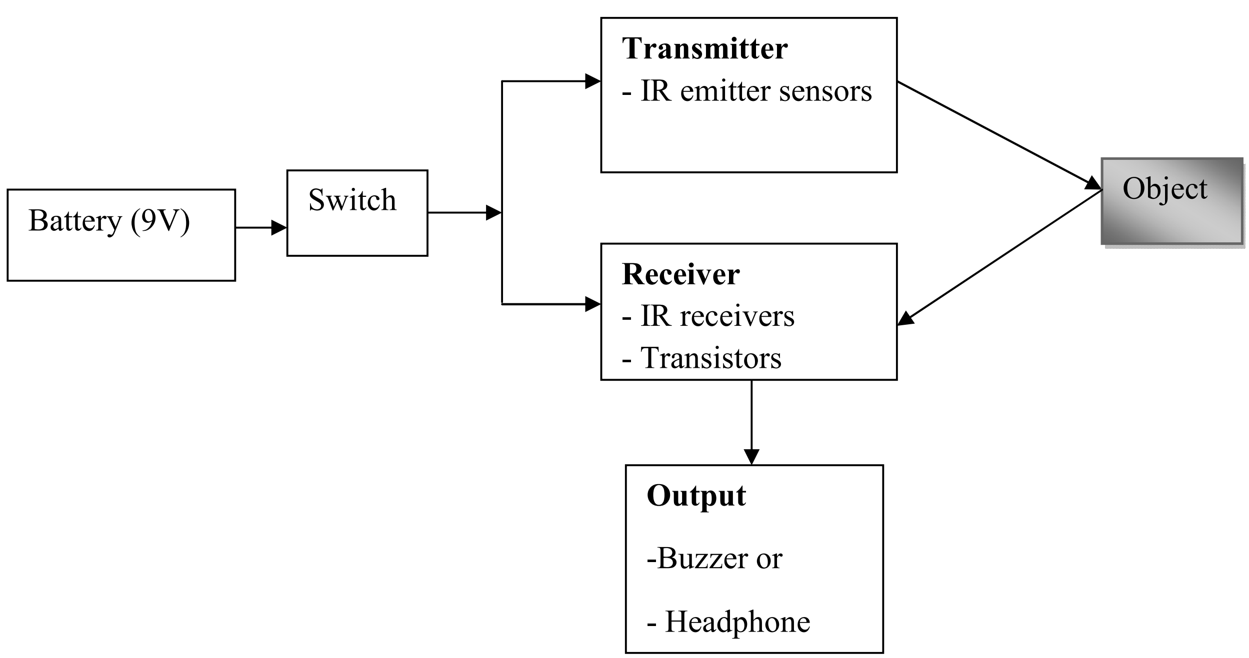

Figure 3.1 Electronic mobility devices System Block Diagram

3.2 Methodology

To realize this project, each critical development of activity is taking place. The realization consists of details about what the system does and how it will work. During the first steps of the systems analyst development a set of specification’s indicating exactly what the new system should do and how it will work. The specifications developed during the problem analysis step are used to define a precise description of the nature of the required hardware.

In this project, two main methods are considered for realization of the system according to the arrangement and order of the figure 3.1 above. These are hardware and software based.

3.2.1 Hardware Based

In a realization of the hardware system, different types of the components are selected according to their specifications, functions and connected together to build the complete hardware circuit of the system effectively. This hardware system composes of transmitter section, and receiver section.

3.2.2 Software Tools

In a software tools, the complete circuit of the system can be drawn using different circuit maker software to check either the system works as expected or not. These software's are Proteus design suite 8.0 and multisim 10.01 are used to draw the system circuit to test the appropriateness of the system before the construction of the hard ware to minimize the wastage of material, time etc.

CHAPTER FOURE

SYSTEM IMPLEMENTATION AND ANALYSIS

4.1 Hardware Implementation

System implementation is a complementary problem-solving technique that reassembles a system's component pieces back into a complete system-hopefully, an improved system. This may involve adding, deleting, and changing pieces relative to the current system. This is a problem-solving technique that decomposes a system into it component pieces for studying how well these component parts work and interacts to accomplish their purpose. The implemented hardware system consists of transmitter section and receiver section. As their name implies that, they have different functions depends up on their properties.

4.1.1 Transmitter sections

The transmitter section of the system used to scan the surrounding object by using differently interconnected circuitry components. The obstacle detection of the transmission system is shown as a figure 4.1 below.

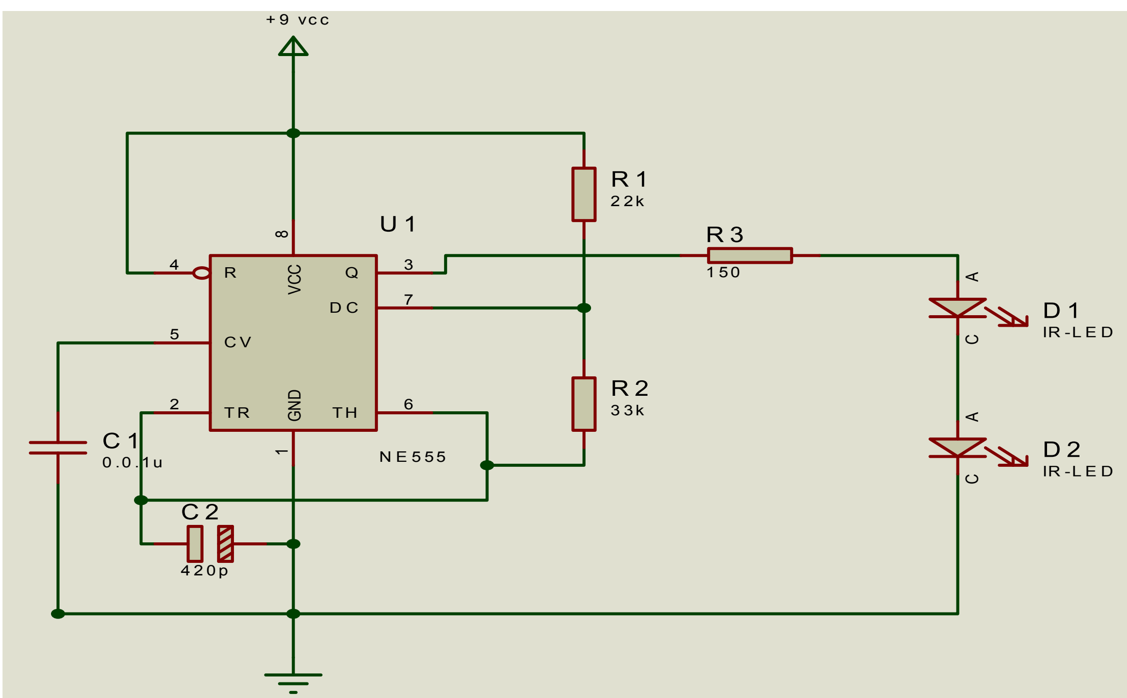

Figure 4.1 System transmission circuit

4.1.1.1 An NE555 A stable Timer

The 555 in it's a stable configuration can be used to generate a square wave signal and it consists of two voltage comparators, a bi-stable flip-flop, a discharge transistor, and a resistor divider network. The resistive divider network is used to set the comparator levels. From the figure, 4.1above, the three resistors which have different value for different functions are connected to the different timer terminals.

