PPU College of Engineering and Technology

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College Of Engineering & Technology

Electrical and Computer Engineering Department

Bachelor Thesis

Graduation Project

Controlling The TV-Receiver Using Electrical Signal Generated From Eyes Movement

Project Team

Shaher Aljabari

Mousa Shalalfeh

Hamada Tarawa

Project Supervisor

Eng. Mashhor Tarrerh

Hebron – Palestine

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كلية الهندسه والتكنولوجيا

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اسم المشروع

Controlling The TV-Receiver Using Electrical Signal Genrated From Eyes Movement

أسماء الطلبه :-

شاهر يسري الجعبري

موسى محمد شلالفه

حماده فخري طروه

بناء على نظام كليه الهندسه والتكنولوجيا واشراف وممتابعه المشرف المباشر على المشروع وموافقة اعضاء اللجنه الممتحنه تم تقديم هذا المشروع إلى دائرة الهندسه الكهربائيه والحاسوب وذلك للوفاء بمتطلبات درجة البكالوريوس في الهندسه

توقيع المشرف

.....

توقيع الجنه الممتحنه

....

توقيع رئيس الدائره

.....

الإهداء

لابد لنا ونحن نخطو خطواتنا الأخيرة في الحياة الجامعية من وقفة نعود إلى أعوام قضيناها في رحاب الجامعة مع أساتذتنا الكرام الذين قدموا لنا الكثير باذلين بذلك جهودا كبيرة في بناء جيل الغد لتبعث الأمة من جديد ...

وقبل أن نمضي نقدم أسمى آيات الشكر والامتنان والتقدير والمحبة إلى الذين حملوا أقدس رسالة في الحياة...

إلى الذين مهدوا لنا طريق العلم والمعرفة... إلى أساتذتنا الأفاضل الذين علمونا أن الشمعة لا تحترق لتذوب بل لتنير الدرب على الآخرين

وأخص بالتقدير والشكر ....

الذي تقول له بشراك قول رسول الله صلى الله عليه وسلم:

إلى سندي وقوتي وملاذي بعد الله أمي وأبي ....

إلى من لهم الجد بركم وتحت أقدامهم الأرض تهتز شهدائنا وآسرنا البواسل

إلى كل هؤلاء أهدي هذا العمل المتواضع

"كن عالما . فإن لم تستطع فكن متعلما ، فإن لم تستطع فأحب العلماء ، فإن لم تستطع فلا تبغضهم"

Abstract

This study will explores the controlling of television channel and sound volume and opining the menu to choice channel by eye movement .This Technique are used to help people who suffer from permanent disability in upper limbs of the body .

A system able to control most operations on the future of the TV, user can(with special needs "who are suffering from a disability in upper limbs of the body"),control the future of television through the system.

These include the mechanism take the signal dynamic of the eye and turn it into an electrical signal through electrodes placed around the eye monitoring the movement of muscle of eye, by moving the "eyeball." So that the movement of the horizontal eyeball control the rate of sound and motion perpendicular to the eyeball works a move channels , and open the menu and choose the channel is through the work of the timer signal, delay time "wink".

This mechanism user to control the future of television without the need for another person and the work through this mechanism during the signal generated by eye movement This study provides them control of the TV. This mechanism is trying to help people with special needs.

الملخص

يهدف هذا البحث إلى مساعده ذوي الاحتياجات الخاصه" وهم الذين يعانون من صعوبه استخدام الأطراف العلوية للجسم "وذلك عن طريق استحداث اليه قادره على تحكم بمعظم العمليات الخاصة بستقبل جهاز التلفاز وتتضمن هذه الآلية أخذ أشارة حيوية من العين وتحويلها إلى أشارة كهربائية بوضع مجسات حول العين ويتم رصد حركه عضله العين. من خلال تحريك "كرة العين "حركه افقيه من خلالها تسطيع التحكم بمعدل الصوت . والحركه العاموديه تعمل على التنقل بين القنوات ورمشه العين تعمل على فتح القائمة واختيار القناة .

وهذه الدراسة توفر لهم السيطرة على التلفاز.

TABLE OF CONTENTS

FIRST PAGES

First pages		i
Dedication		ii
Abstract english		iii
Abstract arabic		iv
Table of contents		v
List of figers		vi
List of tables		vii

CHAPTER 1 :

1	The content of chapter one	1
1.1	Introduction	2
2.1	Objectives	2
1.3	Project Important	3
1.4	Previous Studies	3
1.5	Task Time Schedule	3
1.6	Distribution of Task Schedule	4
1.7	The Cost Of Equipments	4

CHAPTER TWO:

2	The content of chapter two	5
2.1	Background Of The Project	6
2.2	The Eyes Muscles	6
2.3	Structure And Function Of The Extra Ocular Muscles	8
2.4	Physiologic And Pharmacologic Properties	8
2.5	Electrooculography	8
2.5.1	Ag/AgCl Electrode	11
2.5.2	Noise Reduction	11
2.6	Eye Safety	12
2.7	Wireless communication	13
2.8	Infrared Technology	13
2.8.1	Infrared Led (IR)	14
2.8.2	Modulation Used By Infrared Frequency	14
2.8.3	Main Standard For Infra-Red Transmission	15

2.8.4	Kinds Of Modulation Of Infra-Red Devices	15
2.8.5	The Pulse Code Modulation (PCM)	15
2.8.6	The Principle Of Pulse Code Modulation	18
2.8.6.1	The Bi- Phase Modulation (Manchester Code)	18
2.8.6.2	The Pulse Width Modulation (PWM)	18
2.8.7	Bands	19
2.9	Different regions in the infrared	19
2.10	International Standards For Lighting	20
2.11	Infrared Transmitter/Receiver	20
2.12	Infrared remote control	21

CHAPTER THREE

3	The content of chapter one	22
3.1	Block digram	23
3.1.1	Surface Electrode	24
3.2	Instrumentation Amplifier	27
3.3	Band Pass Filter	28
3.4	Gain Amplifier	30
3.5	Comparator Circuit	30
3.6	PIC Microcontroller	31
3.7	Infrared Wave	32
3.7.1	IR Advantages:	33
3.7.2	IR Disadvantages:	34
3.8	Infrared Transmitter	34
3.8.1	Feature	35
3.8.2	Basic RC5 Protocol	35
3.8.3	Feature	35
3.8.4	RC5 detecting	36
3.8.5	Transmitter Schematic	37
3.8.6	Infrared led	37
3.9	Receiver Schematic	38
3.9.1	The TSOP48	39
3.9.2	Features	39

CHAPTER FOUR

4	The content of chapter four	40
4.1	Surface Electrode (Ag\AgCl)	41
4.2	Instrumentation Amplifier	42
4.3	Band Pass Filter	43
4.4	Gain Amplifier	44
4.5	Comparator	45
4.6	PIC Microcontroller	45
4.7	Transmitter circuit	46
4.8	Receiver circuit	47
	References	48
	Appendix	

LIST OF FIGURES

CHAPTER TWO

Figure 2.1	Eyes muscle	7
Figure 2.2	Bit stuffing	16
Figure 2.3	Manchester Coding	18

CHAPTER THREE

Figure 3.1	Silver–silver chloride electrode	25
Figure 3.2	Metal plate electrode	26
Figure 3.3	Suction electrode	26
Figure 3.4	Band pass filter	29
Figure 3.5	Operational amplifier	30
Figure 3.6	PIC16F877 microcontroller	31
Figure 3.7	RC5 modulation 1	36
Figure 3. 8	RC5 Frame format	36
Figure 3.9	Bi-Phase coding	36
Figure 3.10	Synchronizing and sampling	37
Figure 3. 11	infrared led	38

CHAPTER FOUR

Figure 4.1	Ag-AgCl electrode	41
Figure 4.2	Instrumentation amplifier	42
Figure 4.3	Second order BPF	43
Figure 4.4	741 Gain amplifier	44
Figure 4.5	Comparator circuit	45
Figure 4.6	PIC microcontroller	45
Figure 4.7	Transmitter circuit	46
Figure 4.8	Receiver circuit	47

LIST OF TABLES:

CHAPTER ONE

Table (1.1)	Task Time Schedule	3
Table(1. 1)	Distribution of Tasks Schedule	4
Table(1.3)	Cost of Equipments	4

CHAPTER TWO

Table (2.1)	Band Wave Length Description	19

Chapter one

Introduction

Chapter contents

1.1 Overview

1.2 Motivation.

1.3 Objective.

1.4 Previous Studies

1.5 Estimated cost and budget

1.6 Time plane

1.7 Report Contents

1.1 Overview

This chapter focuses on the main idea of the project about the eyes movement and control TV channel moreover , it will state the most important challenges, as well as the aims and the previous works related to the project.

1.2 Motivation

Our project of (Controlling The TV Receiver By Using Electrical Signal Generated From Eyes Movement) will be used to help the elderly persons who are missed the upper part of his or her body . Also the problem is how to make the controlling of the receiver from the biomedical signal generated on the human body.

In this project we will choose the electrical signals generated from eyes movement in two dimension , at first the eyes will be moved by the contraction and relaxation of three pairs of muscles ,these muscles can generate very small electrical signal from contraction then using these signals as an input of our project then we can control the TV-channel and the volume of sound.

This technique is very simple, we can detect the eyes signal ,and we should amplified and processing these signal ,then we can transmit these signal by using special transmitter to special receiver, this receiver will be connected directly to the receiver of television , and then the patient can control the channel and the sound with his or her body as they like .

Making life easier is the main reason of making this project ,it's important to give elderly people natural life as other people by giving them this device to control their life as they like.

1.3 Objective

The main objective of our project :

1. study the physiological structure of the eyes muscles.
2. study the electrical signal generated in the two pairs of these muscles.
3. design and implementation of this project in low cost .
4. design a circuit for the transmitter and receiver to make communication .

5. Understand how TV receiver works and how the signal is passed and processed.
6. Exploit what we have learned in the principles of communication and biomedical in a practical application.

1.4 Previous Studies

1) Controlling computers with neural signals electrical impulses from nerves and muscles which can command computers directly, And a method that aids people with physical disabilities, by Hugh S. Lusted and R. Benjamin Knapp.

2) Investigating the effects of an abusive subtitling procedure on the perception of TV anime by using eye tracker and questionnaire. School of Applied Language and Intercultural Studies,Dublin City University Supervisor: Dr. Minako O" Hagan

3) Video-realistic image-based eye animation via statistically driven state machinesAxelWeissenfeld · Kang Liu · Jörn Ostermann

1.5 Estimated cost and budget

The initial cost of this project is about, distributed as follows:

Table 1.1 Estimated cost

Component	Required number	Price $
Electrodes	5	300
IC's	5	50
Resistors and capacitors		20
Microcontroller PIC18F4550	6	100
Zigbee transmitter	1	100
Relay	4	100
Zigbee receiver	1	100
Micro Switches	4	10
TV & Receiver	1	500
Total Cost		1580$

Table 1.1

1.6 Time plane

The project schedule will be divided into the following table (1.2):

Table 1.2 Layout of time

Week No.	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Choose project																
Gathering information																
Analysis and studying																
Writing and printing																

Table 1.2

1.7 Report Contents

The documentation of this project is divided into five chapters, each chapter describes specific points in the project, and these chapters are divided as follows:

Chapter One: Introduction

This chapter focuses on the main idea of the project about the eyes movement and control TV channel moreover , it will state the most important challenges, as well as the aims and the previous works related to the project.

Chapter Two: Back ground

This chapter contain the idea our project that is to control TV operations using biological signal, in this project we will use the electrical signal that well be generated from eye movement. In our project we will use the eye to control the TV operation to make a way of helping elderly persons and give them method to control our life, and to Enrich research through knowledge In order to satisfy Scientific curiosity in research and development.

Chapter Three: Block Diagram

This chapter includes block diagram of the project, explain each part in block diagram.

Chapter Four: Project design

In this chapter we will discuss project hardware ,processing and interfacing were designed. Each stage was explained and the calculation of these stage .

Chapter Five: Implementation and Testing

The chapter including testing for each component , testing scheduling.

