Body Movement Based Shutter Control

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According to the orientations of the supervisor on the project and the examined committee is b y the agreement of a staffers all, sending in this project to t he Electrical Engineering Department are in the College of the Engineering and the Technology by the requirements of the department for the step of the bachelor's degree.

Project Supervisor Signature

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Committee Signature

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Department Headmaster Signature

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Dedication

For our family, for our parents, for our sisters and brothers, to all whom I love, to all of our loyal teacher, to all who help us to reach this level of education, and to who has made the development of this humble project, to all of my friends and my academic younger friends, to my colleges that I have learnt from them

الــملـخـــص

" نظام التحكم بستائر النوافذ "

إعداد

عبدالله ماهر علي **نادي جبارين**

جامعة بوليتكنك فلسطين

إن التطور والتقدم التكنولوجي هذه الأيام يدفعنا للبحث دوما عن حلول لبعض المشاكل الحياتية باستخدام الطرق التكنولوجية الحديثة والتي تؤثر إيجابا بحياة الإنسان مما توفره له من راحة ورفاهية وتسهل عليه تطبيق أموره الحياتية المختلفة وذالك يوفر الوقت والجهد ويعمل على إيجاد جيل جديد مفعم بالنشاط والذي يساهم في بناء الوطن وتقدمه.

نظام التحكم بستائر النوافذ عن طريق صوت صفقة اليد مدمجاً معه نظام مراقبة درجة الحرارة الخارجية ووضع الإنارة الخارجية من حيث النهار والليل، هو نظام يهدف وبالدرجة الأولى إلى جعل معيشة الإنسان تنعم بالسهولة واليسر وتؤمن النوم الهادئ والمريح له.

يعمل النظام على فتح ستار النافذة بواسطة صوت صفقة اليد مرتين متتابعتين مع وجود شروط لذالك ألا وهي : 1- أن تكون الحرارة الخارجية مناسبة من حيث أن أشعة الشمس غير مسلطه على النافذة والتي بدورها ترفع من حرارة الغرفة وتسبب الإزعاج لساكني الغرفة. 2- أن يكون تحريك النوافذ نهارا حتى نستفيد من ضوء النهار لإنارة الغرفة بشكل طبيعي والسماح بتهوية طبيعيه أيضا وذالك لان لا جدوى من فتح الستائر ليلا . ذالك مع وجود نظام التشغيل اليدوي والذي يسمح لنا باستخدام الستائر دون شروط النظام الأوتوماتيكي حيث يتم التغير من الوضع الأوتوماتيكي إلى الوضع اليدوي بواسطة مفتاح تغيير يوجد به أيضا خيار الإغلاق الكامل للنظام .

نظام التحكم هنا هو باستخدام المعالج الدقيق PIC18F4550 والذي يعتبر القلب لهذا النظام ملحق معه بعض المجسات المهمة مثل مجس الحرارة LM35 ومجس الضوء LDR .

ABSTRACT

"Body Movement Based Shutter Control"

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The ongoing technological development urges the researchers to look for reliable solutions for a number of everyday life problems using modern technological techniques. The modern techniques the researchers look for aim to make the human life easier and more comfortable. The technological solutions also aim to save our time and efforts which help us overcome the complicated everyday activities. Moreover, the technological practical solutions create an active, powerful, and smart generation that can contribute heavily to our march in building our homeland.

The window curtains system that works with handclap for twice sequentially aims, in the first place, to make the human life easier and to provide comfortable sleep situations. This system is also equipped with a subsystem by which one observes temperature and light outside the buildings.

The window curtains system is computerized to open the curtains when the user claps, by his hands, twice sequentially. The system works sufficiently in the following conditions:

1. **The temperature should be suitable. The sunlight should not be directly shed on the curtains because the sunlight raises the temperature of the building, as a result, the atmosphere of the building will not be comfortable for the people inside.**
2. **The user should move the curtains in day-time to seize the sun light. Opening the curtains in night-time will have no benefits in lightening process.**

These conditions are set to make the automatic system work perfectly. The window curtains system is also equipped with a manual system that can be turned on by pressing a button on the control pad. The manual system can be used to turn off the whole system. The microcontroller PIC18F4550 is the heart of the entire system. PIC18F4550 is also supported by a temperature sensor LM35 and a light sensor LDR.

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Chapter One

Introduction

1.1 Overview

In our Palestinian land; and due to our holy struggle on it, large numbers were killed, and even more were injured, lots of people lost hands, legs or any other part of their body, leaving them with permanent disable; since they can't do the usual simple things in their lives by themselves.

So as Palestinian students, we will to design and implement new helping system, based on the latest modern technology; such system which really could help these people in doing actions that they usually can't do due to their disability; In order to retreat even a little pits of their normal lives to them.

1.2 Project objectives

1. Design a transmitting control unit, can take many kinds of human body signals and translate it to corresponding electrical ones in order to send it to another receiving unit.

2. Design a receiving control unit, can receive a deferent's number of signals and translate it to corresponding electrical ones in order to activate any other electronically system to carry out any particular functions that we want.

1.3 Project Motivations

For these projects we have three main reasons that can be hold as very good motivations:

First from the hopeless side; they will be able to do their needs in a simple method, and that will create a good feeling to themselves knowing that they can do things alone without any help from others.

The second reason is that, from our side as project designers, we see that our project will improve our educational levels, by taking the chance to put it under the practical testing in designing such practical system.

The last reason is that we will have the chance to work on the wireless communication field, which it's a new modern topic that we want to be involve in.

1.4 Project idea and Approach

As previously mentioned, the main idea of this system is to help persons who have defects in there terminals to do the unusual things that they can't do or they having difficult on doing it.

The all ideas is to implement a command from the hopeless person in simple way that he or she will face no problem in acting it, commands like Clamping their hands, or even via their voice, in other wards actions that hopeless persons can simply do.

In other hand; we also want to create some intelligence in this system, by making it automatically monitor the temperature level in the room and then to control it by a small condition, and all that will done without any human interfere.

1.5 Literature Review

After reviewing the previous studies Hand Clap Sound, clapper control the researchers have limited the studies that talks about the subject of this study and any matter relates to it as the following:

1- **The Clever Clapper ,** *PETE'S BLOG, website : http://petemills.blogspot.com/2012/01/clever-clapper.html* **,** *published in 01-2012, review in 2014*

2- **Hand clap Electronic Control,** *Electronics Plus Projects, website : http://home.roadrunner.com/~randylinscott/dec97.htm*

1.6 Time schedule

The time planning for the project is shown in the following table distributed on the weeks during working on the project introduction:

	Time	**Activity**
T1	10 Feb 2014 – 5 Mar 2014	Collecting Components of project.
T2	6 Mar 2014 – 15 Mar 2014	Connecting component on bred board.
T3	16 Mar 2014– 1Apr 2014	Programming the microcontroller and sensors.
T4	2Apr 2014– 25 Apr 2014	Printing the PCB board and Welding component on it.
T5	26 Apr 2014– 15May 2014	Preparing the final form of project.
T6	16 May 2014– 19May 2014	Testing project.

Table1.1: Time planning.

1.7 Estimated Cost

1.7.1 Hardware Resources

The hardware components that we used in this project and its corresponding costs are shown in table1.2.

Component Name	Quantity	(NIS)	Total cost(NIS)
PIC18f4550	1	70	70
LM35	1	15	15
LDR	1	25	25
DC Motor	1	150	120
Motor Cabler	1	35	35
Board	30	1	30
Relay	2	20	40
LM358	1	5	5
LM7812,7805	2	7	14
Crystal 4MHZ	1	10	10
switch	3	10	30
Cover	1	200	200
Shutter	1	100	50
Electrical Accessories	-	-	300
Bearing and screw	-	-	50
PC Transformer	-	-	120
Total			**1114**

Table 1.2: Components Costs.

1.7.2 Human Resources

Type of resources	**Cost NIS**
Transportation	200
Printing supplies	300
Human resources 500 NIS	

Table 1.3 Human recourses.

1.7.3 Total costs

Resources	**Cost NIS**
Hardware resources	1114
Human resources	500
Total costs 1614 NIS	

Table 1.4 Total Costs.

2

Chapter Two

Theoretical Background

2.1 Introduction

Each part in this system can be easily designed and implemented in many different ways. Sensors, microcontrollers, wireless technology, electrical/mechanical and even the interfacig technique all have a large rang of component categories and algorithms. So, in this chapter we intend to study and analyze each part of this project in intensive way showing the advantages and disadvantages for each component; in order to decide the best option that we could use.