To generating the 39 kHz transmission oscillation frequency within a required timing and distance, we have designed the value of the each external transmission components as the below equations. Since the frequency of the oscillation is determined, according the equation 4.1 below it needs to calculate the resistance value of R_1 and R_2. Our aim is generating 39 kHz oscillation frequency by using 420pF capacitor and 62.5% of the duty cycle. So that, the oscillation period is given by the equation 4.1 below:

$T = \frac{1}{f}$……………………………………………………………………………Equation 4.1

$$= \frac{1}{39\text{kHz}} = 25.64\mu\text{s}$$

Where, T = period

Relating to this period of time we have calculate the resistance of the resistors (R_1andR_2) is given by the equation

$T = 0.693R_1+2R_2)*C1$ …………………………………………………………………....4.2

$$25.64\mu s = 0.693(R_1+2R_2)*420pF$$

$$25.64\mu s = 291pF\ (R_1+2R_2$$

$$R_1 + 2R_2 = \frac{25.64\mu s}{291pF}$$

$$R1 + 2R2 = 88.1k\Omega$$

To determine the value of R1 the duty cycle is 62.5% = 0.625

$$DC = \frac{R_1 + R_2}{R_1 + 2R_2} * 100\% = 62.5\%$$

$$R_1+ R_2 = 0.625(R_1+2R_2$$

$$R_1+ R_2 = 0.625\ R_1 +1.25\ R_2$$

$$R_1- 0.625\ R_1 = 1.25\ R_2- R_2$$

$$0.375\ R_1 = 0.25\ R_2$$

$R_1 = \frac{0.25R2}{0.375} = 0.67\ R_2$……………………………………………………….Equation 4.3

To calculate the value of R_2, substitute equation 4.3 above.

R_1 +2 = 88.1kΩ

$0.67R_2 + 2R_2$ = 88.1kΩ

$2.67R_2$ = 88.1kΩ

$$R_2 = \frac{88.1\text{k}\Omega}{2.67} = 33\text{k}\Omega$$

To determine the value of R_1 we can use the following KVL formula below.

$R_1 + 2R_2$ = 88.1kΩ

R_1 + 2(33kΩ) = 88.1kΩ

R_1 = 88.1kΩ - 66kΩ

R_1 = 22kΩ

From the figure 4.1 above, the voltage and current of the required parameters are determined according to the KVL law. This equation is shown as a below.

$VR_1 = V_{CC} * R_1 / R_1 + R_2$ ……………………………………………………….. Equation 4.4

= 9V* 22kΩ/ (22Ω+33Ω) = 3.6V

VR_2 = 9V*33kΩ/ 22kΩ+ 33kΩ = 5.4V

In this condition, the flow of current through different resistors (R_1, R_2 and R_3) calculated as the equitation below.

$IR_1 = VR_1/R_1$ …………………………………………………………. Equation 4.5

= 3.6V/22kΩ = 0.164mA

$IR_2 = VR_2/R_2$ ………………………………………………………… Equation 4.6

= 5.4V/33Ω = 0.164mA

The final current for the transmission system in the specified distance it needs around 25.5mA. Therefore, to provide this current we use the below ohms law. This formula written as:

$VR_3 = 1/3V_{cc}$ ………………………………………………………… Equation 4.7

= 1/3*9V = 3V

4.1.1.1.1. Function of Timer pins

The transmission system of the timer pin of an NE 555 a stable timer is it depends up on the internal circuit and external connections of the components. The functions of the pins are different as their names are implied.

a) Reset pin

The function of reset pin of the timer is regressing to the triggering mode; it should note that once the device has triggered and the bi-stable flip-flop is set, continued triggering would not interfere with the timing cycle. However, there may come a time when it is necessary to interrupt or halt a timing cycle. This is the function of what the reset accomplishes. Also, inhibits all devices functioning when taken to the ground. The output is drive low, the bi-stable flip-flop is reset, and the timing capacitor is discharged. In the stable mode, the reset used to gate the oscillator.

b) Trigger pin

The timer will trigger on the negative-going edge of the input pulse due to the nature of the triggering circuitry. For the device to time-out properly, it is necessary that, the trigger voltage level returned to some voltage greater than one third of the supply before the time out period. When the trigger signal then returns to a high level, the output will fall immediately.

The trigger now tied to the threshold pin. At power-up, the capacitor discharged, holding the trigger low. These trigger terminal establishes the capacitor charge path through R_1 and R_2. When the capacitor reaches the threshold level of $1/3v_{cc}$, the output drops low and the discharge transistor turns "on". In this system, the signal down wards to 0V and the infrared goes to "off" state. In this period, the system cannot detect the obstacle until the capacitor charging again $1/3v_{cc}$ triggering level. This triggering voltage is determined as a below equation 4.8.

$$\text{Triggering voltage} = 1/3 * v_{cc} \quad \text{...Equation 4.8}$$

$$= 1/3 * +9V = 0.333 * 9V = 3\ V$$

The timing capacitor now discharges through R_2. When the capacitor voltage drops to 3V,the trigger comparator trips automatically and retriggering the timer again by creating an oscillation frequency. From R_1 and R_2 the oscillation frequency is determined as the equation 4.9 below.

$f = \frac{1.44}{(R1+2R2)C1}$……………………………………………………………..….Equation4.9

$= \frac{1.44}{(22k+2*33k)420p}$ = 38.96 kHz

Where, R_1& R_2- the resistance of the resistor in ohm (Ω)

C_1, the capacitance of the capacitor in farad (F)

F, oscillation frequency in Hertz (Hz)

c) Discharging

The capacitor one (C_1) of420pFconnected across the terminal one& two of the timer.. The operation sequence begins as transistor (T_1) is turned on, keeping the capacitor grounded. This discharging of the transistor saturates and the capacitor discharges through the transistor. The trigger sees a low state and forces the timer output high. When the transistor turned off, the capacitor commences its charge cycle. When the capacitor reaches the threshold level, only then does the output change from its normally high state to the low state. The output will remain low until T_1 again turned on. The capacitor charges at a rate determined by the external resistor and capacitor, when the transistor is cut-off. Selecting the ratios of R_1 and R_2 varies the duty cycle accordingly and consider. If R_1=0, the charge time cannot be made smaller than the discharge time because the charge path through R_1+R_2 while the discharge path only through R_2.The threshold and trigger are tied together, monitoring the capacitor voltage. Therefore it controls the maximum charging voltage 2/3 of v_{cc} and minimum 1/3 of V_{cc}. The charging and discharging time of the 420p capacitor is determined according to the equation below.

The charging time at the output of the infrared emitter is HIGH is determined by:

$T_H = 0.693(R_1 + R_2)C_1$ ……………………………………………………Equation4.10

$= 0.693(22K\Omega + 33K\Omega)420pF$ = 16µs

So that, the capacitor (C_1) in charges fully within the 16µs.In this period, the internal transistor is off and the output of the transmission system is high.

The discharging time at the output of the infrared emitter is LOW is determined by:

$\mathrm{TL} = 0.693(R_2\ )C_1$ ……………………………………………………………Equation 4.11

$= 0.693(33K\Omega)420pF$ = 9.6µs, then, the time taken to discharge the capacitor is 9.6µs.

From the equation 4.6 and 4.7, the total period of (T) charging and discharging 420p capacitor given by:

$\mathrm{T} = TH + TL = 0.693(R_1\ + 2R_2\ )C_1$ …………………………………………...Equation 4.12

= 16µs + 9.6µ = 25.6µs

Where:

TH = time of High in second (sec)

TL= time of Low in second (sec)

T = total period in second (sec)

Time constant = 0.693

In this time, the oscillation period of the duty cycle is 62.5%. Duty cycle means the ratio of pulse duration to pulse period. The pulse duration is TH; this is how long the pulse remains high. The pulse period is T; this is the duration of one complete cycle, and is just the inverse of the frequency. The duty cycle of the system output waveform is shown in the figure 4.2 below.