Chapter Two

Background

Chapter contents

2.1 Overview

2.2 Eyes Muscles

2.2.1 Structure And Function Of The Extra Ocular Muscles

2.2.2 Physiologic And Pharmacologic Properties

2.2.3 Electrooculography

2.2.4 Ag/AgCl Electrode

2.2.5 Noise Reduction

2.2.6 Eye Safety

2.3 Wireless communication

2.4 Infrared Wave

2.4.1 IR Advantages:

2.4.2 IR Disadvantages:

2.5 Zigbee technique

2.5.1 Why we use the Zigbee technique

2.1 Overview

This chapter contain the idea our project that is to control TV operations using biological signal, in this project we will use the electrical signal that well be generated from eye movement. In our project we will use the eye to control the TV operation to make a way of helping elderly persons and give them method to control our life, and to Enrich research through knowledge In order to satisfy Scientific curiosity in research and development.

The pervious project about “moving mouse cursor according to eyes tracing use the PC mouse and operation use eye by special mouse can moving according to eye movement.

The project importance appear in the field to help person using TV-receiver without necessary to use his or her hands to control some operation in changing the channel TV- receiver and volume and open menu.

2.2 Eyes Muscles

The extra ocular muscles perform two functions: Opt-static and opt-kinetic.

- The opt-static function requires that the muscles maintain a state of postural tonicity.
- The opt- kinetic function requires that quick titanic contractions be performed these two contradictory functions are served by two different sets of muscles in the skeletal muscle system. Eye muscles, however, are equipped to perform both functions simultaneously.[1]

In the principle of type of response by extra ocular muscles would be controlled either by the central nervous system or by peripheral mechanisms residing in the extra ocular muscles. The structure of the extra ocular muscles and its possible relation to their function will be discussed in our project as an introduction to know a lot of properties of these muscle.

To know the properties of eyes muscle in human body. Three pairs of extra ocular muscles and their positions. The eye movements are controlled by three separate pairs of muscles, including: the medial and lateral recite (It enables the eyeball to move from side to side), the superior and inferior recite (It enables the eyeball to move upward or downward),and oblique muscles (operate mainly to rotate the eyeballs). Distribution of the muscles for controlling the two eyes is symmetrical.[1]

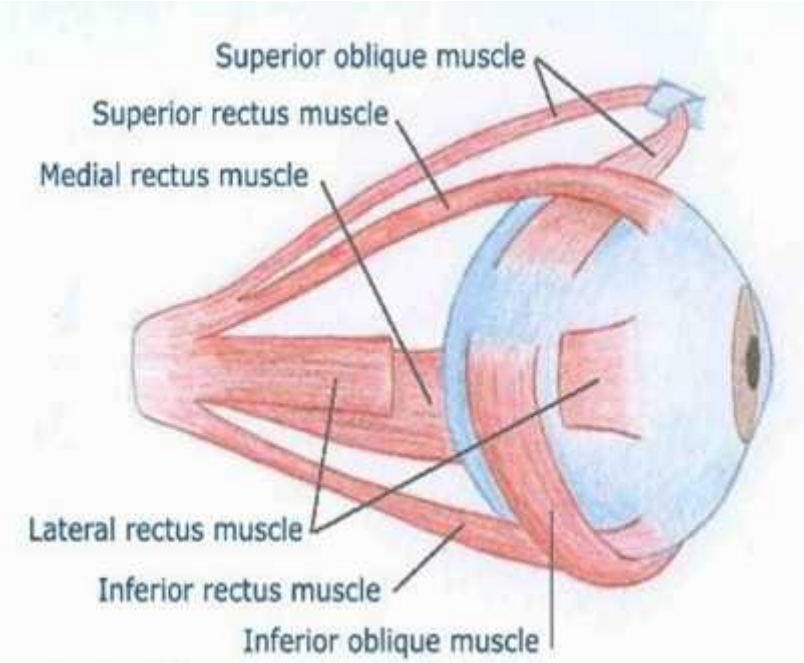

Figure 2.1, Eyes muscle[1]

Each of the three sets of muscles to each eye is reciprocally innervated, so that one muscle of the pair relaxes while the other contracts.

In general, two types of striated muscles are distinguished in the skeletal muscle system :

1) Red or dark muscles composed of fibers of small diameter and rich in sarcoplasm.[1]
2) Pale or white muscles with fibers of greater diameter and scanty sarcoplasm.[1]

Red muscles will contract more slowly and are kept in a state of tonic contracture by fewer impulses per second than are white muscles which contract more quickly. Red muscles relax more slowly than white muscles, and their metabolism increases much less during contraction than that of white muscles.

Consequently, red muscles do not tire as easily as white muscles but red muscles are more continuously active and serve the function of postural activity rather than the white muscles are muscles of that will be in the locomotion and quick activity.[2]

2.2.1 Structure And Function Of The Extra Ocular Muscles

The structure of eye muscles, which perform the functions of both red and white muscles, differs in many properties from other muscles. Extra ocular muscles contain fibers of varying diameters. In general they are the finest fibers found at any striated muscles. They vary in diameter from (9 mm) to (17 mm), with fibers as (3 µm), but these muscles also contain coarse fibers up to (50 µm) in width. One can appreciate the fineness of fibers of extra ocular muscles if their diameters are compared with those of fibers of the gluteus maximums (90µm to 100 µm). [1]

2.2.2 Physiologic And Pharmacologic Properties

The physiologic and pharmacologic properties of extra ocular muscles correspond to the many unusual histological features of these muscles. Eye muscles require and receive more oxygen than other skeletal muscles showed by means of electromyography that responses of extra ocular muscles in humans are considerably lower in amplitude (20 to 150 mV), of much shorter duration (1 and 2 ms), and much higher in frequency (up to 150 cps) than those of peripheral skeletal muscles, in which the amplitude is (100 to 3000 mV) and the duration (5 to 10 ms) and the frequency only up to (50 cps) .[1] Attributed these differences to the low nerve fiber-to-muscle fiber ratio of the motor units in extra ocular muscles. [1]

Extra ocular muscles contract much more quickly than other voluntary muscles. The great speed of contraction of extra ocular muscles is in keeping with the requirements of saccadic eye movements and with what is structure and innervations of extra ocular muscles. It is all the more striking when contrasted with another observation. [2]

2.2.3 Electrooculography

Electrical responses have been recorded from extra ocular muscles of human's eyes by using electrooculography system . The electrooculography of human eyes it's more important contributions have been made toward understanding of the function of extra ocular muscles in normal and pathologic states basically, electrooculography consists of oscilloscopic to recording of suitably amplified electrical activities of eyes muscle. [3] Unipolar or bipolar electrodes are inserted into the muscle to record the current. The electrodes are placed on the face of the person. This basic technique may be highly refined by using of various electronic components for integration, analysis, and storage of responses. [4]

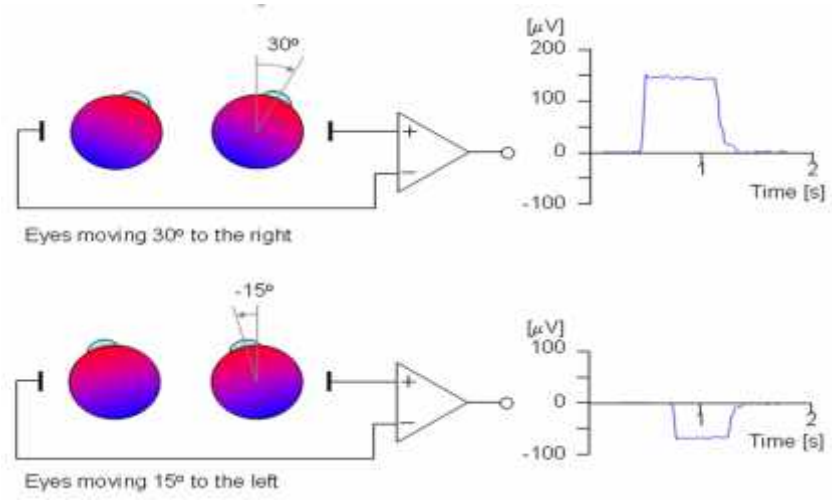

Figure 2.2,EOG Output Signal

Extra ocular muscles are especially interesting to those engaged in electrooculography studies because of their low nerve fiber-to-muscle fiber ratio, the anatomical motor unit consists of the neuron cell body, its axon and the muscle fibers innervated by that axon. All these fibers discharge synchronously when the axon is stimulated. The integrated voltage of this discharge constitutes is the electric motor unit. Only a few fibers of an extra ocular muscle are innervated by one axon, electrooculography comes close to recording the electrical activity of a single anatomical motor neuron in limited muscle.

Electrooculography has proved to be of value in assessing paretic and pseudo paretic conditions of extra ocular muscles , in sympathies, and in elucidating the path

physiology of the retraction syndrome. No specific abnormalities are revealed in patients with committing strabismus .Great difficulties are encountered in quantifying.[5]

The physiology of the motor functions of the eyes. It should be noted that the applicability of electrooculography is for technical reasons limited. First the connection of electrodes into the muscles is easy only for eyes muscles, although some discomfort is always part of this procedure. The insertion of electrodes into the oblique muscle is far more difficult. Generally, no more than two muscles in each eye can be studied simultaneously. Multichannel recordings have recently been obtained after insertion of electrodes into the muscles during surgical procedures. The recordings were performed days after surgery and without discomfort to the patient, after which the electrodes simply pulled out of the muscle. This approach may hopefully provide better information on electrical activity of the extra ocular muscles.

When a muscle rotates an eye into its field of action, there is an increment of electrical activity. Similarly in extreme gaze to the right, the left medial rectus fires maximally while the left lateral rectus is electrically silent, the opposite is true in extreme gaze to the left. The waking person a muscle may be electrically silent only when in extreme positions out of its field of action. Where an eye increment in the electrical activity occurs in the lateral rectus muscle. Extra ocular muscles in vengeances and a discussion surrounding it.

Saccadic movements differ from vengeance movements in their innovational pattern. We well searched initiated by a sudden burst of motor unit activity of the agonist with corresponding inhibition in the antagonist .The duration of the initial burst is proportional to the extent of the movement (30 ms for a 2.5 movement to 150 ms for a 40 movement). This initial burst is followed immediately by an orderly series of uniformly firing motor units. The firing rate of the motor unit depends on the angular displacement from primary position. Large movements (15 to 20) cause a second or third saccadic burst representing efforts to overcome a lag in fixation. These findings are in accord with those made by optical and electro-oculographic recordings of eye movements. [6]

The eye maintains a voltage of (0.4 - 1.0 mV) with respect to retina (due to the higher metabolic rate at the retina compared to the cornea). This corneoretinal potential is roughly aligned with the optic axis. Hence it rotates with the direction of gaze. It can be measured by surface electrodes placed on the skin around the eyes. These recorded signals are smaller (15 to 200 μV),so they are amplified before processing.[6]

Electrooculography has both important advantages and disadvantages. The advantage of this equipment is cheap, readily available. The necessary fixtures do not obstruct the visual field, and are completely insensitive to head movement, although significant deviation from the last calibrated position would require the user to repeat a calibration sequence for accurate tracking.

On the other hand the measured signals are subject to drift from several sources changing skin resistance, electrode slippage or polarization, even a variable corneoretinal potential due to light accommodation and level awareness. Noise pickup from other electrical devices can be minimized by careful shielding, but action potentials of the other facial muscles can mask the desired signal. Straight forward signal processing steps can be devised to condition the data so it can be reliably interpreted. Some of the noise patterns such as the (60 Hz) line frequency can be easily removed, using a notch filter(band reject filter).

Because this type of signal is quite distinct from the usual data from pursuit or saccadic movements, they can be recognized and categorized. In other words, the EOG technique can potentially recognize eye gestures such as winking blinking .

It is possible to obtain independent measurements from the two eyes. However, the two eyes move in conjunction in the vertical direction. It is sufficient to measure the vertical motion of only one eye together with the horizontal motion of both eyes .To detect these signal that generated from eye movement we well use four electrodes, two electrode to detect vertical signal and the other two electrode to detect the horizontal signal. In our project we well use one type of electrode that is Ag/AgCl because this type is used in many application and it is cheap.