2.2 MCU(Main Control Unit)

MCU consist from microcontroller and anther helping electronic component for exampel '"Transistor , Resistor, Capactor, Crystal, Potintometer , Relay"
Microcontroller is a small computer on a single integrated circuit contains central processing unit CPU, memory (RAM/ROM) for data and programs, serial and parallel I/O and timers, as shown in figure 2.1.

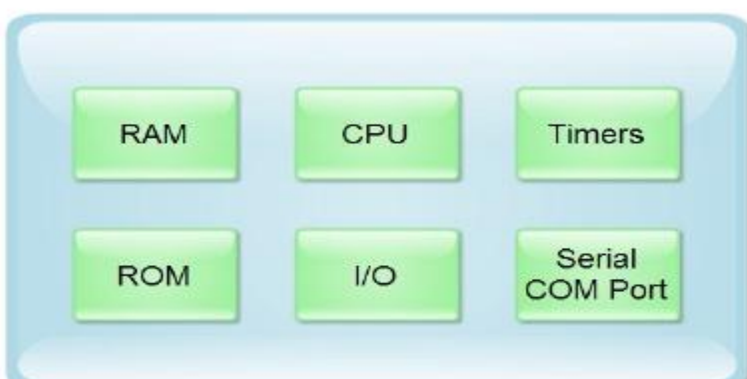


Figure 2.1: Microcontroller Component.

The microcontroller called embedded system; because it contains in single chip the CPU in addition to fixed amount of RAM, ROM, I/O ports, and timers. [1]

Microcontrollers were designed to do a very specific task, controlling a particular system automatically. Such as Power tools, mechanical device, critical medical device, remote controls, and baby toys. Were cost and size are critical in such application. Therefore microcontroller has all the support chips incorporated inside its single chip.

Central Processing Unit (CPU) is the main part of microcontroller where all of the arithmetic and logic operation are performed.

Input ports allow microcontroller to read data from the out world, while the output ports allow the microcontroller to control other systems, on other hand microcontroller also contains Universal Asynchronous (Receive r / Transmitter)) . It is a type of " asynchronos receiver/transmitter", a computer hardware that translates data between parallel and serial forms.

Microcontrollers can be programmed using either the assembly language or using a high level language such as BASIC, PASCAL, or C++. Although assembly language is fast in decoding and fetching processes but it has basic disadvantage that any assembly program consists of mnemonics , which makes learning and maintaining a program written using the assembly difficult. Also, microcontrollers manufactured by different firms have different assembly language , so each microcontroller requires the user to learn a new language and that sabet difficult. So programming microcontroller with high level language can be easier to learn by user than assembly languages.

Microcontrollers are classified by several parameters, number of bits they process it’s the main one. Microcontrollers with 8 bits are the most suitable for most microcontroller-basd small applications. In other hand Microcontrollers with 16 and32 bits are much more powerful and complex, but they are usually more expensive and it's suitable for medium and large sie general purpose applications that call for a powerful microcontrollers.

All microcontrollers require a clock (oscillator) to operate, usually provided by external timing devices connected to the microcontroller. In most cases, these external timing devices are a crystal plus two small capacitors. In some cases they are resonators or an external resistor capacitor pair, which generates oscillation that has cretin frequency.

Peripherals are additional components may be added to the microcontroller such s Analog-to-Digital Converter (ADC), Liquid Cristal Display LCD, and timers.

Common Types of Microcontroller [2]

1- PIC (8-bit PIC16, 16-bit dsPIC33/PIC24)
2- Intel (8051, 8085, 8086)
3- PLC
4- ATmega
5- MIPS
6- Arduino
7- ARM processors

2.3 Sensors

In this type of control systems we should use Sensors with a good scoop of remote sensing. we will use temperature sensor (LM35) to measure the temperature and compare it with a saved value inside it. secondly,a clapping sensor will be used to sense for the clapping if happened and drive the cuircuit to operate as to be discribed. finally, a light sensor (LDR) will be used to sense for the light when happen.

2.3.1 Temperature sensor (LM35)

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

The input applied voltage in LM35 sensor from 4V DC to 20V DC in Vs pin and the output voltage take in the following:

$$1C^{o} = 10mv$$

For this we can found the output voltage in $25C^{o}$ 'for example' in the following equation:

$$25C^{o} \times 10mv = 250\ mv$$

As show the relationship between Celsius degree and volt in the following curve:

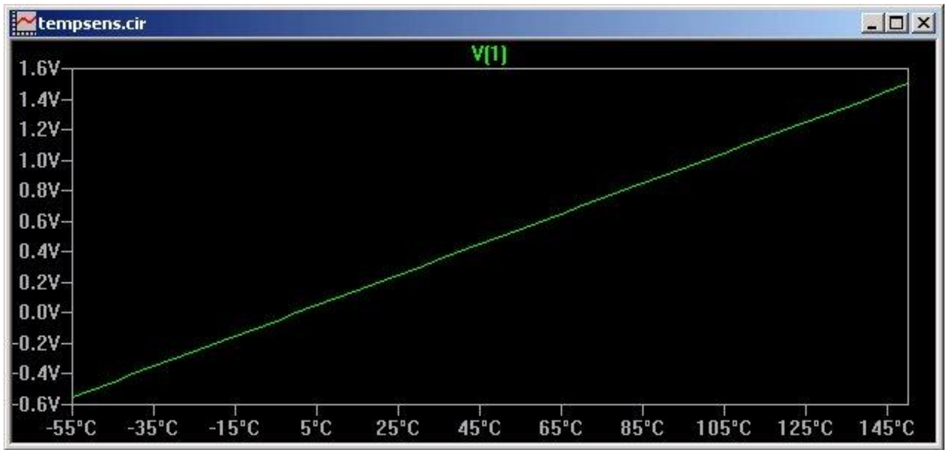


Figure 2.2: Temperature sensor curve

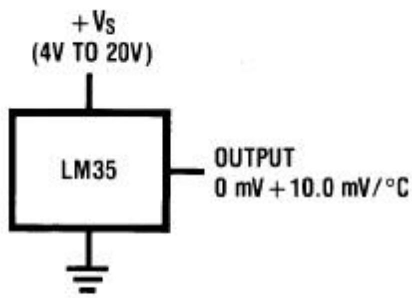


Figure 2.3: Temperature symbol

2.3.2 Light sensor (LDR)

A photo resistor or light dependent resistor (LDR) or photocell is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity.

A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its whole partner) conducts electricity, thereby lowering resistance.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon.

In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called do pants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor

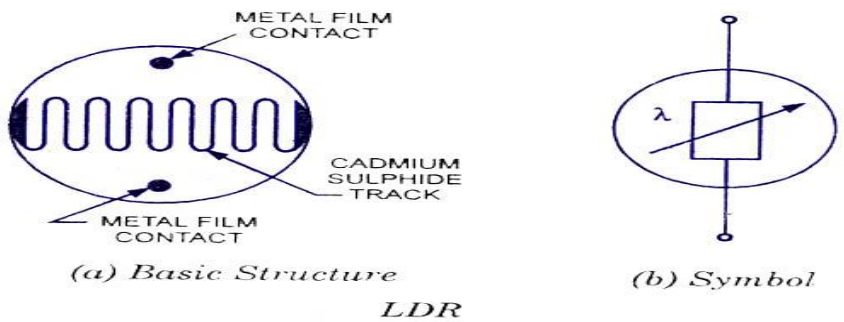


Figure 2.4: LDR symbol

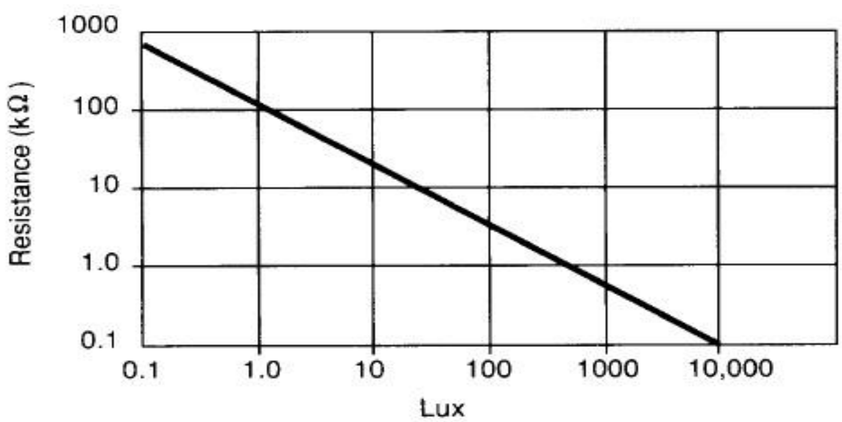


Figure 2.5: LDR curve

2.3.3 Condenser microphone (MIC)

An electric microphone is a type of capacitor microphone invented by Gerhard Sesser and Jim West at Bell laboratories in 1962. Electrets are a ferroelectric material that has been permanently electrically charged or polarized. The name comes from electrostatic and magnet; a static charge is embedded in an electrets by alignment of the static charges in the material, much the way a magnet is made by aligning the magnetic domains in a piece of iron.