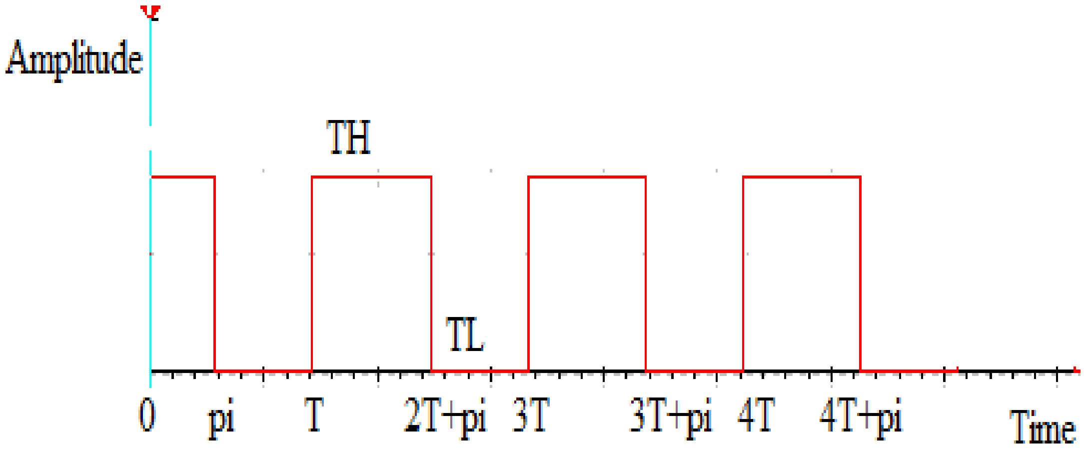

Figure 4.2 Duty Cycle Terms

Hence, from the time of high and low, the duty cycle of the oscillation is determined according to the equation 4.13 below.

D= TH/ T *100% …………………………………………………………...Equation 4.13

= (16μs/25.6μs)*100%= 62.5%

On the other hand, this duty cycle is determined from the resistance value of the resistor R_1 and R_2 as the below equitation4.14 below.

$D = \frac{(R1+R2)}{(R1+2R2)} * 100\%$……………………………………………………..Equation4.14

$$D = \frac{(22k\Omega+33k\Omega)}{(22k\Omega+2*33k\Omega)} * 100\% = \frac{55k\Omega}{88k\Omega} * 100\% = 62.5\ \%$$

Where: D = Duty cycle

T = Pulse period

TH = Pulse duration

This duty cycle indicates that 62.5% the system is on HIGH and 37% is in a LOW state. The indication of this percent is the high state is greater than the low state. When the system operates accordingly, the user can saves more from different accidents. Since the delay time "off" period is minimum than "on", the time taken to detect an object is high and it offer fast response.

d) Threshold

The threshold comparator is referenced internally at 2/3 of supply voltage level at 6V and the trigger 1/3 of supply voltage at 3V. The output of the comparators is tied to the bi-stable flip-flop. The threshold pin normally monitors the capacitor voltage of the RC timing network. When the capacitor voltage exceeds 2/3 of the supply equal to 6v, the threshold comparator resets the flip-flop, which in turn drives the output to a low state. When the output is in a low state, the discharge transistor is “on”, thereby discharging the external timing capacitor. Once the capacitor discharged, the timer will await another trigger pulse, the timing cycle having completed..

Once the voltage threshold it reaches, Comparator 1 output suddenly changes state and initiates a sequence of events that causes the external time constant capacitor to begin discharging. Accordingly, the threshold value of the system is determined as a below equation.

$\mathrm{Thr} = \frac{2}{3} * V_{CC}$ ……………………………………. . ……………………………. Equation 4.15

= 2/3 X 9V = 6 V

Where, Thr. = threshold voltage in volt (V)

Since the threshold voltage it reaches to the maximum voltage (6V) it returns to discharge from high to low (6V to 0V) and the pair of an infrared emitters are goes to "off" for a 9.6µs. In this short period, there is no emission and reflection of rays between IR emitter and receiver even in the presence of object until the capacitor charge it reaches to triggering voltage level.

d) Positive Supply Voltage (+ 9vcc)

The system operates by a +9 volt rechargeable battery supply with its pin 8 and reset (pin 4) terminal of the timer. Nevertheless, the output power of the system depends up on the triggering and threshold level values to drive the output of the IR emitters.

e) Output terminal of the timer

The transmission system of the timer depends up on the timing components and its supply voltage. This means, the output of the system goes to high during a time constant period then returns to 0Vduring a low time condition.

Practically, the output of the transmission system through a pair of IR emitters is a capable of sinking and sourcing, which makes it capable of driving the IR emitters. When the output of the system switches in between high and low condition, the output waveform of the oscillator is a square wave signal. The oscillation frequency of the transmission system to scan the surrounding objects is 39 KHz. Both the input and output waveform of the transmission system is shown on figure 4.3 below.

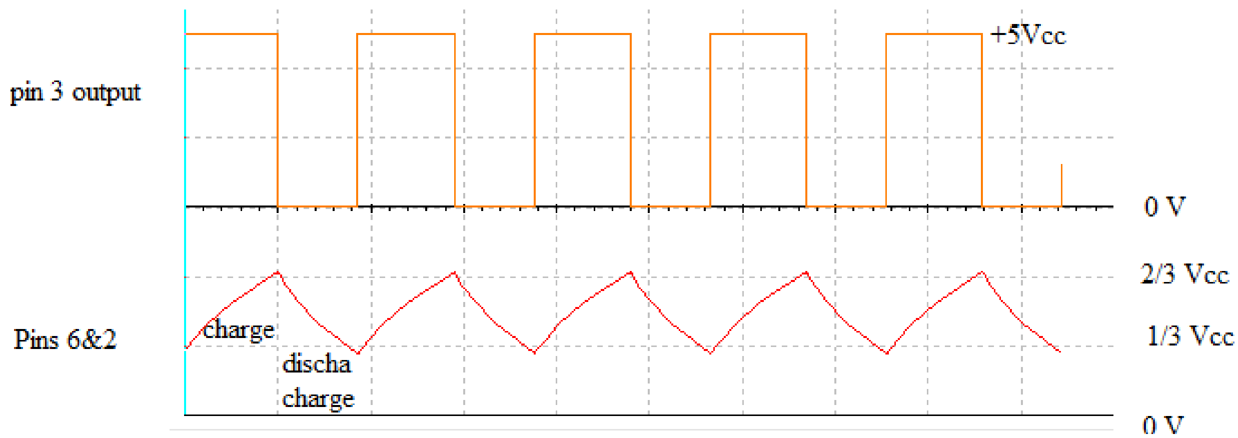

Figure 4.3 stable Charging & discharge Waveforms

f) Ground terminal

The ground (or common) pin is the most-negative supply potential of the device, which is normally connected to common circuit (ground).

The 150Ω, 1/4W of the resistors (R_3) used to limiting the flow of current through two IR emitters to prevent too much of currant passing through the IR emitters and burn it. Mainly, this resistor is used for increasing the sensitivity of the transmission signal. For this reason, we are used such kind of 150Ω resistor for the IR emitters.

Component specifications:

R_1=22KΩ, 1/4W R_2=33KΩ, 1/4W C_1= 420 pF

D_1&D_2 = 5mm CY85G R_3= 150, 1/4W

U_1=NE 555 oscillator timer R4=100Ω, 1/4W C_2= 0.01μF

4.1.1.2 Infrared Emitters (IR-Emitters)

An infrared emitter, or IR emitter, is a source of light energy which is used to generate infrared light such a normal light with a particular color that can transmit information and commands from one device to another device in the infrared spectrum.