2.2.4 Ag/AgCl Electrode

There are many types of electrode that will be used to detect the bio potential signal. In this project we will use the skin surface electrode. This type of electrode is defined as a bipolar electrode. The surface electrodes are not expensive. The problem with skin surface electrodes is that they create sometimes an unstable contact.

An unstable contact causes potential motion artifacts. It could also add thermal noise to an EOG signal and we will correct these problems by using a high impedance electrode that helps prevent thermal noise problem. To avoid unstable skin contact the electrode must be placed firmly to the skin. To secure the electrode contact, the electrode that has an adhesive surface is selected for this EOG amplifier. These electrodes will be put on the upper and lower of the muscle biceps and triceps to detect the electrical signal from these muscle contractions.

2.2.5 Noise Reduction

The eye movement signals are band limited due to the fact that there is a speed limit on eye movements. Thus a low pass filter with (0.05Hz) cutoff could remove most of the high frequency noises. The largest noise we observed was the(30Hz) noise from the power line as we talk in this project. We compared the standard deviation of the signal in order to discriminate meaningful signals from noise .This calibration strategy to choose the threshold parameter to be above the deviation.

After detecting the signal using the EOG system and processing these signal, we will need to transmit these signal using modern technique to control the operations in the television, this technique well be the other part of our project , in this project we will use the infrared wave to transmit these signal from the EOG system to the special receiver to control the operation needed ,but the infrared after testing not give the result needed because this we well change the technique to zigbee communication as we discussed in the next chapter.

2.2.6 Eye Safety

In theory, increasing as much as possible the optical power emitted by a wireless zigbee transmitter could help overcome some of the data transmission limitations suffered by optical wireless technology. A high emitted optical power, for example, could compensate for the high attenuation suffered by the optical signal when transmitted through air, increasing the range of the system and improving its SNR.A high power level at the transmitter could also allow the use of smaller and faster low capacitance photo detectors, which present a smaller active area. Unfortunately, the optical power level at the transmitter is restricted due to eye safety considerations and to power consumption limitations.[7]

Eye safety is one of the most important restrictions to the optical power level emitted by a wireless zigbee transmitter. zigbee, visible, and ultraviolet (UV) radiation can cause damage to the human eye if the energy emitted by optical sources at their respective wavelengths exceeds specific safety levels (39, 71) , and Near-IR radiation, for example, can cause retinal burns, while medium- and far-infrared thermal radiation can cause corneal burns. The fact that the cornea is opaque to infrared radiation beyond (1.4 μm) has raised the question of the possibility of using the (1.55 μm) wavelength for wireless communication systems to avoid the restrictions.[7]

Imposed by eye safety considerations. Unfortunately, even if the retina is protected from near-IR radiation at this wavelength, it remains to be seen if the cornea would be exempt from any damage. In addition, the availability of In GaAs and Get photo detectors that are sensitive to EM (electromagnetic) energy at around (1.55 μm), these detectors are more expensive and present higher capacitances.[7]

Damage to the eye from a near zigbee transmitter (rates vary from 20 to 250 kilobits/second.) can occur if excessive power from an optical source reaches the eye and the energy is focused on the retina. This focused energy creates a high-energy spot that increases the temperature of the tissue. The smaller this spot is, the higher the temperature of the tissue (and the worse the damage).Whether a lens can focus energy down to a point or to a spot of small diameter depends on its imperfections.

When calculating the size of the spot created on the retina by the lens of the eye when focusing the energy from a collimated source, the eye is generally considered to be ideal and diffraction limited. In reality, the capability of the eye is not diffraction limited and the smallest spot that can be focused on the retina from a collimated source ranges between (50 and 100 μm) which is considerably larger than the 10-μm spot that could be created with a diffraction-limited eye .[7]

2.3 Wireless communication

Wireless is a term that refers to any type of electrical connection that is achieved without using hard wired connection. Wireless communication is the transfer of data or information between electrical or electronic components over a distance without using electrical wires .Distances can vary from very short distances (few meters like TV remote control) to very long distances(thousands of kilometers for radio waves) wireless communication is considered to be a branch of telecommunications, it is used in large number of applications including, cellular telephones networks, satellites television, GPS units ,wireless computer keyboard and mice ,and many other applications .[7]

There are many different types of wireless communication :

1- IR (Infrared) wireless communication .
2- RF (Radio Frequency) wireless communication.
3- Bluetooth wireless communication .

Normally, all types of wireless technologies use a transmitter and a receiver. However, we will use the Zigbee for some reasons which will be mentioned later in this project. Another motivation for this system is an implementation of a new idea expected to be widely adopted by people.

Another feature of our planned system is that, the switching between the two modes will be controlled remotely through wireless instructions at the headsets. Therefore, no special plugs will be used at the TV side. Furthermore, we will try to reduce the system cost compared to other similar products in order to make the technology available for a wide spectrum for people.

2.4 Infrared Wave

Infrared light lies between the visible and microwave portions of the electromagnetic spectrum, and the infrared light has a range of wavelengths, just like visible light has wavelengths that range from red light to violet. "Near infrared" light is closest in wavelength to visible light and "far infrared" is closer to the microwave region of the electromagnetic spectrum. The longer, far infrared wavelengths are about the size of a pin head and the shorter, near infrared ones are the size of cells, or are microscopic.

Infrared radiation, having a wavelength in the range from (75 × 10−6 cm to 100,000 × 10−6 cm) (0.000075-0.1 cm). Infrared rays thus occupy that part of the electromagnetic spectrum with a frequency less than that of visible light and greater than that of most radio waves. The name infrared means "below the red," or beyond the red. Infrared radiation is thermal, or heat, radiation.[8]

Infrared radiation is typically produced by objects whose temperature is above (10°K).[8] There are many applications of infrared radiation. A number of these are analogous to similar uses of visible light. Thus, the spectrum of a substance in the infrared range can be used in chemical analysis much as the visible spectrum is used. Radiation at discrete wavelengths in the infrared range is characteristic of many molecules. The temperature of a distant object can also be determined by analysis of the infrared radiation from the object.

Radiometers operating in the infrared range serve as the basis for many instruments, including heat-seeking devices in missiles and devices for spotting and photographing persons and objects in the dark. Medical uses of infrared radiation range from the simple heat lamp to the technique of thermal imaging, or thermographs. A thermograph of a person can show areas of the body where the temperature is much higher or lower than normal.

First part of communication system is the transmitter part , this part will take our controlled transmitted signal from the PIC-microcontroller that well connected to it directly, the transmitter well take six signal to control six operation in the television

, these signals on the PIC-microcontroller well converted to digital code , every signal of the six signal well take special code After that, the output of the PIC connected to transmitter to transmit these code using the infrared technique.

2.4.1 IR Advantages:

1) Low power requirements, Therefore ideal for laptops, telephones, personal digital assistants.
2) Low circuitry costs, $2-$5 for the entire coding/decoding circuitry .
3) Simple circuitry, No special or proprietary hardware is required, can be incorporated into the integrated circuit of a product.
4) Higher security, Directionality of the beam helps ensure that data isn't leaked or spilled to nearby devices as it's transmitted.
5) Portable.
6) Few international regulatory constraints, IrDA (Infrared Data Association) functional devices will ideally be usable by international travelers, no matter where they may be.
7) High noise immunity, Not as likely to have interference from signals from other devices.[8]

2.4.2 IR Disadvantages:

1) Line of sight, Transmitters and receivers must be almost directly aligned to communicate.
2) Blocked by common materials, People, walls, plants, etc. can block transmission.
3) Short range, Performance drops off with longer distances.
4) Light weather sensitive, Direct sunlight, rain, fog, dust, pollution can affect transmission.
5) Speed, Data rate transmission is lower than typical wired transmission.[8]

**Note: when we plane the project we will use the zigbee communication for many reason and we notice that the zigbee is better than IR-technique to use in our project .

2.5 Zigbee technique

Through our studying and researching in the previous semester, we were able to make a complete image about the system which will be built. Firstly, we specify the technique which will be used for the transmission and reception which was the IR technique. We faced some problems that prevent our project to be accomplished, so we study other techniques. After study we found that we should use the Zigbee technique which could allow us to control the switch in a better mode and give us more flexibility to control the system by programming the Xbee for controlling the sound and other options like changing the channel .[9]

2.5.1 Why we use the Zigbee technique

Zigbee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. The technology is intended to be simpler and less expensive than other WPANs such as Bluetooth. Zigbee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory.[9]

Zigbee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. Data transmission rates vary from 20 to 250 kilobits/second.

Because Zigbee nodes can go from sleep to active mode in 30 ms or less, the latency can be low and devices can be responsive, particularly compared to Bluetooth wake-up delays, which are typically around three seconds. Because Zigbee nodes can sleep most of the time, average power consumption can be low, resulting in long battery life. [9]

Key Features Long XBee

- Indoor/Urban: up to 100’ (30 m).

- Outdoor line-of-sight: up to 300’ (100 m).
- Transmit Power: 1 mW (0 dBm).
- Receiver Sensitivity: -92 dBmXBee-PRO.
- Data Rate: 250,000 bps.

Low Power XBee

- TX Current: 45 mA (@3.3 V).
- RX Current: 50 mA (@3.3 V).
- Power-down Current: < 10 µAXBee.

An important advantage for the Zigbee technique is that it uses the DSSS which is used to overcome the jamming problem so we can say it is a highly Secure . An additional advantage of the Zigbee is that it’s easy to used. This is because it has no complicated configuration and it has a free software called X-CTU used for identify some parameters like baud rate and PAN-ID.

Chapter Three

Block Diagram

The content of chapter

3.1 Overview

3.2 Block diagram

3.2.1 Surface Electrode

3.2.2 Electrodes lead wires

3.3 Instrumentation Amplifier

3.4 High Pass Filter

3.5 low Pass Filter

3.6 Inverting Amplifier

3.7 Notch Filter

3.6 PIC Microcontroller

3.7 System design

3.8 Zigbee Technique

3.8.1 Zigbee protocol stack

3.8.2 Application using Zigbee Technique

3.9 Power Supply

3.1 overview

This chapter includes block diagram of the project, explain each part in block diagram.

3.2 Block diagram

Simple block diagram for all parts on our project and the description of these parts.

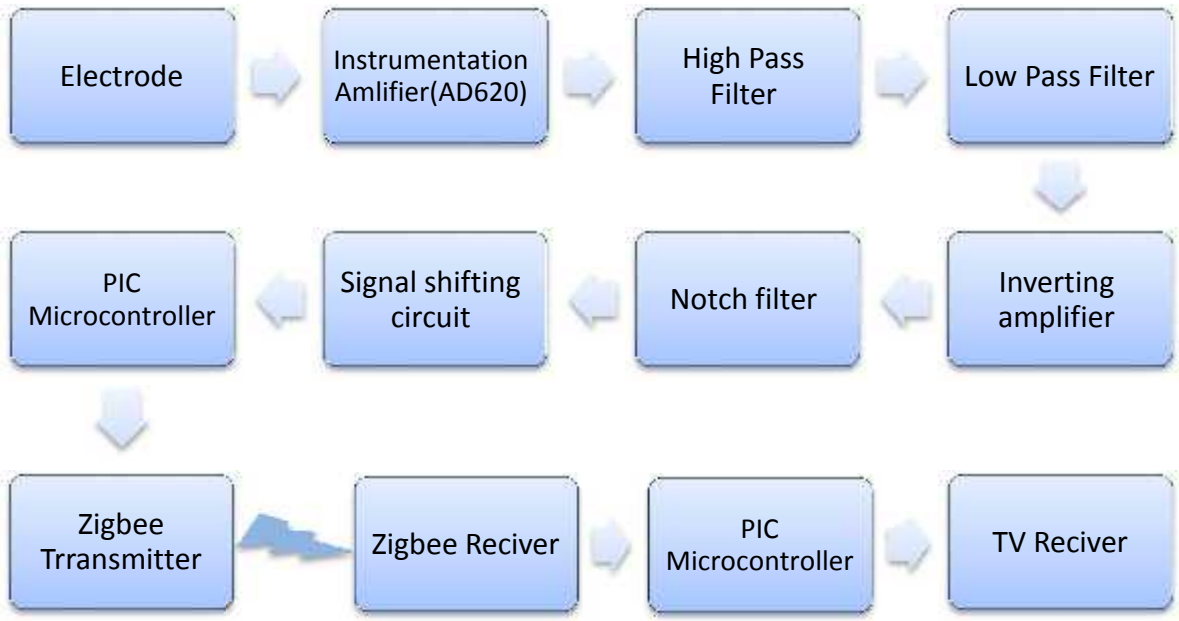

Figure3.1,Block diagram

3.2.1 Surface Electrode

In our design of the EOG circuit , we will use one type of many types of electrode, this type is called (Ag-AgCl) electrode, the reason for using this type that their performance such as high sensitivity and high accuracy of detecting signal .In this project the electrodes will be put in seven different places to detect the electrical signal from eyes muscle .One of these electrodes are put above the eye and the other under the eye, the other two electrode will be put it in the left and on the right around

the eye. And tow electrode well be put it in the other eye to detect the signal generated from Closure of the eye , the seventh electrode will be used as reference.