Due to their good performance and ease of manufacture, hence low cost, the vast majority of microphones made today are electrets microphones; a semiconductor manufacturer [15] estimates annual production at over one billion units. Nearly all cell-phone, computer, PDA and headset microphones are electrets types. They are used in many applications, from high-quality recording and lavaliere use to built-in microphones in small sound

Recording devices and telephones. Though electrets microphones were once considered low quality, the best ones can now rival traditional condenser microphones in every respect and can even offer the long-term stability and ultra-flat response needed for a measurement microphone. Unlike other capacitor microphones, they require no polarizing voltage, but often contain an integrated preamplifier that does require power (often incorrectly called polarizing power or bias). This preamplifier is frequently phantom powered in sound reinforcement and studio applications. Monophonic microphones designed for personal computer (PC) use, sometimes called multimedia microphones, use a 3.5 mm plug as usually used, without power, for stereo; the ring, instead of carrying the signal for a second channel, carries power via a resistor from (normally) a 5 V supply in the computer. Stereophonic microphones use the same connector; there is no obvious way to determine which standard is used by equipment and microphones.

Only the best electrets microphones rival good DC-polarized units in terms of noise level and quality; electrets microphones lend themselves to inexpensive mass-production, while inherently expensive non-electrets condenser microphones are made to higher quality.

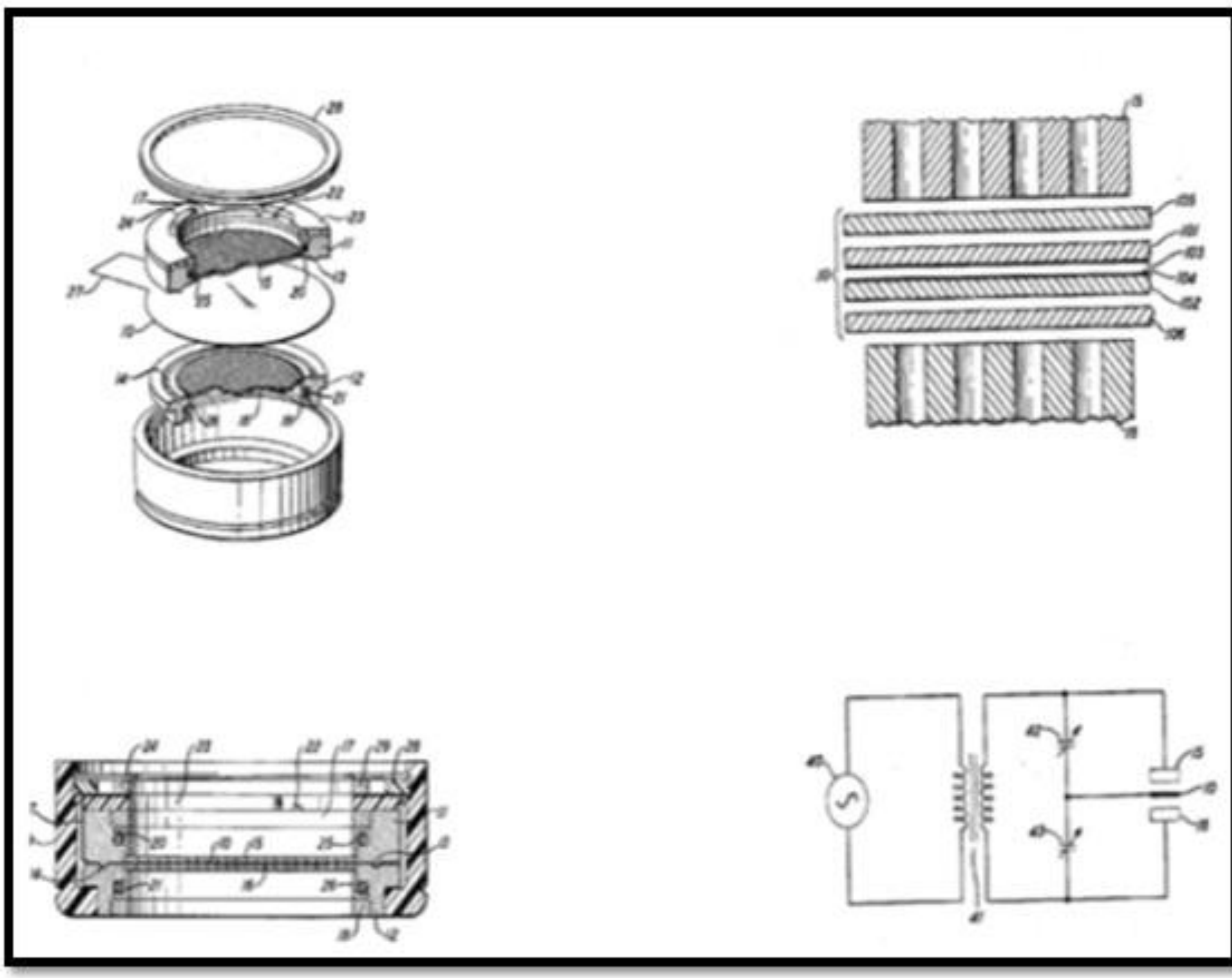


Figure 2.6: Mic symbol

2.4 Electrical and Mechanical Components

2.4.1 DC Motor

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore the current in the rotor is switched by the commentator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

DC motors have a rotating armature winding (winding in which a voltage is induced) but non-rotating armature magnetic field and a static field winding (winding that produce the main magnetic flux) or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics.

The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

A PM motor does not have a field winding on the stator frame, instead relying on PMs to provide the magnetic field against which the rotor field interacts to produce torque. Compensating windings in series with the armature may be used on large motors to improve commutation under load. Because this field is fixed, it cannot be adjusted for speed control. PM Fields (stators) are convenient in miniature motors to eliminate the power consumption of the field winding. Larger DC motors are of the "dynamo" type, which have stator windings. Historically, PMs could not be made to retain high flux if they were disassembled; field windings were more practical to obtain the needed amount of flux. However, large PMs are costly, as well as dangerous and difficult to assemble; this favors wound fields for large machines.

To minimize overall weight and size, miniature PM motors may use high energy magnets made with neodymium or other strategic elements; most such are neodymium-iron-boron alloy. With their higher flux density, electric machines with high-energy PMs are at least competitive with all optimally designed fed synchronous and induction electric machines. Miniature motors resemble the structure in the illustration, except that they have at least three rotor poles (to ensure starting, regardless of rotor position) and their outer housing is a steel tube that magnetically links the exteriors of the curved field magnets.

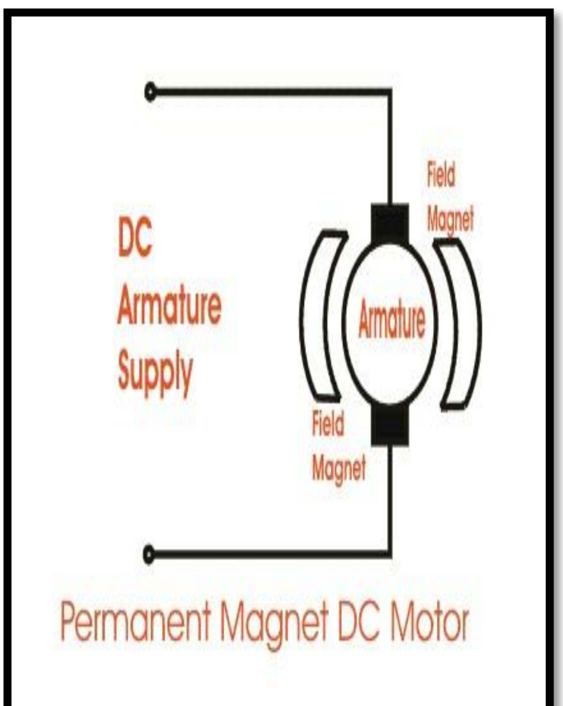


Figure 2.7: PM DC Motor

2.4.2 Gears

A machine consists of a power source and a power transmission system, which provides controlled application of the power. The define of transmissio*n* as an assembly of parts including the speed-changing gears and the propeller shaft by which the power is transmitted from an engine to a live axle. Often transmission refers simply to the gearbox that uses gears and gear trains to provide speed and torque conversions from a rotating power source to another device.