In this project, two5mm CY85GIR emitters (D_1 and D_2) are used to detect an object in between at a distance range of 150cm.This infrared light emitting diode has a special purpose to emitting an infrared ray in the range of 950 nm wavelength. Every time, either presence or absences of object, the IRs are continuously emitting light ray to the required direction. The pulse of infrared light emitted from IR emitter is reflecting back to the IR receiver only at the presences of the object. In absences of object at the required direction, the modulated ray from the IR emitter cannot reflect back to the receiver. Accordingly, these sensors are able to measure and detect the nearby object, with in the specified range without any physical contact.

The light travels out in the IR emitters are either hits an object or just keeps on going. In the case of no object, the light is never received and the reading shows no object. If the light react an object, it returns to the detector and creates a triangle between the point of reaction, the emitter, and the detector. The detected object is a proximity sensor's target. The angle in this triangle varies based on the distance to the object. The transmitter portion of these new detectors is actually a precision lens that transmits the emitted light onto various portions based on the angle of the triangle.

The implemented system consist a pair of IR emitter and IR receiver that connected parallel to each other. A Pair of IR receiver connected in between two IR emitters. Because of, the IR receiver can get the reflected modulated ray, which emitted from both IRs or from one of them. Mostly this system is used to detecting uneven surface. A pair of infrared emitter and infrared receiver bears higher power and longer functional distance. The more they are in quantity and the better the emitters are, the stronger and wider the resulting signal. Therefore the current flowing through the IR LEDs is equal to I_{R3}.Therefore I_{R3} is determined by the following equation below.

$I_{R3} = V_{R3}/R_3$ ……………………………………………………..……………Equation 4.16

$= 3V/150\Omega = 20mA$

However, the measured consumption current value from the practical work is 25.4mA. In this case the measured value minus calculated value equal to five point four mill ampere (25.4mA-20mA = 5.4mA). Therefore, the difference of this consumption current may be due to calculation approach, internal resistance of the instrument, tolerance of the resistance value of the resistor and reused electronic component.

The purpose of this transmission system above figure 4.1 is to transmit infrared ray using 39 kHz oscillation frequency generated by an NE 555 timer circuit to scan the objects in between the device to the object 150cm distance range. The output of this transmission system is switches to drive an infrared emitter and it will turn off at about 39,000 up 40,000 times per second. The transmission time is controlled depend up on the value R_1, R_2 and C_1 of the stable timer. In this system, an NE 555 timer is the "brain" of the whole of the implemented system.

4.1.2. Receiver section

The receiver section of developed system used to receive/intercept the modulated ray from the transmission section through the detected objects. For receiving the incoming signal from the transmission section reflected back we are used two infrared receivers. The IR receiver has three conventional connections which allow the supply voltage (+5V), ground and output to be connected 470kΩ variable resistor to adjust the sensitivity of the reflected signal back. The sensitivity of incoming signal from the reflected back it depends up on the strengths. The glass of the receivers are has been made sensitive to infrared light and then exposed via a lens. This receiver detects the IR rays reflected back to the device from some objects in its proximity. The receiver it becomes conductive when infrared light hits the photosensitive lens of the IR receiver. These receivers triggered by incident of infrared light. Infrared light hitting the receiver and it activates the IR receiver to allowing current pass through. Varying light intensity and frequencies can cause the variation of IR receiver output sound and voltage. For receiving the reflected signal by the object we are used two TSOP 4838 type of the infrared receiver. TSOP means Thin Small Outline Package. The oscillation frequency of this IR receiver is 38 kHz. The component is looks like the phototransistor but in a fact an IR receiver.

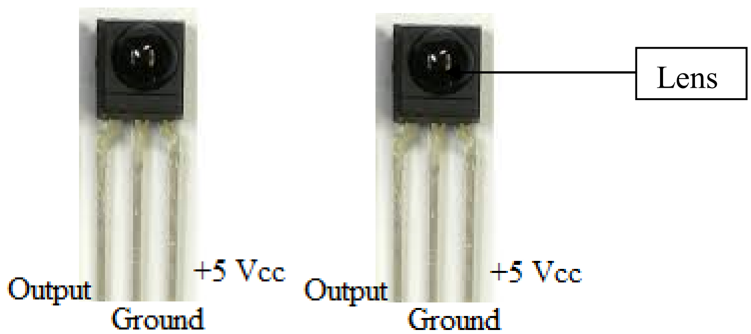

Figure 4.4 TSOP 4838 IR receiver module

The TSOP 4838 IR receiver normally used to detect the object as it reflected back, but the reflection system it depends up on the object distance. This receiver connected to the IR emitter wirelessly to detect the modulated ray from a pair of IR emitters. While the distance between IR emitter and object or IR receiver and object is larger, the receiver intercepts lower modulated ray, then, the output sound through a buzzer is also low. Because, the output of the system through the buzzer depends up on the distance of obstacle and supplied voltage to it at that time. A lens is required on both of IR emitters and receiver parts to focus and concentrating the light. For more concentration of light, we have covered the sides, bottom, and top of the IR emitters and IR receivers.

In this optical emission/detection system, the IR emitter and receivers matched to the same wavelength of 950nm and works together. The transmitter and receiver of the IRs are discrete parts and they have the same ranges for significantly higher results. Figure 4.5 shows the output wave form of the of the IR receivers. The receiver used to receive an infrared ray reflected back by the different obstacles and it converts to an electrical signal. After this conversion is accomplished, the signals amplified by different stages of amplifiers, which are connected to each other with their different terminals.

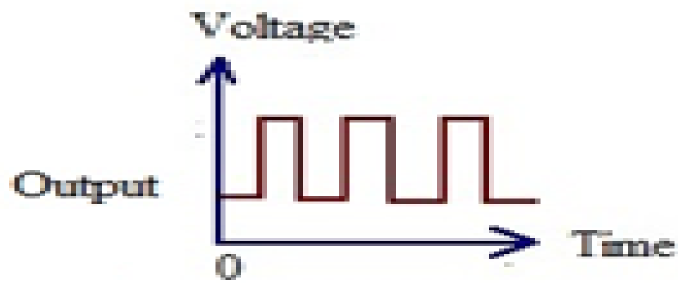

Figure 4.5 The output wave form of the IR receiver

As the above 4.5 figure above, the transmitted modulated ray from IR emitter to the object is a square wave due to charging and discharging of the capacitor (C_1) through two different values of resistors in between 1/3 and 2/3.The output signal goes from high to low state. This signal continuously switches between time of 'high' and 'low'. In the presence of object, the signal bounces back within the soma wave shapes and conditions.

The intercepted signal waveform is reverted from low to high state and the output signal of the receiver directly supplied to the RV_1 (470kΩ) potentiometer. The incoming signal from the obstacle is in the form of electrical signal.

The 470kΩ potentiometer (RV_1) which connected to the output of the IR receiver used to adjust the sensitivity of the system. This means, the lower voltage at the output signal, the higher sensitivity of the system and vice versa. This variable resistor is adjusted in such a way to obtain the required distance 150cm. The receiver section of the system contains different parts. These are two stages of amplifiers (signal conditioning circuit) with a one mono stable timer and sounding element is called the buzzer.

4.1.2.1 Signal conditioning unit

The system is used a BC 547 transistor for switching and amplifying the incoming electrical signal from IR receiver in the form current for the effective output. This transistor is an NPN bi-polar junction transistor and its configuration is common emitter, which commonly used to amplify electrical signal with a maximum current gain of 1.8. The current flowing through its emitter calculated according to the equation 4.17 below.