Biologic systems frequently have electric activity associated with them. This activity can be a constant dc electric field, a constant flux of charge-carrying particles or current, or a time-varying electric field or current associated with some time-dependent biologic or biochemical phenomenon. Bioelectric phenomena are associated with the distribution of ions or charged molecules in a biologic structure and the changes in this distribution resulting from specific processes. These changes can occur as a result of biochemical reactions, or they can emanate from phenomena that alter local anatomy.[5]

The mechanism of electric conductivity in the body involves ions as charges. Picking up bioelectric signals involves interacting with these ionic charges and transuding ionic currents into electric currents required by wires . This transuding function is carried out by electrodes that consist of electrical conductors in contact with the aqueous ionic solutions.

Electrodes are made from noble metals such as platinum are often highly polarizable . A charge distribution different from that of the bulk electrolytic solution is found in the solution close to the electrode surface. Such a distribution can create serious limitations when movement is present and the measurement involves low frequency or even dc signals. If the electrode moves with respect to the electrolytic solution, the charge distribution in the solution adjacent to the electrode surface will change, and this will induce a voltage change in the electrode that will appear as motion artifact in the measurement. Then for most biomedical measurements, non polarizable electrodes are preferred to those that are polarizable.[5]

The silver–silver chloride electrode is one that has characteristics similar to a perfectly non polarizable electrode and is practical for use in many biomedical applications. The electrode (fig 3.2)consists of a silver base structure that is coated with a layer of the ionic compound silver chloride. Some of the silver chloride when exposed to light is reduced to metallic silver, so a typical silver–silver chloride electrode has finely divided metallic silver within a matrix of silver chloride on its surface.

The silver chloride is relatively insoluble in aqueous solutions, this surface remains stable. Because there is minimal polarization associated with this electrode, motion artifact is reduced compared to polarizable electrodes such as the platinum electrode. And due to the reduction in polarization, there is also a smaller effect of frequency on electrode impedance, especially at low frequencies.

Figure 3.2 Silver–silver chloride electrode. [5]

Other Type Of Electrode

One type of electrode is the metal plate form The basic metal plate electrode consists of a metallic conductor in contact with the skin with a thin layer of an electrolyte gel between the metal and the skin to establish this contact as we show in (fig 3.3).[5]

Metals commonly used for this type of electrode include German silver (a nickel-silver alloy), silver, gold, and platinum. The other form of electrode is suction electrode as we shown in (fig 3.4) to make it easier to attach the electrode to the skin to make a measurement and then move it to another point to repeat the measurement. These types of electrodes are used primarily for diagnostic recordings of biopotentials such as the electrocardiogram or the electroencephalogram.

Metal disk electrodes with a gold surface in a conical shape such are frequently used for EEG recordings. The apex of the cone is open so that electrolyte gel or paste can be introduced to both make good contact between the electrode and the head and to allow this contact medium to be replaced should it dry out during its use.

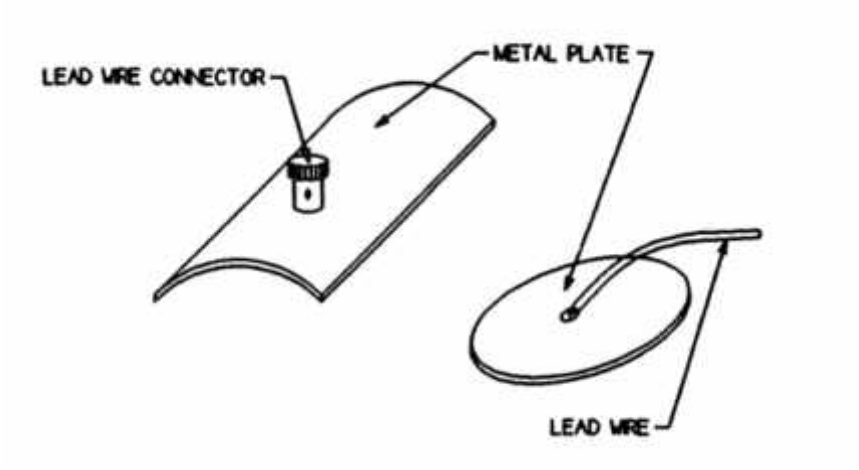

Figure 3.3, Metal plate electrode

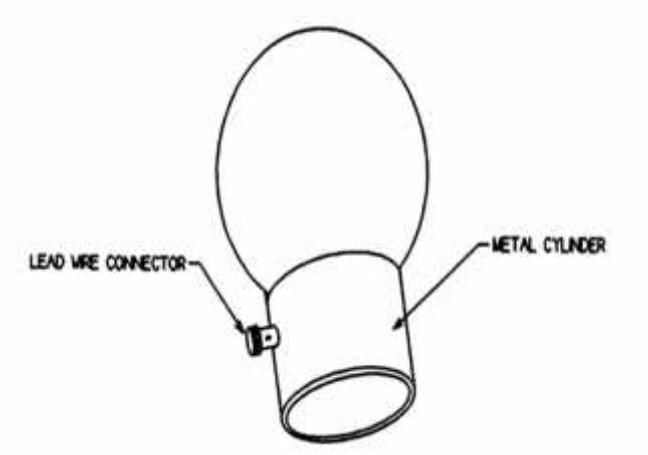

Figure 3.4, Suction electrode

3.2.2 Electrodes lead wires

Wires with specific shape will be used to carry the electrode ,and to make interface between electrode and EOG system.

3.3 Instrumentation Amplifier

Eyes signals such as all biopotential signal , when we detect these signal we will need to take the difference between the electrodes, to extract this signal we will connect the electrode to special circuit, it's the preamplifier. This preamplifier or instrumentation amplifier will consist of three amplifier ,tow non-inverting and the third is inverting .The eyes signals. It is very small in amplitude and needs to amplify to be suitable to use ,this amplification is done on multi stages , in our design we will use an instrumentation amplifier that will connect directly to the electrodes, this instrumentation amplifier take the difference between two electrodes as we mentioned above and take this difference and amplify it to be an electrical signal that will be developed and generated from contraction muscle.

The differential input single-ended output instrumentation amplifier is one of the most versatile signal processing amplifiers available. It is used for precision amplification of differential dc or ac signals while rejecting large values of common mode noise. By using integrated circuits, a high level of performance is obtained at minimum cost.

To obtain good input characteristics, two voltage followers buffer the input signal. and it have a high of an input impedance provides two benefits first it allows the instrumentation amplifier to be used with high source resistances and still have low error and it allows the source resistances to be unbalanced by with no degradation in common mode rejection ratio. The followers drive a balanced differential amplifier , which provides gain and rejects the common mode voltage.

The Instrumentation amplifier circuit contains two stages ,we find these tow stage in one IC that used in our project this IC is (AD620),because the most of amplifier can't detect the bio potential signal and amplified it without noise, and it will be commercial part , on the otherwise the AD620 will detect and amplify the signal from the source without any change in the shape of the signal .

This (AD620) are connected as non-inverting amplifier and it has many properties noticed when we use it as an instrumentation amplifier such as: [from datasheet]

1) Low cost.
2) High accuracy that requires only external resistor to set the gain of circuit .
3) High common mode rejection ratio (CMMR), at remove the small voltage noise, it is passed by electrodes.

3.4 High Pass Filter

An ideal filter would have a completely flat pass band (e.g. with no gain/attenuation throughout) and would completely attenuate all frequencies outside the pass band. and the transition out of the pass band would be instantaneous in frequency. In practice no band pass filter is ideal. The filter does not attenuate all frequencies outside the desired frequency range completely in particular, there is a region just outside the intended pass band where frequencies are attenuated, but not rejected. This is known as the filter roll-off, and it is usually expressed in dB of attenuation per octave or decade of frequency. Generally, the design of a filter seeks to make the roll-off as narrow as possible, thus allowing the filter to perform as close as possible to its intended design. Often, this is achieved at the expense of pass-band or stop-band ripple.

High pass filter is The filter that passes frequencies above a certain frequency while rejecting lower frequencies .The concept of a high-pass filter exists in many different forms. In our project we used the second order high pass filter or 2-pole sallen key high pass filter

equation 3.1 for determine the cutoff frequency.

$$\mathbf{Fc} = \frac{\mathbf{1}}{\mathbf{2\pi\sqrt{RARBCACB}}} \qquad 3.1$$

Were RA &RB &CA&CB component of high pass circuit.

3.5 low Pass Filter

The Low-pass filter passes low-frequencies signals but it attenuates signals with frequencies that are higher than the cut frequency.

The concept of a low-pass filter exists in many different forms. In our project we used the second order low pass filter or 2-pole sallen key low pass filter .
equation 3.2 for determine the cutoff frequency.

$$Fc = \frac{1}{2\pi\sqrt{RARBCACB}} \qquad 3.2$$

Were RA &RB &CA&CB component of low pass circuit.

3.6 Inverting Amplifier

Inverting amplifier is the most basic op-amp circuit. It uses negative feedback to stabilize the overall voltage gain. The reason we need to stabilize the overall voltage feedback, inverting amplifier configuration has an input impedance approximately equal to the input resistor Ri and output impedance approximately equal to the output impedance of the op amp itself .
equation 3.3 for determine voltage gain.

$$G = -\frac{Rf}{Ri} \qquad 3.3$$

Rf and Ri are component of inverting circuit.

3.7 Notch Filter

This operational amplifier notch filter circuit is simple yet effective, providing a notch on a specific fixed frequency. It can be used to notch out or remove a particular frequency that may need to be removed. We used notch filter to remove the effect of 50 HZ signals , equation 3.4 for determine cutoff frequency .

$$Fnotch = \frac{1}{2\pi RC} \qquad 3.4$$

R&C are component of notch circuit .

3.6 PIC Microcontroller

The microcontroller it's a device that will be able to control hardware component by programming. It using different language , there are many type of microcontroller in the world many language of programming these ship, microcontroller are made by numerous different manufactures. Different microcontroller are used in many applications on our life and the most common used family are (PIC16F) and (PIC18F) . In our design we will use PIC16F84A microcontroller which can be easily interfaced with the chopper from its output by using specific software writing in C language , the software will be written using C language because this language is assembly to understand from the chip and programmer.[from datasheet]

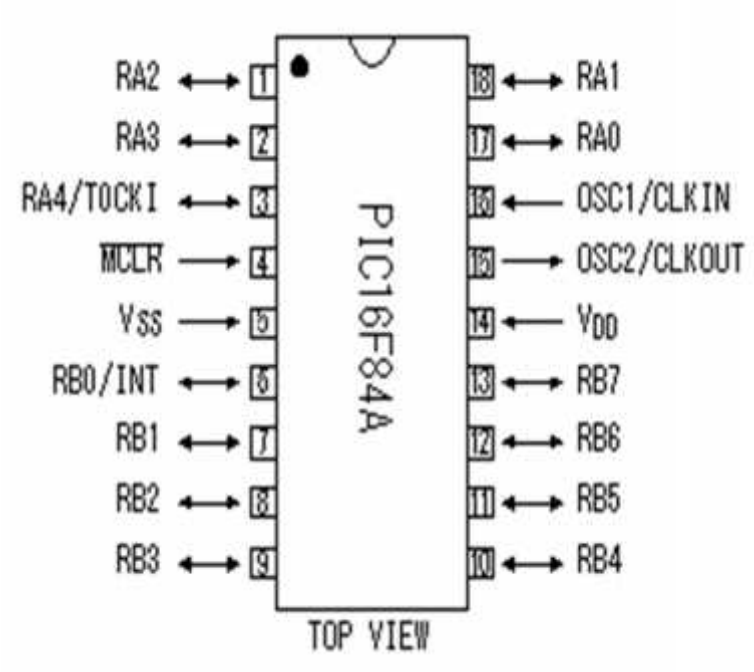

Figure 3.5 , PIC16F877 microcontroller

In fig(3.5) , we will see the pins of microcontroller ship , in this figure we will see the pin that will use as an input and pins that will use as an output of the data to use it for microcontroller .