Fear box consist of a set of teeth can be rank in specialist position to provide perfect transmission and smallest size and high transmission ratio; in the following we can show the gear box from the inside:

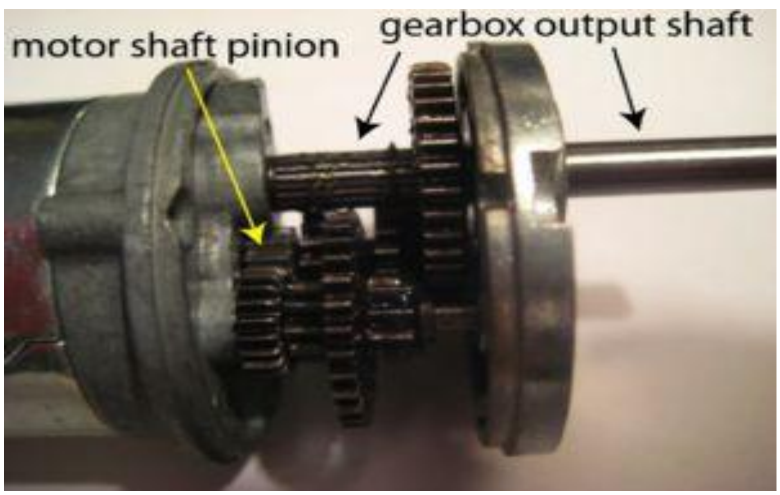


Figure 2.8: Box Gear

3

Chapter Three

System design

3.1 Introduction.

3.2 System Block Diagram.

3.3 Mechanical Design.

3.4 Control circuit Design.

3.5 Electrical Circuit.

3.6 Power supply circuit.

3.1 Introduction

The Body Movement Based Shutter Control consists from three main parts, mechanical, control and power part.

The mechanical part consist from overall structure and some mechanical component, control part consist from Micro Controller Unit and some sensors and another electronic components, and power part consist from electrical motor and power control circuit.

3.2 System Block Diagram

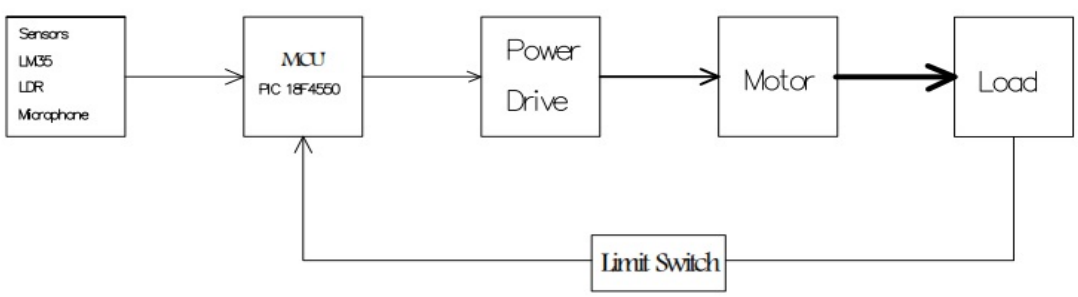


Figure 3.1: General block diagram.

3.3 Mechanical Design

The mechanical part design to allow free motion and soft start and stop, in the following fig (3.2) can see the overall structure drawing in AutoCAD software.

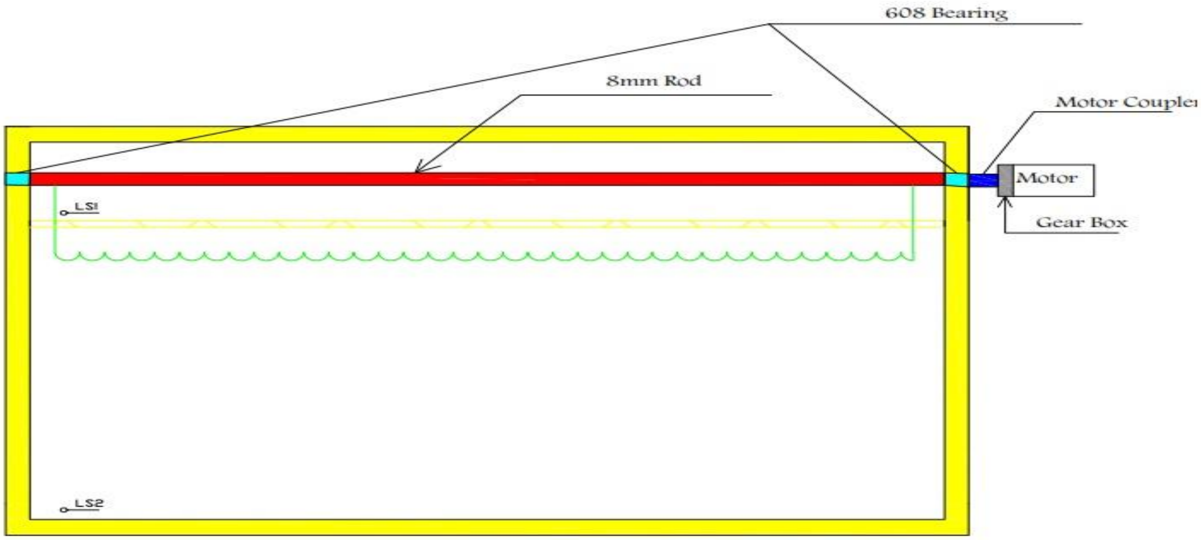


Figure 3.2: Mechanical part design.

Red roll is the moving roll to move the shutter up or down using the electrical motor in the maid of roll, two side of roll catch from bearings to allow free moving.

Yalow cover is the main structure of window, green line is the shutter rolling in red roll above this.

LS1, LS2 are micro switches to stop the motor and fixed position.

The motor connect from gear box to decrease the motor speed and increase the motor torque, the connecter between motor shaft and 8mm rod is the motor copular.

8mm rod:

Figure 3.3: Rod

PM DC Motor and gear box:

Figure 3.4: Motor and gear box.

608 Bearing:

Figure 3.5: Bearing.

Motor copular:

Figure 3.6: Motor copular.

3.4 Control circuit Design

Control part is main part in the system; consist from Micro Controller Unit to control the input signals and output signals in right side.

Control part is main part in the system, consist from Micro Controller Unit to control the input signals and output signals in right side is a microcontroller from PIC family , PIC18f4550 select to this system because the following advantages :

1- Easy to programming.
2- Cheaply.
3- Available in local market.
4- Strongly in work.

Many programming languages are available, but the language we use in this system is the flow chart language by using Flow code software.

The system control the position of Body Movement Shutter Control up or down" build to outside temperature and sun light and two clamping in hand" sound of hand clamp ".

Temperature measuring by electronic sensor LM35 , sun light measuring by LDR sensor and the sound of Hand Clamp measuring by Microphone or sound sensor.

The LM35

Series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling.

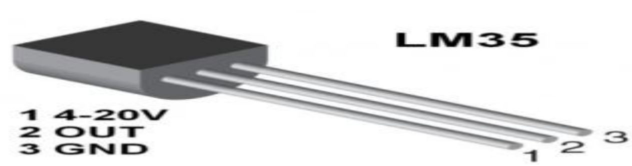


Figure 3.7: LM35.

LDR ***"Light Dependent Resistor"***

This resistor changing the resistor value dependent to light intensity for example in the sun light LDR resistor is low value but in dark LDR resistor is higher value in "Mega Ohm " the following curve describes this relationship between LDR resistor and light illumination :

Figure 3.8(a): LDR.