$I_E = I_C + I_B$ ……………………………………………………………………Equation 4.17

From this equation IBE = 0.7V/ VR1 = 1.49µA

Where, I = Current in Ampere (A)

E= Emitter terminal of the transistor

C = Collector terminal of the transistor

B = Base terminal of the transistor

0.7V = Base biasing voltage for silicon

A small current 1.49µA at its base of the Q_1 transistor controls a larger current at its collector &emitter terminals. The transistor terminals require a fixed DC voltage to operate in the desired region $\geq$ 0.7V for biasing.

The transistor is biased and partly on for all input conditions of amplification. The resistors R_4 and R_5 across the emitter of the transistor Q_1 is used for biasing the incoming electrical signal from IR receiver through its base terminal. The overall input signals of these different stages of amplifiers around controlled by the potentiometer. By varying the value of the potentiometer, we can vary the input signal of the amplifier transistors. The input electrical signal of the transistor Q_1amplified and out through its emitter terminal across R_4 and R_5.The value of these resistors are, 100Ω and 10kΩ connected to its emitter, base and ground terminal of the Q_2 transistor. The collector terminal of the Q_1 used to supply a +5 v_{cc} to drive the transistor. The voltage divider is the commonly used biasing mode.

For switching application, the transistor is biased so that, it remains fully on if there is a signal at its base. In the absence of electrical signal through its base the transistor, it gets completely off.

The reflected rays by the object always detected by the IR receiver and amplified through these different stages of transistor amplifier. These will work with IR receiver configuration by connecting the collector to the positive supply (+5v_{cc})and the sensed incoming electrical signal supplied through its base with 470k variable resistor (VR_1).The circuit diagram of the signal conditioning circuit situated in the system shown in the figure 4.6 below.

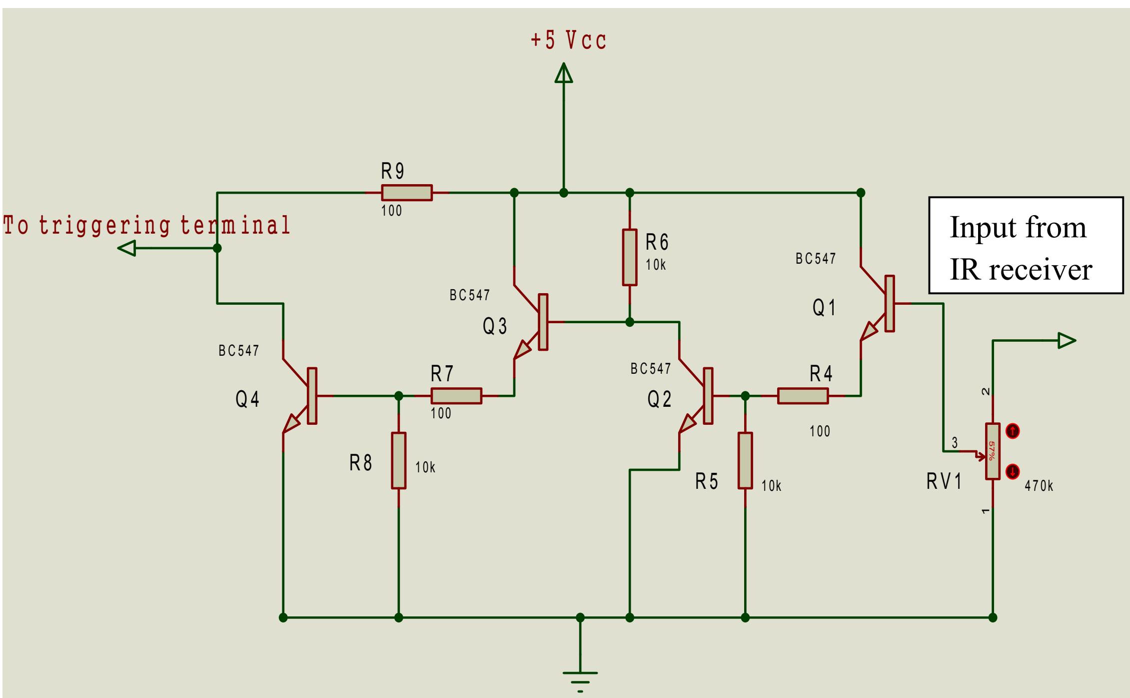

Figure 4.6-circuit diagram of signal conditioning

The system made to here above figure 4.6 is used to switching and increasing the magnitude of the incoming weak signal from IR receiver to monitor and control the visually impaired people movement in a single road. The input terminal of this circuit used to supply the incoming signal through the output of the IR receiver. The detected signal by the IR receiver amplified through different formed Darlington transistor Q_1 up to Q_4. The Darlington's transistors used to increases the magnitude of the incoming electrical signal and supply to trigger terminal of the mono stable timer trough the final amplifier transistor Q_4 collector terminal. The entire signal trough-triggering terminal of the mono stable timer is a pulse signal.

4.1.2.2 An NE 555 Mono stable timer

The mono stable timer is the part of the receiving to changes state once triggering, but returns to the original state after a certain time delay. The input signal of the timer is a pulse for triggering the incoming pulse signal from the collector terminal of the transistor Q_4 of the second stage amplifier. The mono stable schematic diagram and its waveforms are shown in the figure 4.7 (a), (b) and (c) below respectively.