Second Part

The second part of the project is to design communication system that will transmit the controlling signal from the eyes to the special receiver to control special operation on the television, this part of communication will contain the transmitter and the receiver part .The output signal from PIC-microcontroller well connected directly to transmitter. After that, the transmitter send this signal using infrared technique in special condition to the receiver , then the receiver well detect this signal and use it to control operation. When we design the receiver we well connect the this special receiver to the PIC microcontroller to analyses this signal and control special operation in television as the sound , channels.

In our project ,we will combine all the concepts in order to design an a Zigbee transmitter and Zigbee receiver. One of the main problems we will come over it is the noise, manifested in the form of ambient light. Therefore, we will need to design a circuit that is immune to the effects of ambient light .To make the transmitter/receiver circuit immune to noise more immune to noise, the transmitted signal needs look different than the noise. This is achieved by modulating the transmitter part at an appropriate chosen frequency through the signal output from the PIC-microcontroller. Then, a receiver will be built that is much more sensitive to this frequencies than to other frequencies.

3.7 System design

In this system ,we used a lot of electronic and electrical components like diodes, Led's .First, we start with the Zigbee chip. The X-CTU has been used to program the chip. The Zigbee chip was connected to MAX232. Using X-CTU, it is possible to specify important parameters for the operation of Zigbee chip. Such parameter include baud rate which was set to (3600 bps) and PAN-ID (1989). The PIC has been programmed using C programming language. some tests on Zigbee and PIC by the PC to be sure that the system will work probably before connection.[9]

3.8 Zigbee Technique

Using the Zigbee technology to carry the data between transmitter and receiver is the better than the infrared after testing in our project.

3.8.1 ZigBee protocol stack

ZigBee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 (2003 version) for low-rate WPAN's. The specification goes on to complete the standard by adding four main components: network layer, application layer, ZigBee device objects (ZDO's) and manufacturer-defined application objects which allow for customization and favor total integration.[9]

Besides adding two high-level network layers to the underlying structure, the most significant improvement is the introduction of ZDO's. These are responsible for a number of tasks, which include keeping of device roles, management of requests to join a network, device discovery and security. ZigBee is not intended to support power line networking but to interface with it at least for smart metering and smart appliance purposes.

3.8.2 Application Using Zigbee Technique

The current list of application :

- Released specifications
- ZigBee Home Automation
- ZigBee Smart Energy 1.0
- ZigBee Telecommunication Services
- ZigBee Health Care
- ZigBee RF4CE - Remote Control
- Specifications under development
- ZigBee Smart Energy 2.0
- ZigBee Building Automation
- ZigBee Retail Services

The ZigBee Smart Energy V2.0 specifications define an IP-based protocol to monitor, control, inform and automate the delivery and use of energy and water. It is an enhancement of the ZigBee Smart Energy version 1 specifications, adding services for plug-in electric vehicle (PEV) charging, installation, configuration and firmware download, prepay services, user information and messaging, load control, demand response and common information and application profile interfaces for wired and wireless networks. It is being developed by partners including:

3.9 Power Supply

We supplied our project with 9V battery, in order to avoid power supply signals, which will make noise on our project.

Chapter Four

Project design

Chapter contents

4.1 Overview

4.2 Surface Electrode (Ag\AgCl)

4.2 Instrumentation Amplifier

4.3 High Pass Filter

4.4 low Pass Filter

4. 5 Inverting Amplifier

4. 6 Notch Filter

4.7 Shifting Circuit

4.8 PIC Microcontroller

4.9 The Transceiver

4.10 Relays

4.11 Power Supply

4.1 Overview

In this chapter we will discuss project hardware ,processing and interfacing were designed. Each stage was explained and the calculation of these stage .

4.2 Surface Electrode (Ag\AgCl)

In our project we well use seven electrode, four of these electrode are placed around the right eye and the other two electrode are placed around the left eye, and the seventh electrode well use as reference electrode is placed on the ear loop .the seven electrode well use it should be different than other electrode used in other system, the EOG electrodes should be relatively non-polarisable such as standard medical EEG or ECG electrodes, of a size appropriate for attachment to the side of the nose as we see in (figure 4.1).

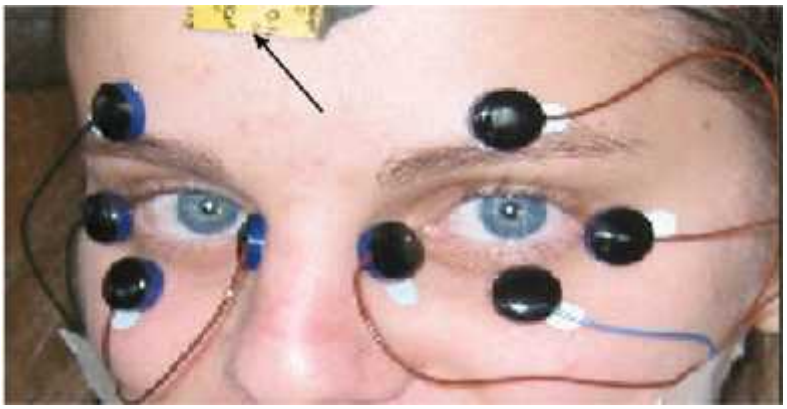

Figure 4.1 , Ag-AgCl electrode

The electrical signals that detect using first four electrode are used to control two operation on the our system ,these operation are the movement of channel and the sound volume. The other two electrode well use to control the menu of the channel ,these three operation is most important than other operation when anybody would have to watch the television.

When we placed these electrode on the face of the patient , we will need to clean up the place of electrode and use conductive gill ,all of these to make good connection between the electrode and the skin.

4.3 Instrumentation Amplifier

The instrumentation amplifier circuit in this project well connected our input directly to the electrode , this circuit well take the difference between their input and amplify the difference , this difference between the electrode is the electrical signal generated from eyes movement .The instrumentation circuit contain tow stages we see in figure(4.2) , first stage it's have two non-inverting amplifier with special gain can determined it using the equation (4.1).[5]

The second stage of this circuit is inverting amplifier ,this amplifier used to amplify the signal that well go out from the two non-inverting amplifier .

The instrumentation amplifier It is an electronic amplifier which precedes another amplifier to prepare an electronic signal for further amplification or processing. The function of a instrumentation is to amplify a low-level signal to line level.

We will used the instrumentation amplifier AD620 with suitable RG. We will use gain equal to 10 . The resistor RG using to determine the gain of the amplifier according to the equation 4.1 the schematic of amplifier is shown in Figure 4.2.

$$\mathbf{Rgain} = \frac{49.9\ \mathrm{K\Omega}}{\mathrm{G}-1} \qquad (4.1)$$

$$= \frac{49.9}{10-1} = 5.5k\Omega$$

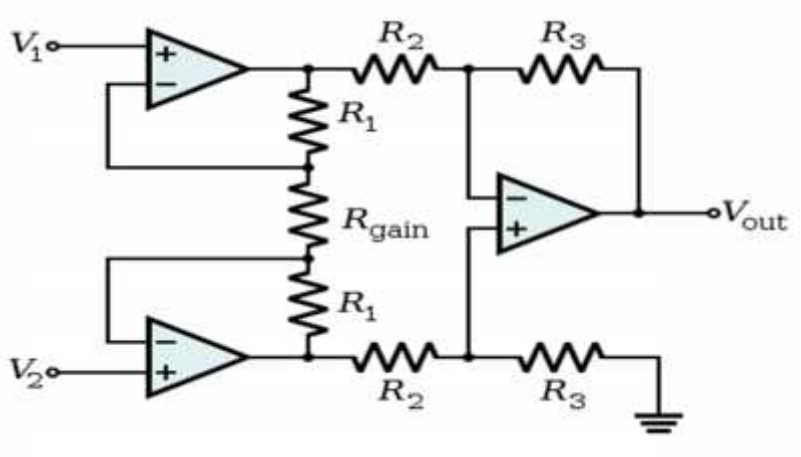

Figure 4.2, Instrumentation Amplifier

4.3 High Pass Filter

The figure 4.3 shows second-order low pass filter circuit, equation 4.2 for determine the cutoff frequency.

$$\mathbf{Fc} = \frac{\mathbf{1}}{\mathbf{2\pi\sqrt{RARBCACB}}} \qquad 4.2$$

Let CA=CB=10 µf & RA=RB=R2 & Fc=0.1HZ

$$RA = \frac{1}{2\pi\,(0.1)(10\mu f)} = 150k\Omega = RB$$

For butter worth response R1\ R2 = 0.586

R1=0.586R2

R1 = 88kΩ

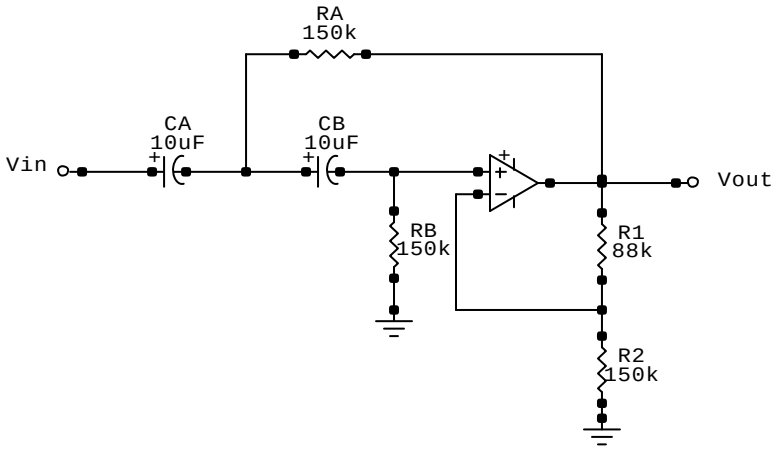

Figure 4.3,Sallen key high pass filter

4.5 low Pass Filter

Figure 4.4 shows second-order low pass filter circuit, equation 4.3 for determine the cutoff frequency.

$$Fc = \frac{1}{2\pi\sqrt{RARBCACB}} \qquad 4.3$$

Let CA=CB=10 μf & RA=RB=R2& Fc=30HZ

$$RA = \frac{1}{2\pi\,(30)(10\mu f)} = 530\Omega$$

For butter worth response R1\ R2 = 0.586

R1=0.586R2

R1=310Ω

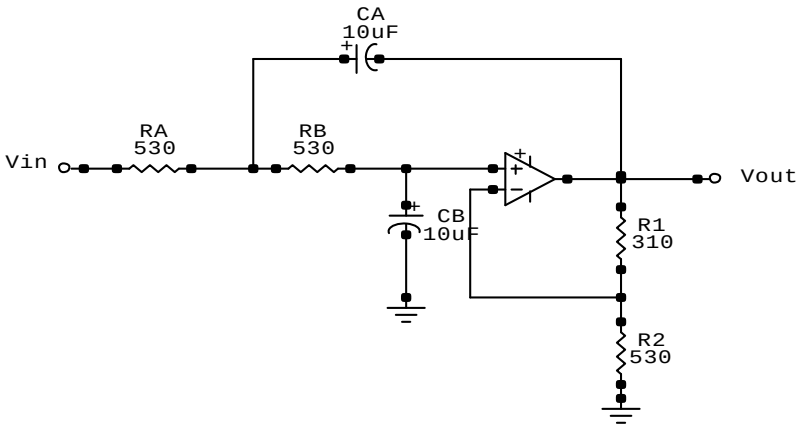

Figure 4.4.Sallen key low Pass Filter

4.6 Inverting Amplifier

In figure 4.5 shows inverting amplifier circuit ,equation 3.4 for determine voltage gain.

$$G = -\frac{Rf}{Ri} \qquad 4.4$$

And by using potentiometer gain will vary from (1-100)

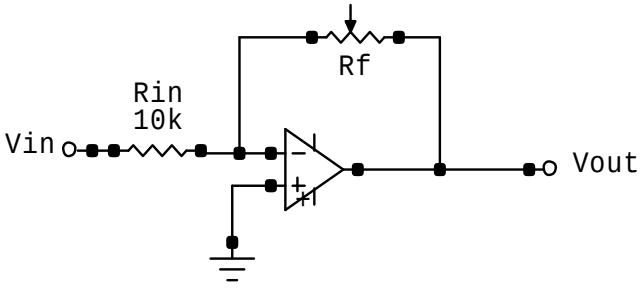

Figure 4.5.Inverting Amplifier

Some Features Of TL082

- Ease of Use.
- Wide power supply range.
- Differential input voltage range equal to the power supply voltage.