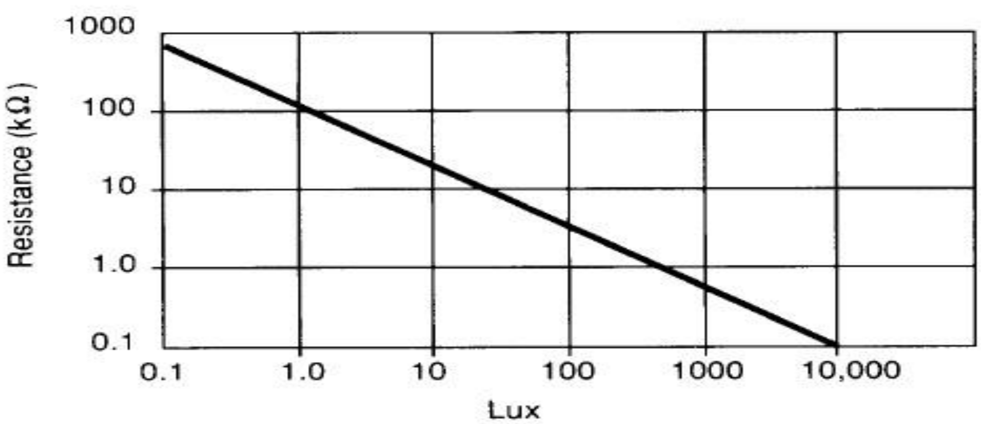


Figure 3.8(b): LDR curve.

Microphone "sound sensor"

If no sound is picked up, the output voltage is low, close to 0V. If the microphone picks up sound the voltage pulses rapidly above 0V in response to the sound wave.

The graph shows in fig (3.9) the kind of output signal that would be produced by a sudden loud noise, such as a hand clap.

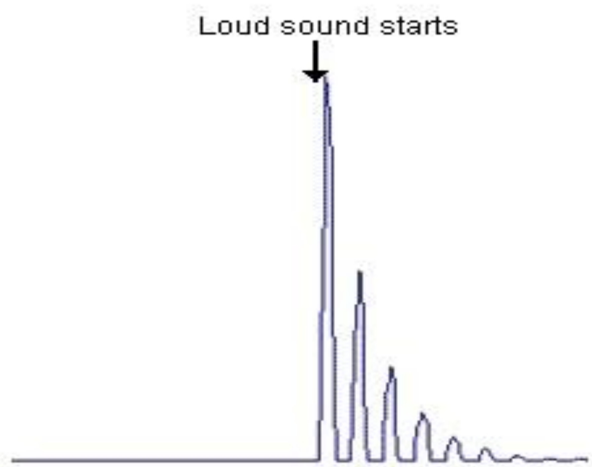


Figure 3.9: Sound wave.

When a sound wave strikes the microphone it produces a very small voltage, proportional to the pressure changes produced by the sound wave. This AC voltage is amplified by the operational amplifier circuits using LM358 IC.

Figure 3.10: MIC.

3.5 Electrical Circuit:

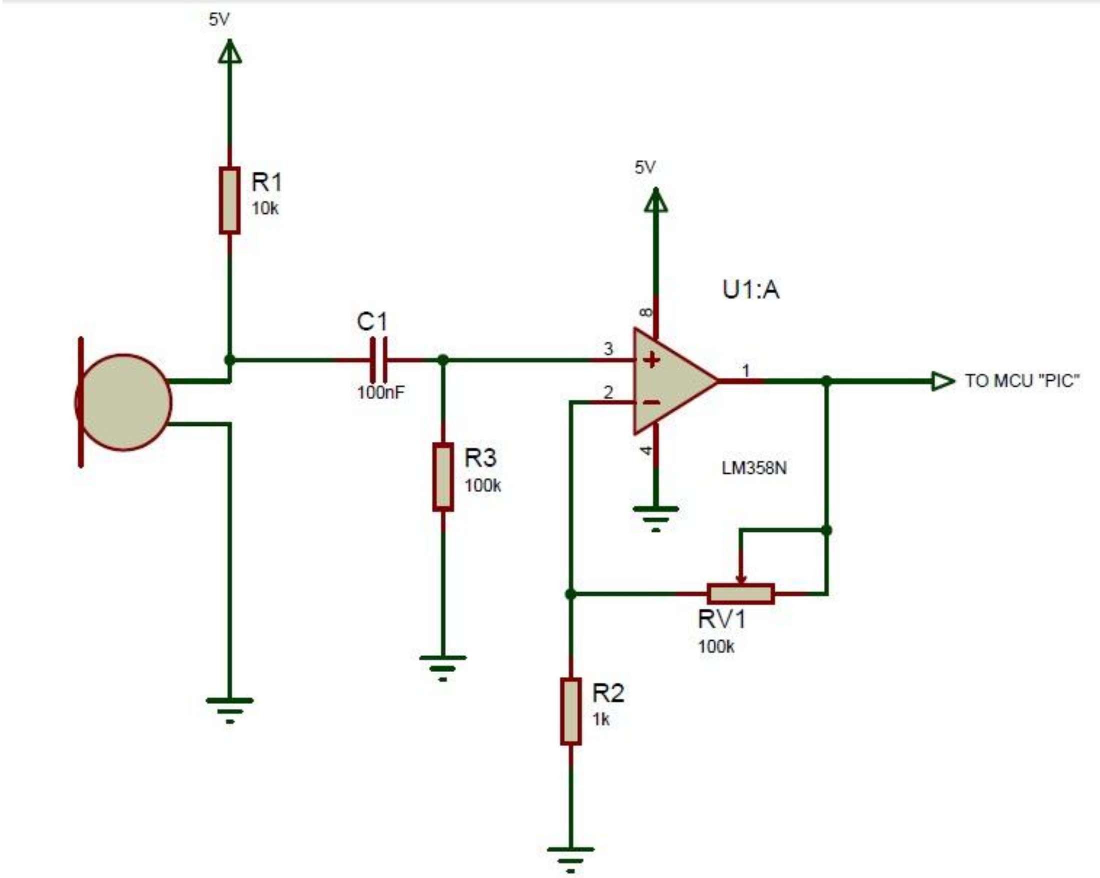


Figure 3.11: Microphone Circuit.

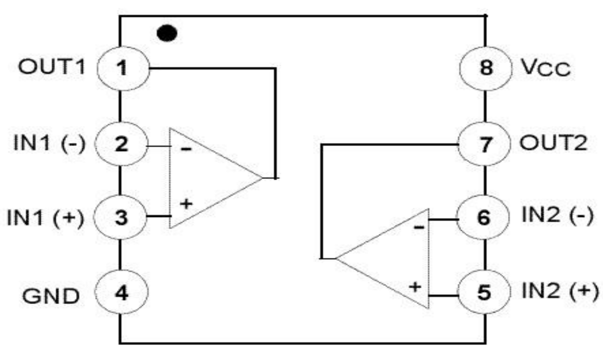


Figure 3.12: Amplifier IC.

The Microphone convert the sound to electrical wave, using voltage divider low the output voltage between resistor R1 and microphone changing value dependent to sound in peripheral area, next stage C1 and R3 is a AC filter after this stage the signal input to LM358 operational amplifier in variable gain using potentiometer RV1 to control the sensitivity of Microphone circuit, output of amplifier circuit go to PIC18f4550 analog port.

This circuit drawing and simulation by PROTUS 7 software, this software can't be simulating the Microphone operation, for this reason used Audacity Sound Recorder Software to view the Microphone output signal of hand clamp. In the flowing can we show this signal.