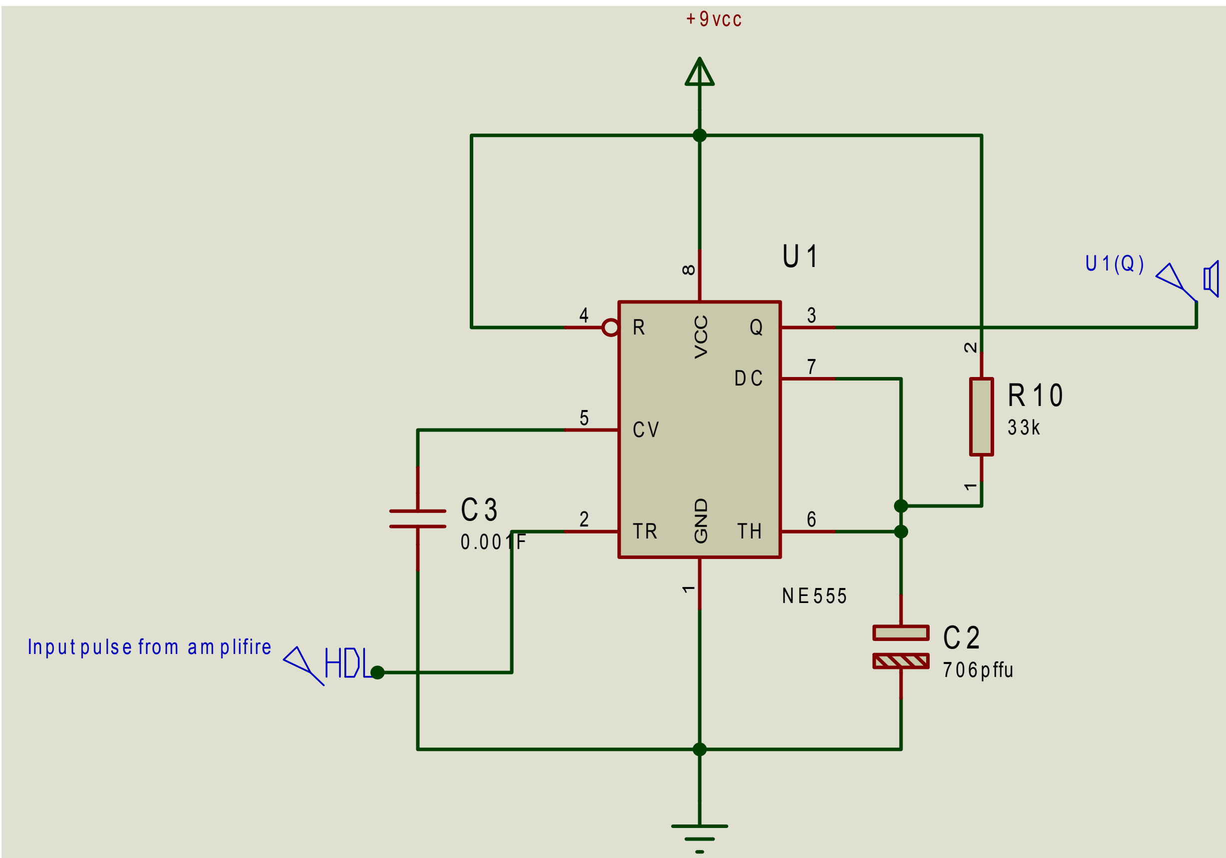

Figure 4.7 (a) Circuit diagram of mono stable timer

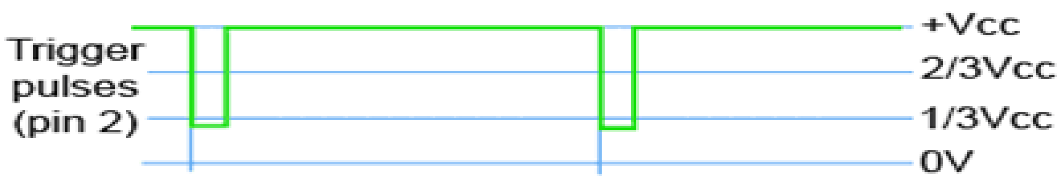

Figure 4. 7 (b) Input pulse of the timer

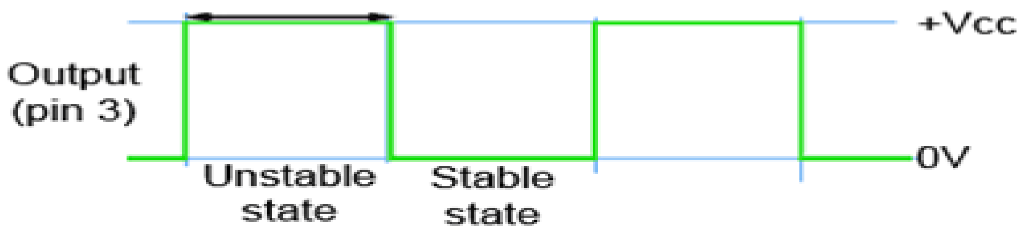

Figure 4. 7 (c) output wave form of the timer

When a suitable pulse triggered through its terminal pin 2 of the timer, it switches from its stable state, in which the output is low, to its unstable state where its output is high. Because, the triggering pin number two of the timer connected with an inverting comparator. This state exists for a time controlled by the values of R_1 and C_2, and at the end of this period, the output switches back to its stable (low) state. Therefore, this timer primarily used for producing a set of time delay and initiated by an input pulse that is entered through the pin number 2. Consequently, the timer used to control the output sound through the buzzer activating and deactivating the transistor Q_5. This transistor is biased by the two resistors (R_{12} =100Ω & R_{13} = 10kΩ) which are connected to its base terminal of the transistor. These resistors used for biasing the current from the output of the mono stable timer. When a little of current is triggered through its base terminal, the transistor is conducting to the collector terminal of the transistor and buzzer is ringing. In the absence of current from the timer trough, its base terminal the transistor is a cut-off and no current flowing to the collector terminal of the transistor. Therefore, the buzzer de-energized and no output sound through. For triggering the system it needs a +5-power source through its terminal four& eight.

Since the timing process of the output system it depends up on both the value of the external resistor R_1 = 33kΩ and capacitor706pFfrom the capacitor time constants information, the capacitor charges from 0V to 2/3V_{cc} in 1.1 time constant exponential fashion to 63.3% of its full charge voltage (+Vcc) in a onetime. To reach 2/3 V_{cc} (66.7%) it will take 1.1 time constants. According to this time constant information, in our system the 2.4nF capacitor charges exponentioally1/3+V_{cc} (1.7V) and it will take 1.1 time constants to charge the capacitor fully 2/3 +Vcc (3.33V) 66.7%. The delay period (T) is the time taken for the timing capacitor to charge. The timing of the mono-stable timer determined according to the equation 4.21 below.

$T = 1.1 * R$……………………………………………………………………Equation 4.18

= 1.1 * (33k *706nF) = 26.6µs

The capacitor begins to discharge within a fraction (2/3) of +V $_{cc}$, due to the internal resistor and capacitor.

However, when C_2 commences charging from 0V towards +V $_{cc}$, but once V_{C2} reaches the discharge level of 2/3V_{cc}, the internal Comparator 1 triggered, the bi-stable reset, then the output at pin 3 goes low and the internal transistor immediately discharges C_2. As C_2 also connected to the non-inverting input of comparator 2, this voltage also falls, and as the trigger voltage on pin 2 is now high again after the trigger pulse, the 1/3V_{cc} threshold level that was active in the a stable configuration ignored as V_{C2} falls and C_2 fully discharged to 0V. No further action takes place until the arrival of a further trigger pulse at pin 2, and during this time the mono timer is stable state. In this condition, the output of the timer through pin 3 is low. Therefore, no further activating the buzzer and no sound signal produced. The indication of this is no object detected between the ranges.

Generally, the receiver part has an infrared detector comprising IC 555 IC (2) wired for operation with mono stable mode followed by a different amplifier transistor Q_1up to Q_4. Upon the reception of infrared signals, the mono stable timer mono is turned 'on' and it remains 'on' as long as the infrared signals are being received. When mono more signals received, the mono goes 'of' after a few seconds (the delay depends on timing resistor-capacitor combination of R_{13}-C_2). The delay obtained using 33k resistorsand706pFµF capacitors are about 26.4µ seconds. Unlike the ordinary mono, the capacitor in this mono allowed to charge only when the reception of the signal has stopped, because of the PNP transistor T_1 shorts the charging capacitor as long as the output from the IR receiver module is available (active low).

4.1.2.3 Output section

The output of the system is a sound and out through the buzzer to warn the user about the object surrounding condition by converting electrical to sound energy. The output of this buzzer is depending up on the output of the switching transistor Q_5 that connected to the output of the R_{11} and R_{12} of the resistors through its base. The buzzer turned ON when the object detected. The output voltage of the buzzer depends up on the size and distance of the object from the user. When the voltage raises a particular level, the output of the buzzer is also increases and the distance is decreasing. The indication of this is the object is near to the user. So, the user has decided to take the proper action before they hate the object. When there is no sound through this buzzer the indication of clear route and if sound is heard from the buzzer it is an indication of object presence. This buzzer contains an internal oscillator for producing a sound which is set at about 400Hz. The operating voltage of this buzzer is about 3Volt which is supplied from a 9V rechargeable battery and rating current is 30mA.

The voltage drop across the buzzer is between 1.4V and 3V.The sound strength of this buzzer is depend on the incoming current from the Q_5 transistor and this current is vary between minimum10mA and maximum of 30mA.

Generally, so, whenever any objects is detected by IR emitter the reflected signal come back to the IR receiver and amplified through different transistors, the buzzer provide low or high output sound signal through its speaker or a head phone

4.1.3. Supply battery

The system it uses any commercial 9V rechargeable supply battery from the market for the effective operation of the system.

Finally the battery connected to different section of the system input of the circuit with battery terminal connector. The battery and its terminal connector is showen in the figure below.