4.6 Notch Filter

Figure 4.6 shows notch filter circuit , equation 3.5 for determine cutoff frequency .

$$Fnotch = \frac{1}{2\pi RC} \qquad 4.5$$

Let R=R3=R4=68k & R1=R2=10k & C=C1=C2 & Fnotch=50HZ.

$$C = \frac{1}{2\pi\,(50)(68k)} = 47nf$$

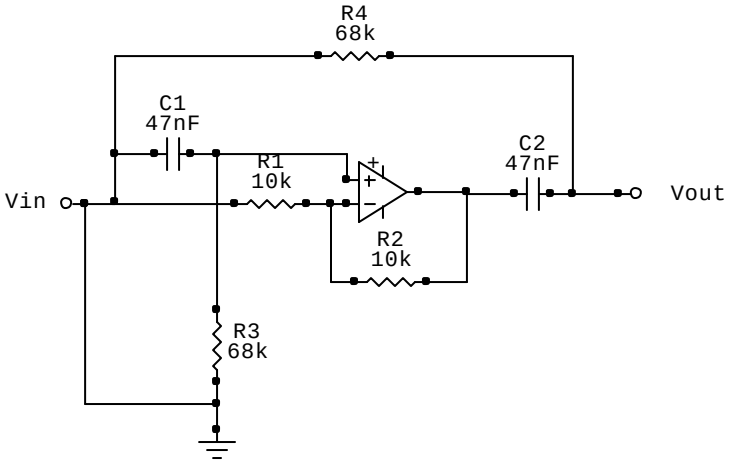

Figure 4.6,Notch Filter

4.7 Shifting Circuit

We will use this circuit to shift EOG signal above zero level by make reference equal 2.5v .

Figure 4.7 shows shifting circuit. Equation 4.6 determine voltage output.

$$\frac{Vin - E}{R} = \frac{E - Vout}{R} \qquad 4.6$$

$$Vout = 2E - Vin$$

By apply voltage divider rule :

$$E = \frac{R2}{R1 + R2} \times V1 \rightarrow \frac{1K}{3K + 1K} \times 5 = 1.25$$

$$Vout = 2 \times 1.25 - Vin = 2.5 - Vin$$

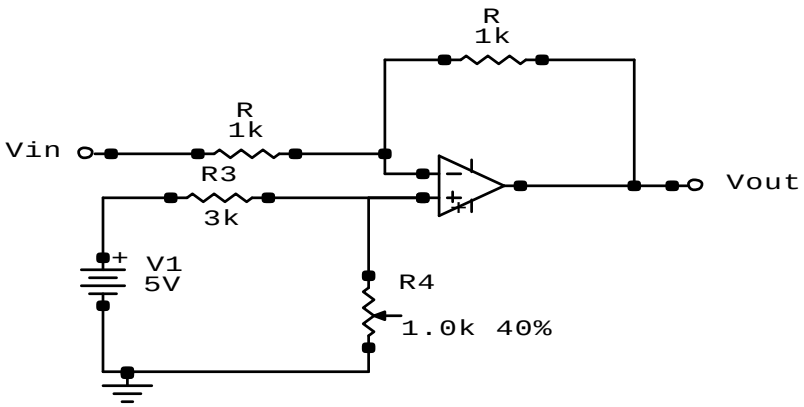

Figure 4.7,Shifting Circuit

4.8 PIC Microcontroller

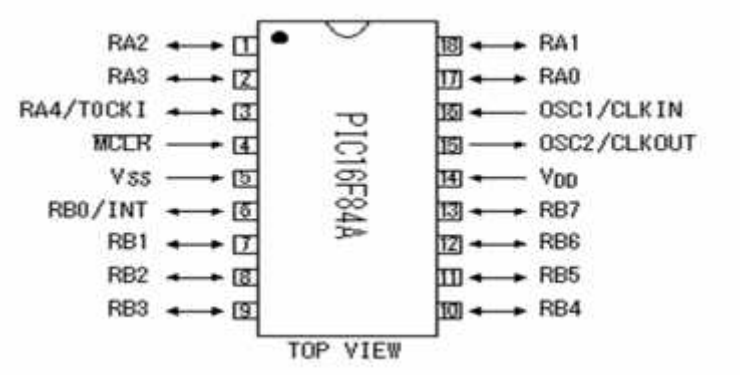

Figure 4.8 , PIC microcontroller

Three input are used in the PIC , that is mean three signal well go on the PIC. In our design we will use the pin (RA0,RA1,RA2) as an input pin , and we well program the PIC microcontroller using the C language to give each of signal binary code .

The code of each signal contain three pit and it well be different from other signal .then we will connect the transmitter circuit directly to the PIC to transmit the code to special receiver .in this part we will use the pin(RB0) as an output pin from the PIC and connect it to the transmitter.

This type of PIC microcontroller needs the oscillator to control the time when take the output from it ,then we will use the crystal with two capacitors that well connected the PIC in pins number (15,16) for oscillator , this mean we well control clock pulse of the output pulse .In our project we well suggest the value of crystal equal (4MHz) and the each capacitors equal (15pF).

4.9 The Transceiver

The word transceiver consists of two words (transmitter, receiver). Our transmitter will be a zigbee for many reasons that will be explained in previous chapter. The block diagram of the transceivers is shown in figure4.9. It is comprised of the following component.[9]

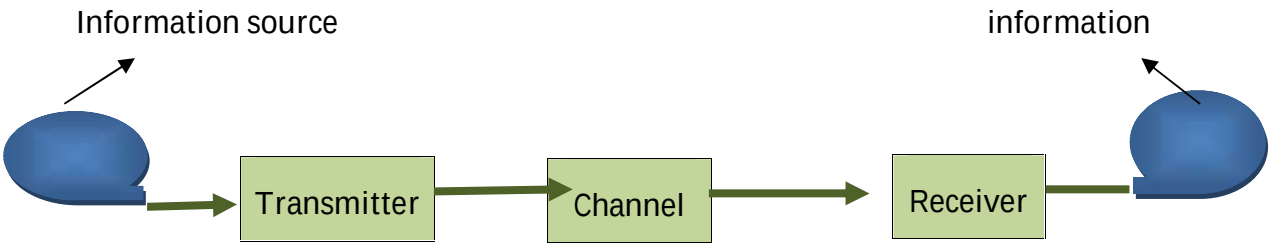

Figure 4.9, block diagram of communication system

- The transmitter basic function is to take the information bearing signal produced by the source of information and modify it into a form suitable for transmission over the channel.[9]
- The Channel provides the physical means for transporting the signal produced by the transmitter and delivering it to the receiver.[9]
- The Receiver operates on the received signal to produce an estimate of the original information –bearing signal. We say estimate rather than exact because of noise, fading and other interference.[9]

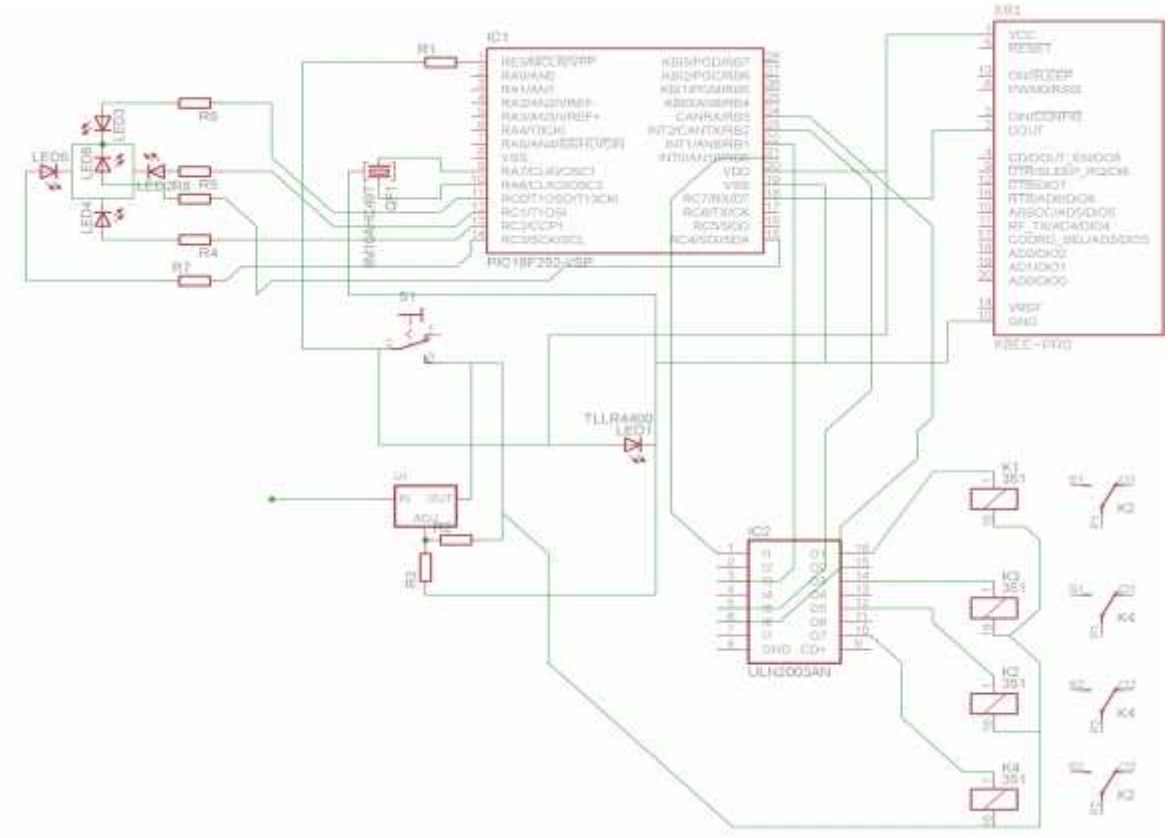

Figure 4.10, Transmitter circuit[9]

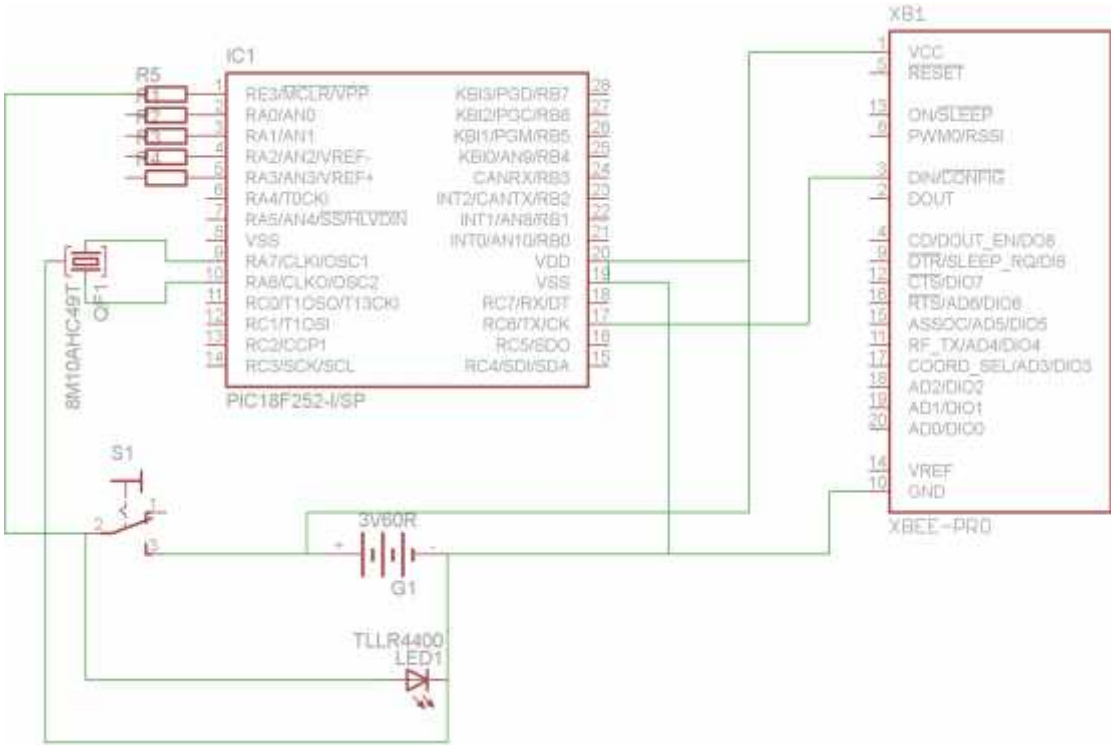

Figure 4.11, Receiver circuit[9]

4.10 Relays

Is an electrical component consists of mechanical key can be controlled by applying voltage to the existing coil inside it. It contains eight pins some of them connected to the coil and the others connected to the device which will be activated so when supplying a voltage to the coil a magnetic field will be generated that cause the rely to be normally closed.