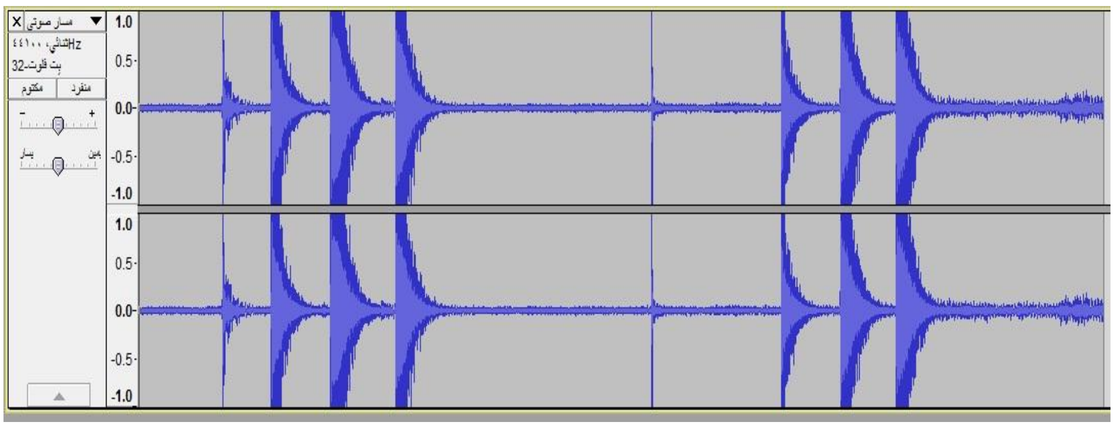


Figure 3.13: Microphone output signal of hand clamp.

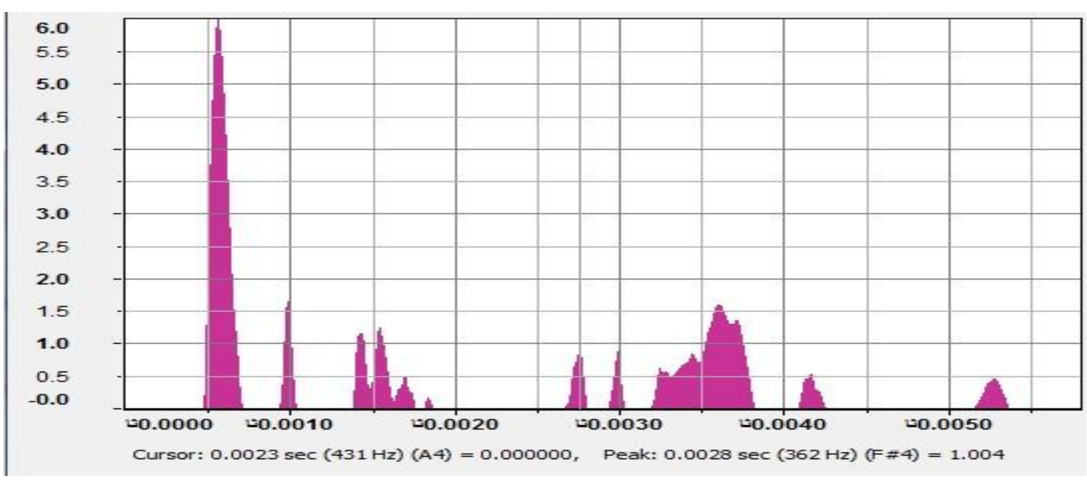


Figure 3.14: Clamping wave.

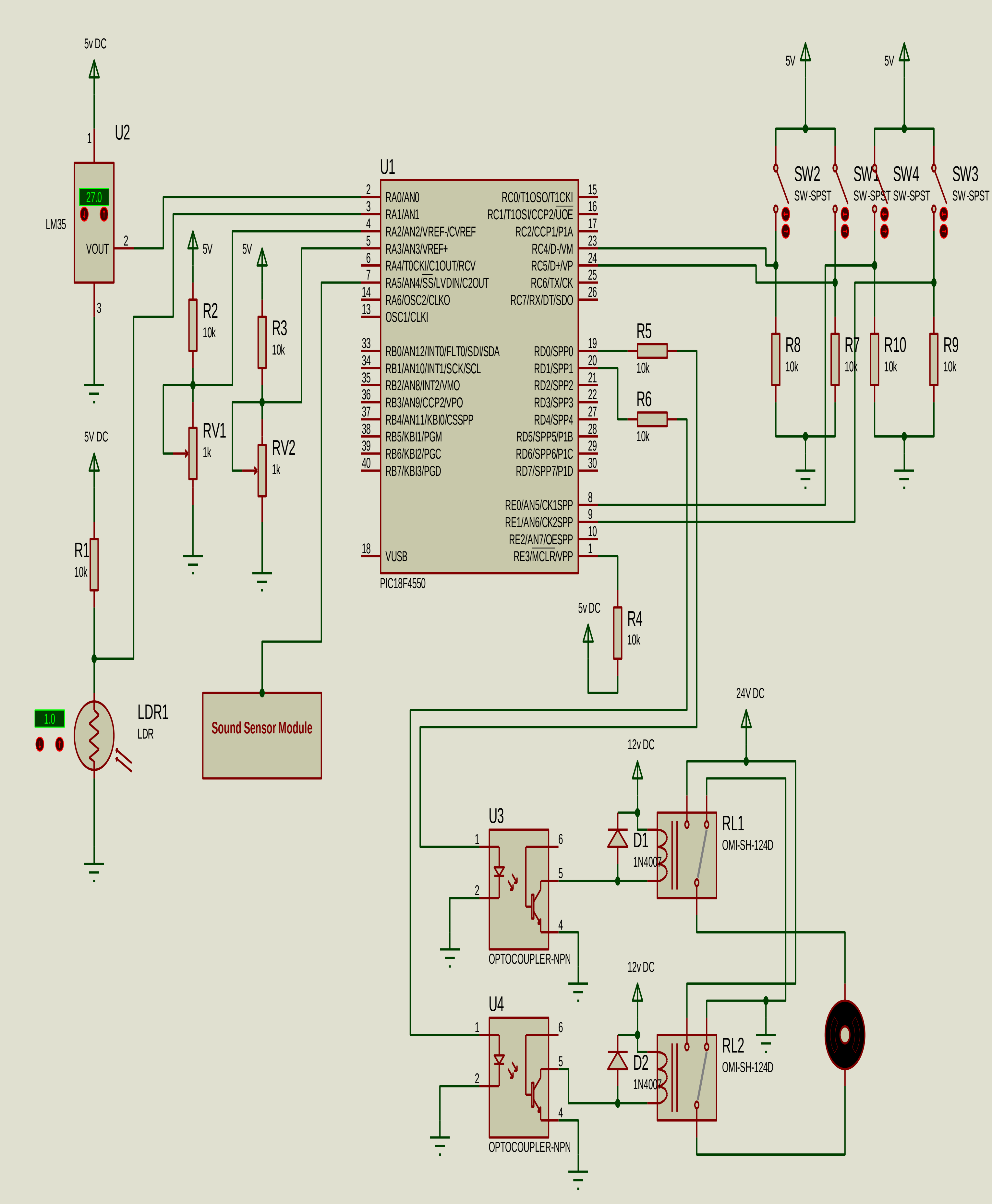


Figure3.15:Project circuit

PIC18f4550 contain analog ports and digital ports, analog port response to analog signal from 0-5V variable value and convert this value to digital number. In this PIC internal crystal oscillator and can used external crystal and operating voltage 5V DC filtrated because the ripple and noise in input voltage is damage the PIC therefore all digital input or output is 5V or 0V.

LM35 take supply voltage 5VDC, the output goes to PIC directly, and in the PIC 10mv amplification to 100mV.

LDR put in voltage divider circuit to change the output voltage on its internal resistor that dependent on light intensity, and go to analog port in PIC18f4550.

To control of temperature and light state should be found reference value, two voltage dividers (R2, RV1) and (R3, RV2) are given this references values.

R4 connecting to MCLR PIC port and Vcc 5V DC to make reset to the PIC.

SW1 and SW2 switches to provide shutter position.

U3 and U4 optocupler transistor to isolation between PIC and relay "control circuit and power circuit".

RL1 and RL2 electromechanically rely to reversing the motor. D1 and D2 freewheeling diode to protect the optocupler from reversing current at time =0 " di/dt and dv/dt".

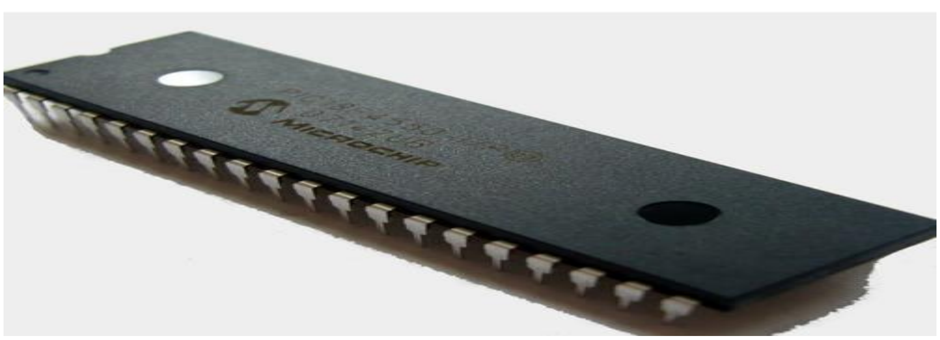


Figure 3.16: PIC18F4550.