Figure 4.8 Battery terminal connector

4.2 System Analysis

The system needs premeditation at the beginning and the subsequent implementation of the electronics circuit, printed copper board and other of course. In this electronic mobility device, Analysis and range of detection is determined. The following analyses also considered as illustrated below:

- ❖ The electronic mobility device should consist of two sections, such as, transmitter and receiver. We are concerned on input and output of the systems to overcome the risk and accident on the road. Because, the output signal is depend up on the input system. The input of the system is a light, which emitted by the transmitter module through a pair of IR emitter. This transmitter used to transmits the modulated ray as a square wave signal, which generated by a stable timer with the carrier frequency of 39 KHz between the device and object is 150cm distance range. When the object detected, the modulated ray reflects back to the IR receiver with in the same transmitted frequency. The final output of the system is a sound signals which is suitable to detect human ear through the buzzer according to the distance of the object.
- ❖ Nowadays, the visually impaired people find the obstacles by tapping back and forth of their surroundings at certain distance. Even, if there are obstacles in front of them, they can hit. Because of the range, detection is limited and lost their energy by tapping their surroundings.
- ❖ These problems resolved through developing an electronic mobility device using IR sensor to detect obstacle effectively. Therefore, our system solves such problem by detecting the presence of objects at the distance to walking alone on the road. Usually, during obstacle detection, such as holes, animals and uneven surfaces the buzzer informs

the user about the distance of the object. Hence, the project implemented using different sensors to make the user more beneficiary than the traditional mobility device.

- ❖ The user should know about the device, when they are heard sound from the buzzer; they can take necessary action about direction. If not they may get an accident and come up to the risk. In real guidance, a sound is used, that is produced by a buzzer according to the distance of the object and user on the road.

4.3 The completed circuit and constructed hardware of the system

The whole of the system circuit is inter connected to each other as the figure below

Figure 4.11constructed module of the transmitter, 4.12 shows receiver module, 4.13 optical sections that has an IR distance sensor, which can detect the object in front of the user.

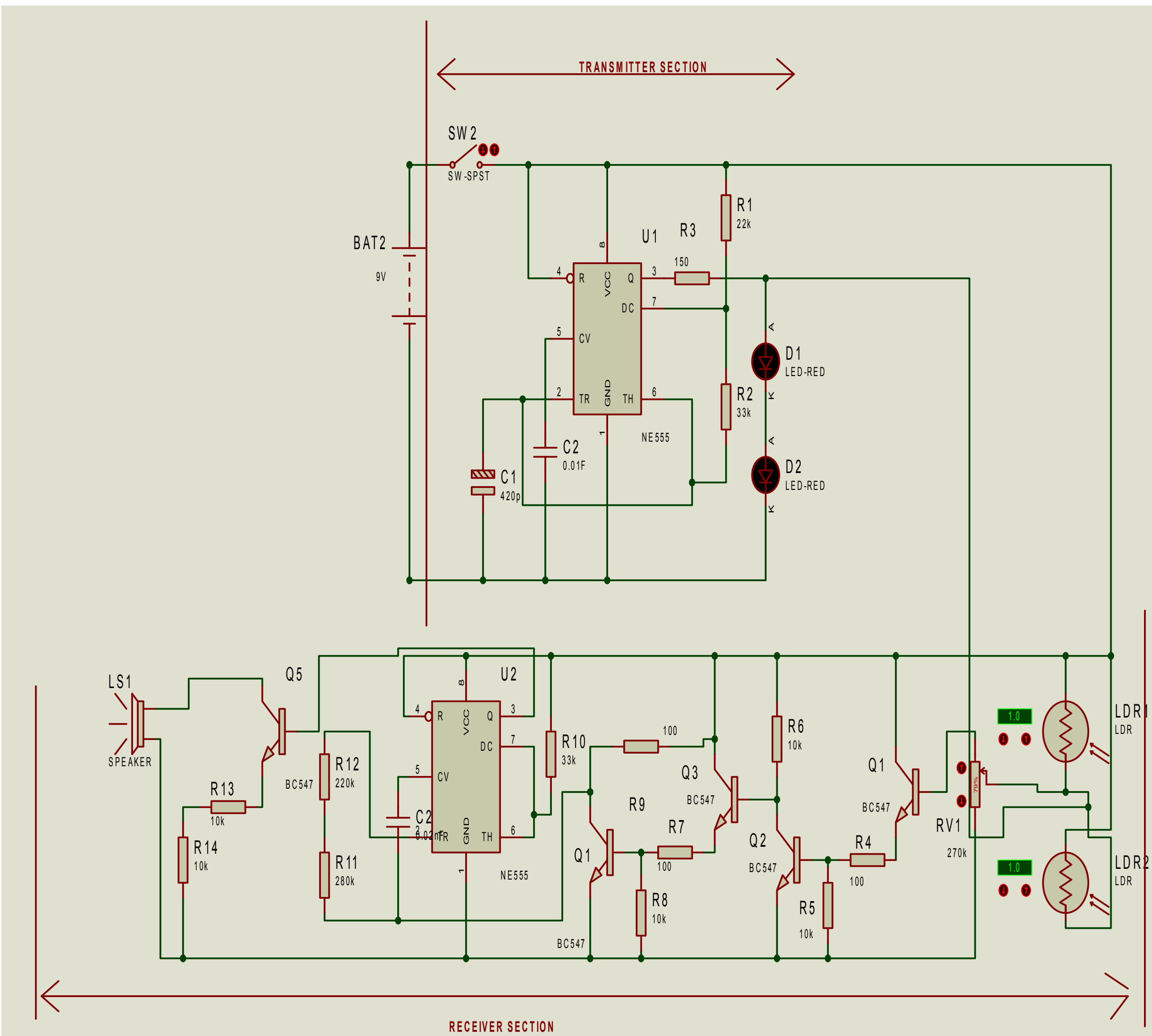

Figure 4. 9 circuit diagram of the whole system

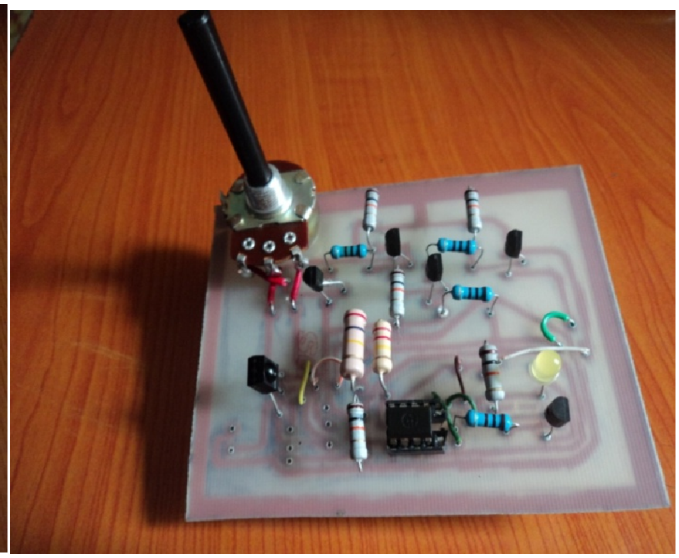

Figure 4.10 Constructed Transmitter module   Figure 4. 11 Constructed Receivers

Figure 4.12 Constructed Optical sections

Figure 4.13 completed Electronic Mobility device

CHAPTER FIVE

RESULT AND DISCUSSION

An experiment is conducted to determine the relationship of distance of object from the sensors and the output voltage, which is used to produced sound signal through the buzzer. The procedures of an experiment and the analysis of result obtained from the experiment will be discussed as a below.

5.1 Comparisons Procedures

1) The circuit is connected as a required function.

2) An object is placed at distance of 150 cm from the IR distance sensor.

3) The output voltage produced is recorded in Table 5.1.

4) Step 3 and 4 are repeated by increasing the distance of an object from the IR distance sensor until it reaches 150cm.