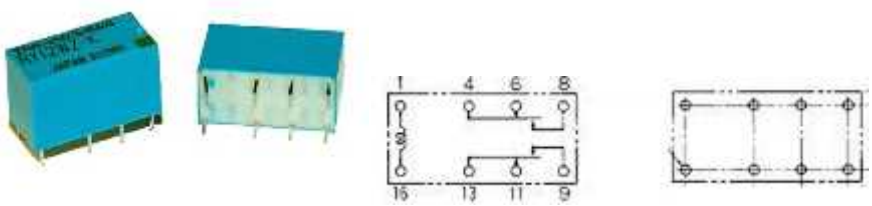

Fig4.12 (Relays(R1,2,3,4,5)).[10]

4.11 Power Supply

We supplied our project with 9V battery and 5Vbattery for pic , in order to avoid power supply signals, which will make noise on our project.

Chapter Five

Implementation and testing

Chapter contents

5.1 Overview
5.2 Testing scheduling
5.3 Components Testing
5.3.1 Power Supply Testing
5.3.2 Pre-Amplifier Testing
5.3.3 High Pass Filter
5.3.4 Low Pass Filter Testing
5.3.5 Inverting Amplifier Testing
5.3.6 Signal Shifting Circuit
5.3.7 Transmitter Testing
5.4 Acceptance testing
5.5 Challenges

5.1 Overview

This chapter covers the testing of the EOG system for detecting the eyes signal and the communication system using Zigbee technique . The PIC was used as an interface between the EOG system and Zigbee at the transmitter side. And interface between the Zigbee and switches at the TV receiver .The Zigbee was used to send and receive data by the user command. The chapter will also talk about the comparison with other systems through:

- Cost.
- signal quality.
- Failure Rate.

5.2 Testing Scheduling

Week No. / Testing Process	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Unit Testing																
Sub-System Testing																
System Testing																
Acceptance Testing																

Table 5.1 Testing Scheduling

5.3 Components Testing

We started to test each component of the project to ensure its functionality. Electrode lead testing was done by connecting each branch to each pin in electrode

cable by using Digital MultiMeter (DMM) and get sound mean that's no short and it's working.

5.3.1 Power Supply Testing

We tested the battery supply first without connecting to horizontal and vertical circuits. In this case, battery was successful and gave the required results, It provides positive volts and others negative needed to IC’s work.

5.3.2 Pre-Amplifier Testing

The AD620 IC was connected with potentiometer RG, and then we control the gain of IC by this potentiometer ,as shown in figure 5.1.

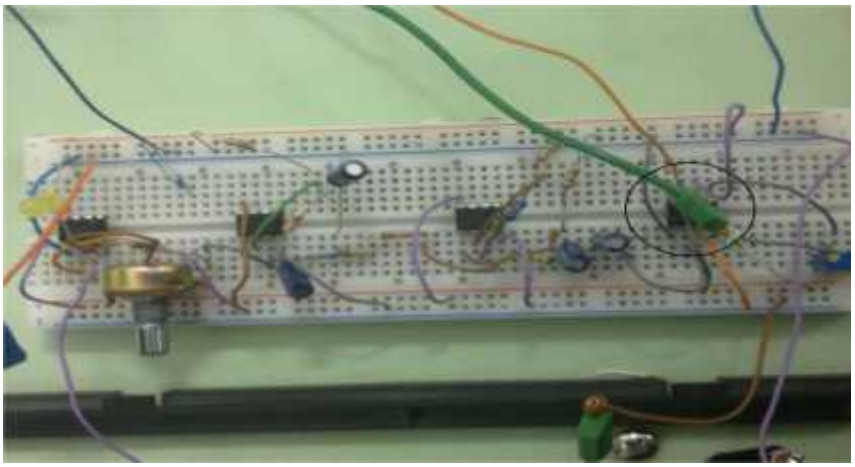

Figure 5.1,AD620 Connection

Then apply signal similar to eye signal to the circuit and the signal recorded on the oscilloscope as shown in figure 5.2.

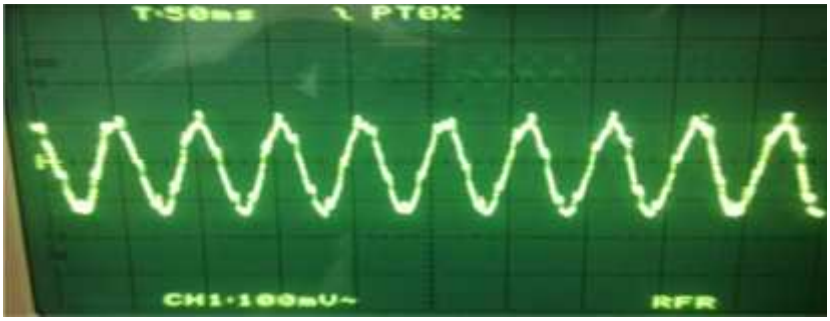

Fig.5.2 Output Signal After AD620

5.3.3 High Pass Filter

The high Pass Filter was connected with suitable resistances and capacitor as shown in figure.5.3.

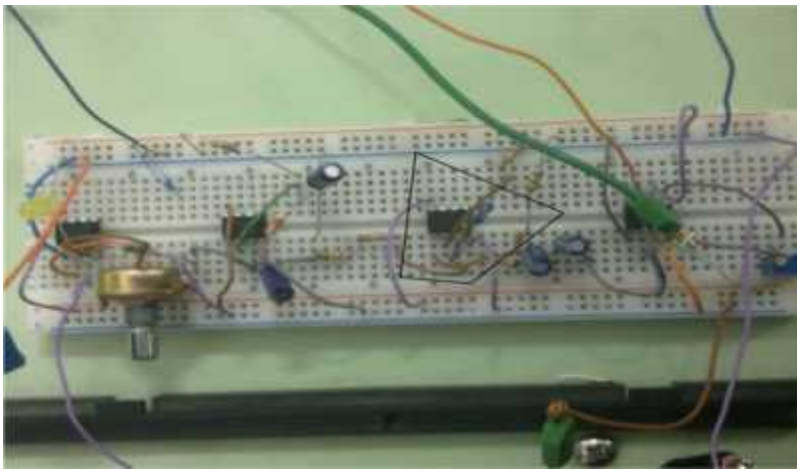

Figure5.3 High Pass Filter

We use high pass filter to pass high frequencies and to get rid of DC effect , figure5.4 shows output signal after high pass filter .

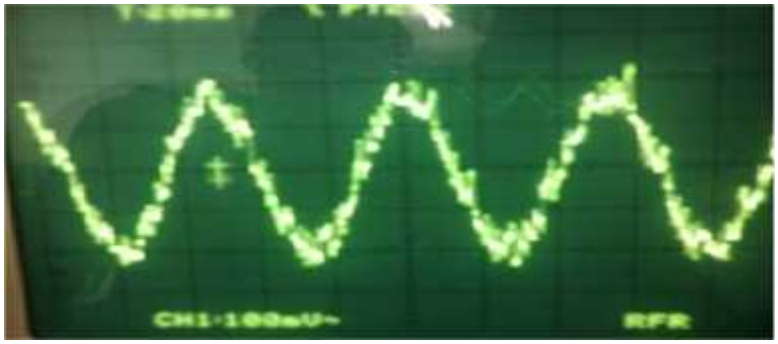

Fig 5.4, Output Signal After High Pass Filter

5.3.4 Low Pass Filter Testing

The Low Pass Filter was connected with suitable resistances and capacitor And connected the power circuit. as shown in figure5.5.

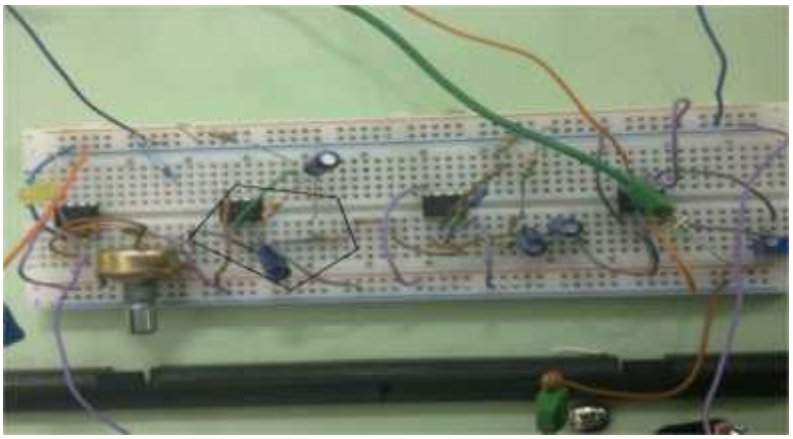

Fig 5.5, low Pass Filter

We use low pass filter to pass low frequencies which less than 30HZ , figure5.6 shows output signal after low pass filter .

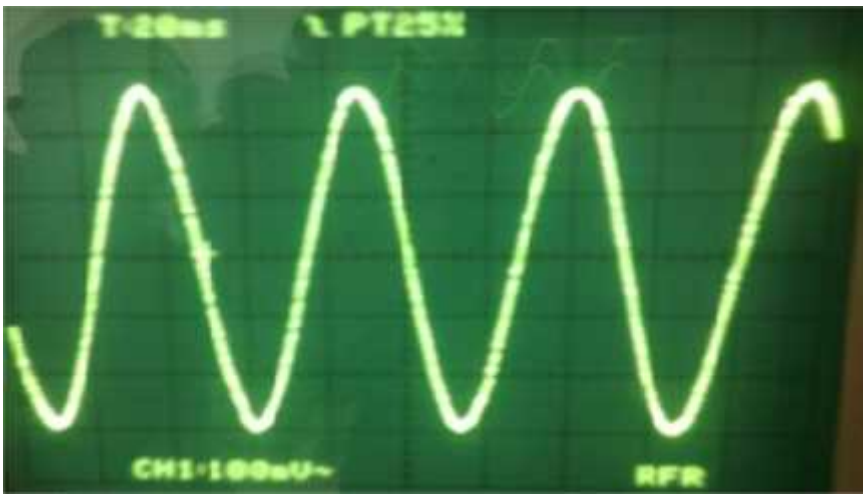

Figure 5.6, Output Signal After Low Pass Filter

5.3.5 Inverting Amplifier Testing

The inverting amplifier was connected with suitable resistances .

It was constructed by using TL082 IC with the power circuit, as shown in figure 5.7.