PIC Crystal Oscillator:

Figure 3.17: PIC Crystal Oscillator

Relay

Figure 3.18: Relay

Potentiometer:

Figure 3.19: Potentiometer

3.6 Power supply circuit

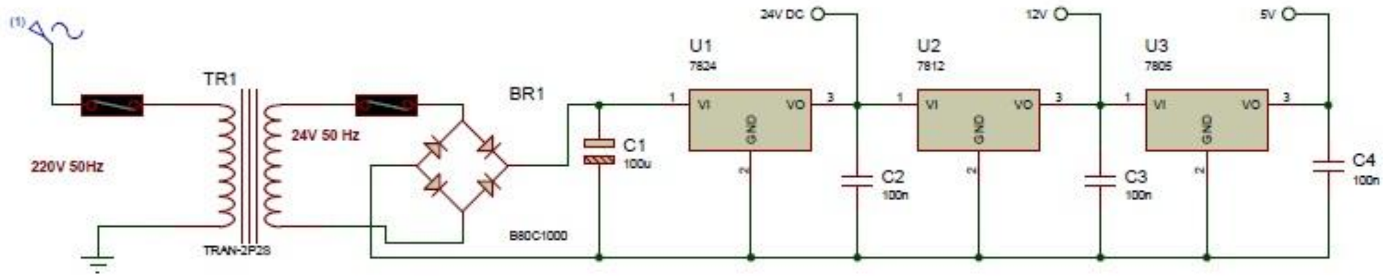


Figure 3.20: Power supply circuit

Power supply is the heart of the system because it supplies all components in the system. AC power line 220V/50Hz is the source of primary coil in step down transformer through protection fuse to protect circuit and human from short circuit current.

Secondary coil in transformer is 24V/50Hz supply the bridge rectifier " full wave rectifier" through protection fuse, C1 is the filter and decreasing ripple in DC wave, 7805 positive voltage regulator IC to regulate output voltage to fixed 24V pure DC wave and 24v to supply the motor and 12v in the next stage to supply relay coil and 5V to supply control circuit, C2 and C3 and C4 filters to clamping the regulator output voltage.

LM 7805, 7812:

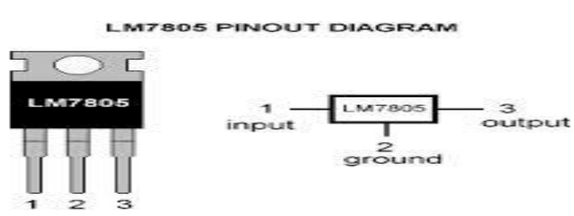


Figure 3.21: LM 7805, 7812

Layout PCB Board design:

To make printed bored should be make layout of system circuit, in the following show the PCP Layout design on PROUTAS 7 software :

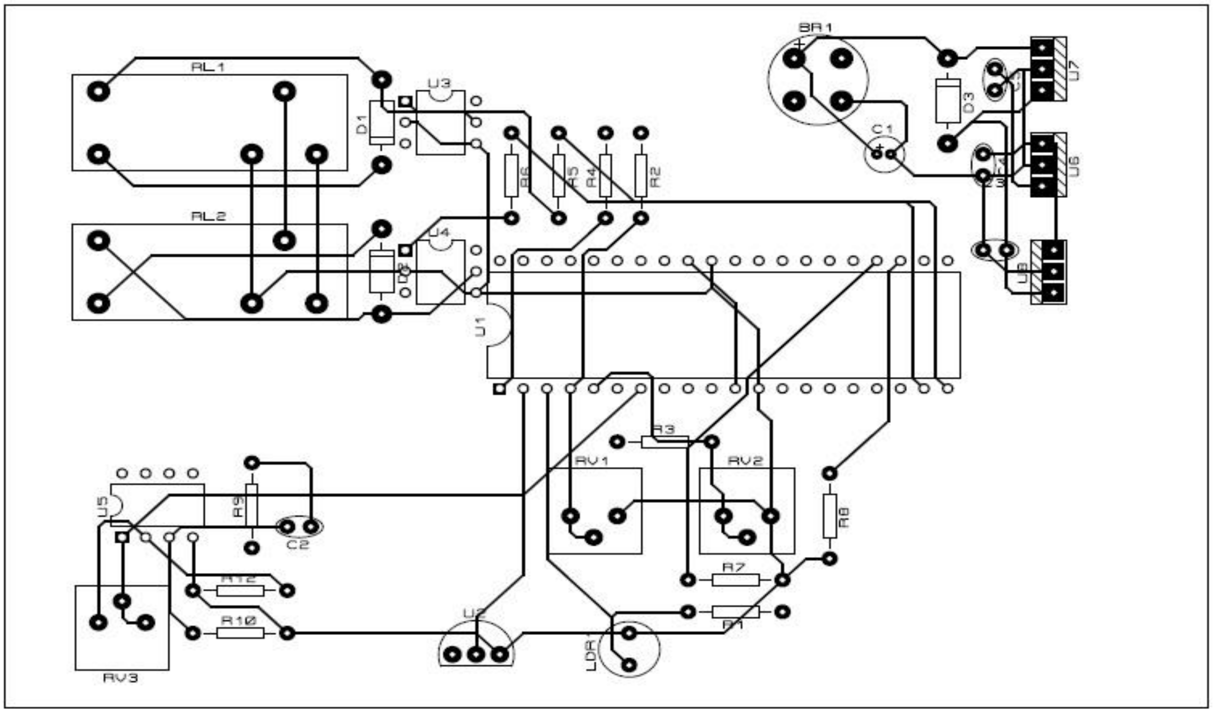


Figure 3.22: Layout PCB Bored design

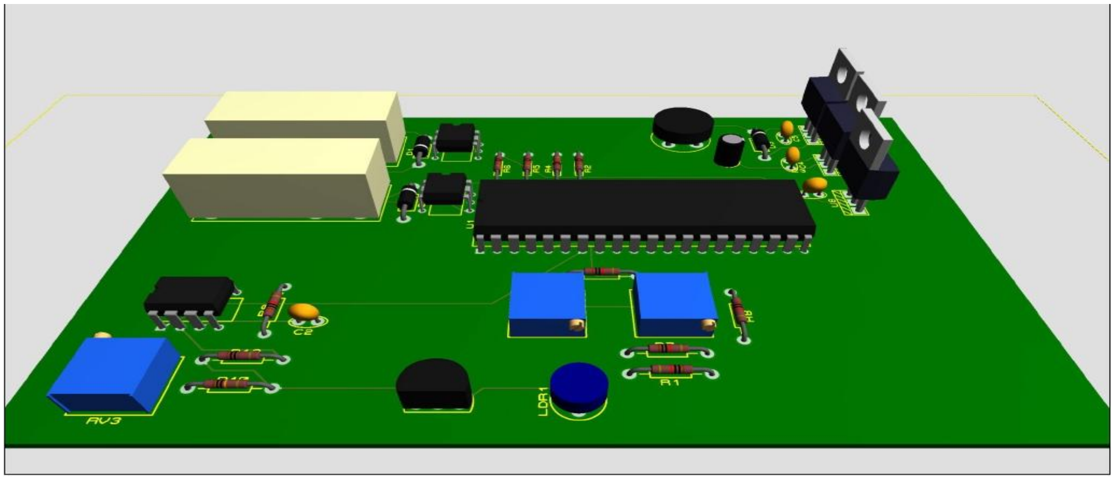


Figure 3.22: Layout PCB Bored design

Power circuit part:

Electrical motor in general case is two types:

1- AC electrical motor.
2- DC electrical motor.

In this system select PM "Permanent Magnet" DC Motor type for these advantages:

1- Easy to control.
2- Small size in large power.
3- Low cost.
4- Available in local market.
5- Wide operating speed range.
6- Operating in low voltage is important to safety consideration.
7- Liner speed-torque characteristic.