5.2. Distance and output voltage Result Analysis

The data from the experiment are recorded in Table 5.1. The relationship between the distances of object from IR sensor with the output voltage is determined by looking the graph of distance versus output voltage in Figure 5.1

Table 5.1 Distance versus output voltage of the system

Distance (cm)	Voltage (V)
20	3
40	2.4
60	1.6
80	0.97
100	0.52
120	0.32
130	0.075
150	≈ 0

According to our observation from the experiment as a table 5.1 shows, the distance of object from the sensors are altered in the range of 150 cm. The highest output voltage obtained from the system is two volt (3V) at the object distance of 10 cm from the sensors. At this point of level the object is very closer to the user. In this period the buzzer produces a very high sound signal and the user can detect that sound through his/her ear. This area is a very danger zone for visually impaired people if the decision is not taken before they are hate to it.

Secondly, the output voltage is approximately zero at the object distance is 150cm far away from the implemented system. The indication is that their surroundings are free from an object in between this 0cm to 150cm of distance range and no sound signal heard trough the buzzer. Hence, the area is a very save for them and they can walk confidentially without any problems.

Thirdly, the output voltage through the buzzer is varied in between 3V and 0V when the distance between the object and sensors are varied in between 0cm to 150cm.Because, at the distance of object is far away from the sensors, the strength of the reflected light by the object is weak. On other hand, When they are gradually near to each other the strength of the reflected light and output through the buzzer is increases.

For this reason, the output voltage is decreasing when the distance of an object from sensor is increasing and the sound through the buzzer is also decreasing when the distance is increasing. So that, the variation of the output voltage it depends up on the distance variation of an object. Therefore, the buzzer it produces different output sound for the far and nearby object and it warns the user in differently.
The graph of distance of object from 0 to 150cm versus the output voltage in between 3V to 0V is shown in Figure 5.1. For this reason, the output voltage is decreasing when the distance of an object from sensor is increasing and the sound through the buzzer is also decreasing when the distance is increasing. So that, the variation of the output voltage it depends up on the distance variation of an object. Therefore, the buzzer it produces different output sound for the far and nearby object and it warns the user in differently.

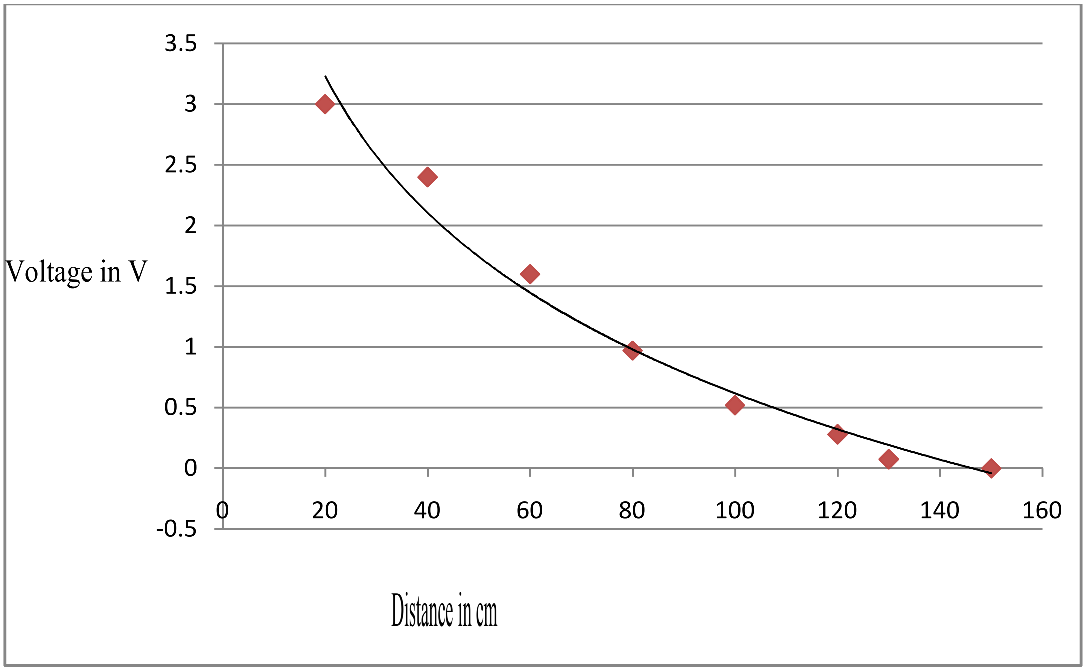

Figure 5.1 Graph of distance versus output voltage

The graph shows the successful operation of the Electronic mobility device for a visually impaired person is functioning within a possible distance between150 cm operation. The transmitter and receiver are placed parallel to each other with in 10mm distance. The Emitted ray from a pair of IR emitters are transmitted as a required with in a current of 25.4mA. Whenever any obstacles like vehicle, Animals, building and other objects are located between sensors and objects, the emitted ray from the IR emitter is reflected back and strikes the pair of IR receiver lens. The detection system of the device depends on the direction of the objects and their distances. Depend up on the direction and distance of obstacles, the buzzer produces sound signal to warn the user about the surroundings object distance. Therefore, the output sound through the buzzer varies with in the distance of object and output voltages. As the distance of object increase, the output sound decreases. When the distance of object is near to the user, the reflection of ray to the receiver is high. Therefore, the implemented electronic mobility device is successfully functioning as a required and anybody of such people can use in ever rural and urban areas.

CHAPTER SIX
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In this project, we have studied the optimization of electronic mobility device for visually impaired people with an alternative source of power for charging the 9V rechargeable battery and IR sensor. By implementing the real technology of the system we try to reduce the possibilities of accident, caused by different object, to an extent and we have successfully gets the result as showed in CHAPTER 5.
In this system, the distance of object is measured in the required direction in between 150cm and users decide about the object based on the distance. This mobility device offers many advantages such as minimizing the amount of accidents and independency as possible that save energy and reduction in emergency response time. This technology has great advantages over the currently available in our country. Therefore, the system is capable to minimizing different accident

Generally, the result of this project successfully achieved and implemented for visually impaired people to detect an object within the specified distance range. Hence, thus people where alive both in rural and urban area can use the technology without any problem. In addition, they can offer this technology within a reasonable price.

6.2 Recommendation and Future Work

Even though the model of this electronic mobility device using IR sensor is functioning as expected, there are some small imperfections that can be fixed. The size of IR sensor circuit is too big to be implanted in the device. It would be great if the size of the sensor is fit to be placed inside the device. The electronic mobility device used in this project is unfolded. So, user will have difficulties to bring and keep the device especially in crowded area. Besides that, the buzzer can be replaced by a vibrator which vibrates to alert the user. The blind people are able to feel the vibration by their touch sense. The deaf-blind people also can use the vibrating device to move from one place to another.

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APPENDIX - A

Table 4.1 Summary of an NE 555 Timer pin description

PIN NUMBER	FUNCTION	NAME
1	Ground reference voltage, low level (0 V)	Ground
2	The OUT pin goes high and a timing interval starts when this input falls below 1/2 of CTRL voltage (which is typically 1/3 of V_{CC}, when CTRL is open).	Trigger
3	This output is driven to approximately 1.7V below $+V_{CC}$ or GND.	Output pin
4	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts. Overrides TRIG which overrides THR.	Reset
5	Provides "control" access to the internal voltage divider (by default, 2/3 V_{CC}).	Voltage control
6	The timing (OUT high) interval ends when the voltage at THR is greater than that at CTRL (2/3 V_{CC} if CTRL is open).	Threshold
7	Open collector output, which may discharge a capacitor between intervals.	Discharge
8	Positive supply voltage (+ 5 vcc)	V_{CC}