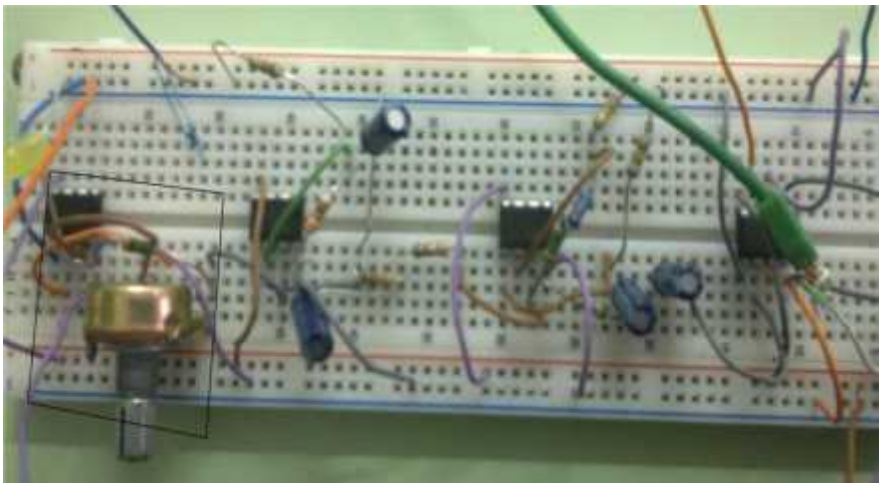

Figure5.7, Inverting Amplifier Connection

Then recorded on the oscilloscope. as shown in Figure 5.8.

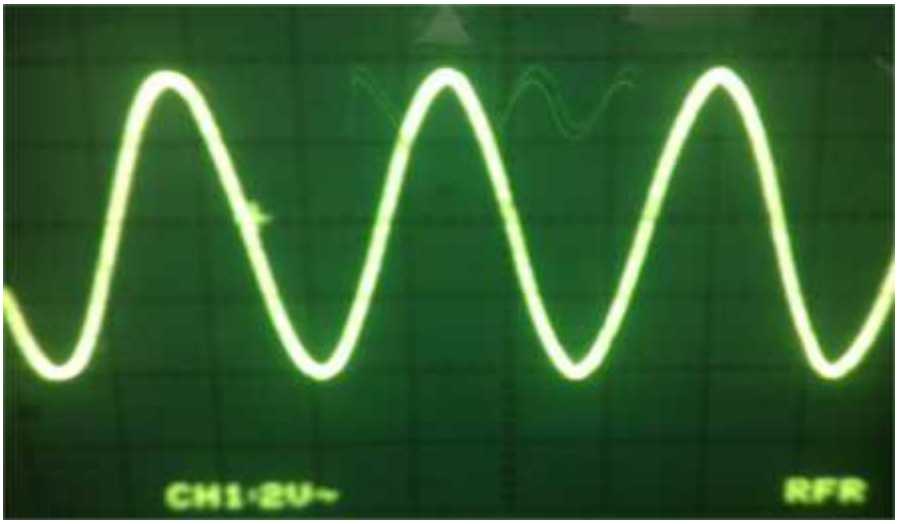

Figure 5.8,output signal after inverting amplifier

5.3.6 Signal Shifting Circuit

Shift Amplifier was connected with suitable resistances ,and connected the power circuit. as shown in figure 5.9.

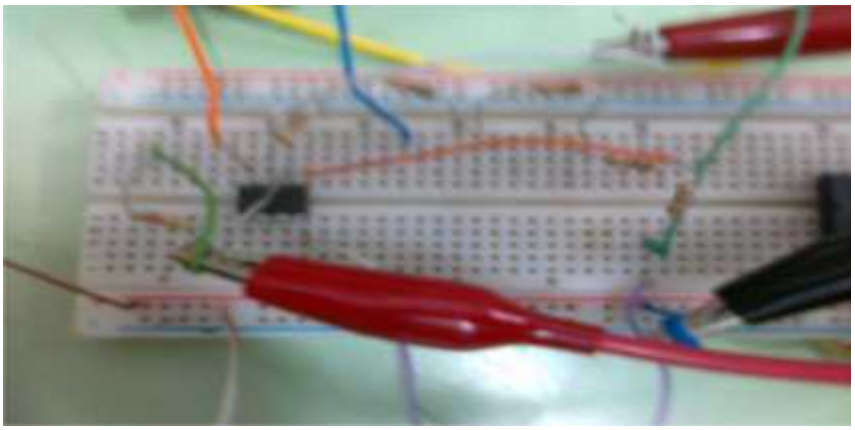

Figure 5.9. Signal Shifting Circuit

Was used it to Raise the level of t signal above zero level ,to be all the signal formation in the positive region ,needing easy to handle for microcontroller. figure 5.10 shows output signal after shifting circuit.

Figure 5.10. Output Signal After Shift Amplifier

5.3.7 Transmitter Testing

Figure 5.11,Transmitter circuit testing

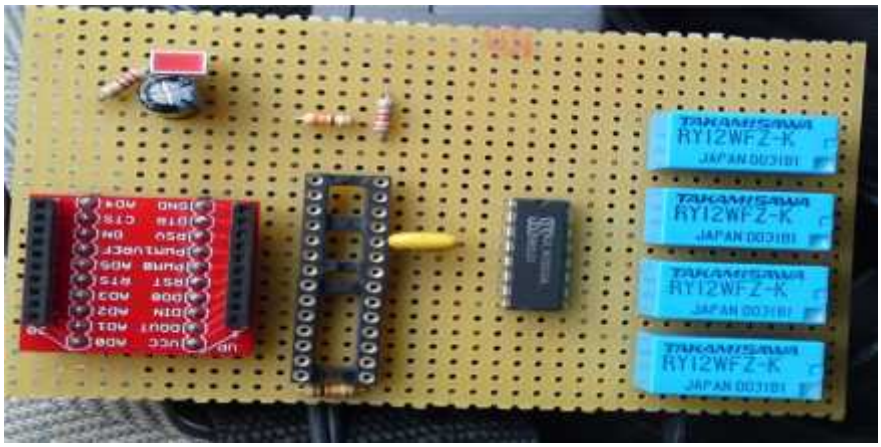

Figure 5.12,Reciver circuit

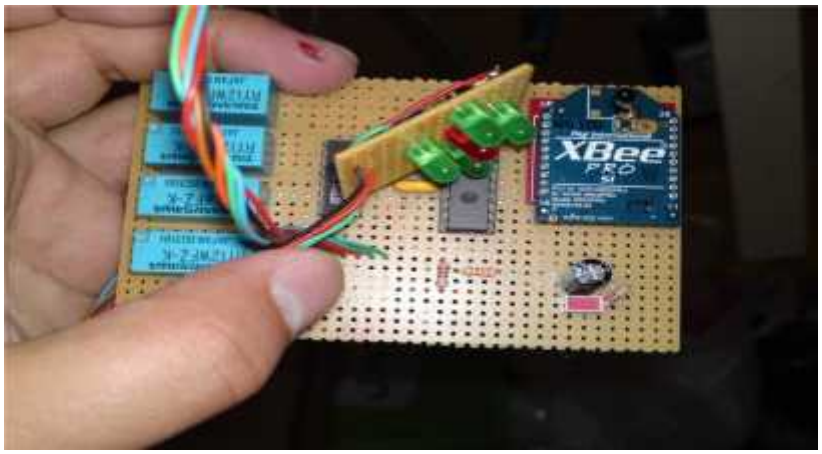

Figure 5.13, Receiver circuit

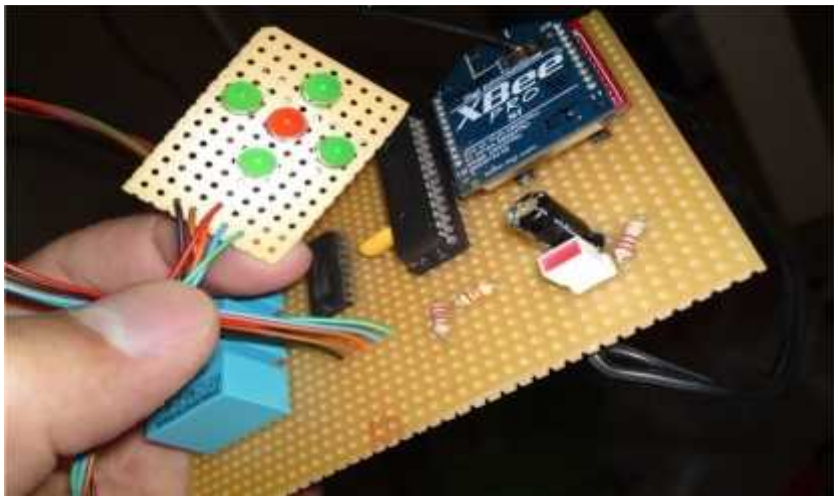

Figure 5.14, Receiver circuit

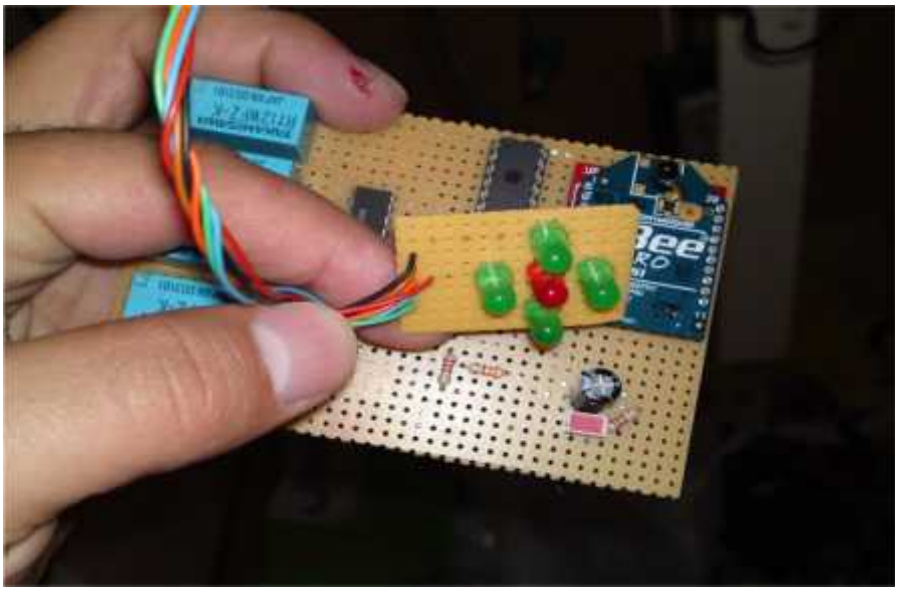

Figure 5.15, Receiver circuit

Figure 5.16, Testing patient

Figure 5.17, Testing patient

5.4 Acceptance testing

In this section, the system will be tested to see if it meets the requirements were the system was built for, and at this point the system did meet the needed tasks in the system.

Box Testing

	Unit	Function	Expected Result	Actual Result	Verification
1	Lead Wire and Electrode	Detect electrical signal from eye movement	Move signal to AD620	Connect between the human body and EOG system	pass
2	AD620	Take the difference from tow electrode	Amplify the difference		pass
3	Zigbee	Used for sending and receiving data	Receive and send data	It received and sent data	pass
4	PIC(18f252)	Interfacing and controlling	Interface between relays and Zigbee ,interfacing between Zigbee and switches	It interfaced between the relays and Zigbee and between Zigbee and switches	pass
5	Relays	Control the sound to be on TV speaker or on headphone	When the relay is N.O the sound appears on the TV speakers and when it is N.C the sound appears on headphones	When the relay was N.O the sound appears on the TV speakers and when it was N.C the sound appeared on headphones	pass
6	Regulator	It reduces the voltage	It reduces the voltage to 5 v	It reduced the voltage to 5 v	Pass

7	Crystal	Clock pulse	It gives the PIC the needed clock pulse	It gave the PIC the needed clock pulse	Pass

Table 5.2 White Box Testing

5.5 Challenges

1) To help people who are missing upper limbs to control their life.
2) To facilitate the life of handicapped people.
3) To developed a new method by using the eye movement.
4) To help handicapped people to communicate with outside world alone without any help from anybody.