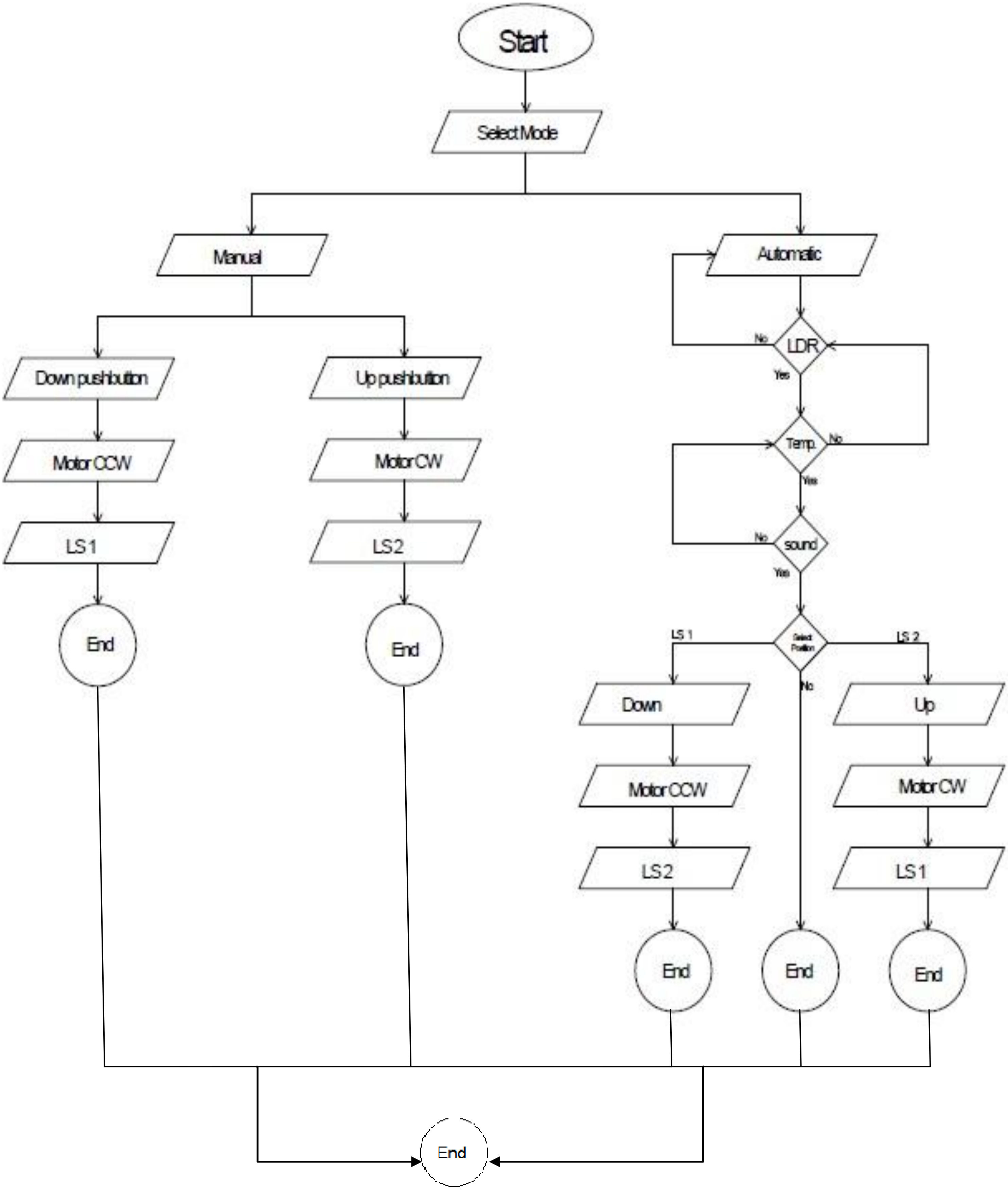


Figure 3.23: General flow chart system.

4

Chapter Four

System Implementation

4.1 Mathematical Design.

4.2 PIC Programming.

4.1 Mathematical Design:

1- High Pass Filter :

A High Pass Filter or HPF, as now the two components have been interchanged with the output signal (V out) being taken from across the resistor as shown.

Where the low pass filter only allowed signals to pass below its cut-off frequency point, fc, the passive high pass filter circuit as its name implies, only passes signals above the selected cut-off point, fc eliminating any low frequency signals from the waveform. Consider the circuit below.

The High Pass Filter circuit:

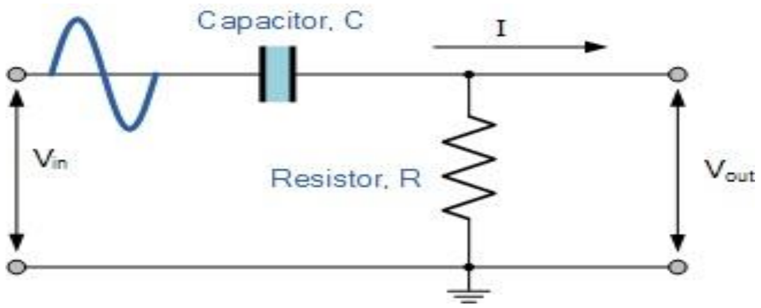


Figure 4.1: High Pass Filter.

In this circuit arrangement, the reactance of the capacitor is very high at low frequencies so the capacitor acts like an open circuit and blocks any input signals at Vin until the cut-off frequency point (fc) is reached. Above this cut-off frequency point the reactance of the capacitor has reduced sufficiently as to now act more like a short circuit allowing all of the input signal to pass directly to the output .

Now …

$$f_c = \frac{1}{2\pi RC}$$

(4.1)

The Microphone frequency to hand clamp sound between 370-430 Hz from simulation in ch.3.

Now can be select 450Hz cut-off frequency and select 100nf capacitor and found the resistor value from above equation.

$$450Hz = \frac{1}{2\pi R(100 \times 10^{-9})}$$

$$R = \frac{1}{2\pi(450)(100 \times 10^{-9})} = 3536.78 \approx 3.5\ K\Omega$$

2- Non-inverting Amplifier

In the non-inverting amplifier the input voltage signal, (Vin) is applied directly to the non-inverting (+) input terminal which means that the output gain of the amplifier becomes "Positive" in value in contrast to the "Inverting Amplifier" circuit we saw in the last tutorial whose output gain is negative in value. The result of this is that the output signal is "in-phase" with the input signal.

Feedback control of the non-inverting amplifier is achieved by applying a small part of the output voltage signal back to the inverting (-) input terminal via a Rf - R2 voltage divider network, again producing negative feedback. This closed-loop configuration produces a non-inverting amplifier circuit with very good stability, a very high input impedance, Rin approaching infinity, as no current flows into the positive input terminal, (ideal conditions) and a low output impedance, Rout as shown below.

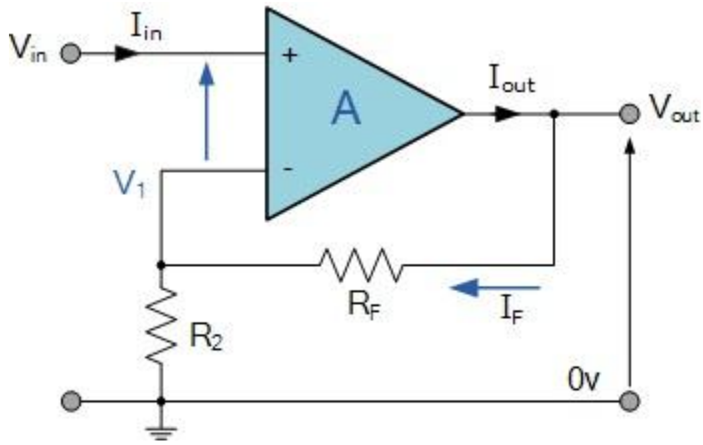


Figure 4.2: Non-Inverting amplifier

To found the gain of non-inverting amplifier can be use the following equation :

$$A_{(v)} = 1 + \frac{R_f}{R_2}$$

(4.2)

In the microphone circuit design to allow clamping the sensitivity that's mean clamping the amplifier gain using potentiometer "variable resistor ".

The resistor select 1K ohm "R2" and Av =100 therefore the potentiometer value can be found from gain equation as the following :

$$100 = \frac{R_f}{1\text{K}\Omega}$$

$$R_f = 100 \times (1 \times 10^3) = 100\text{K}\Omega$$

3- Motor and Gear

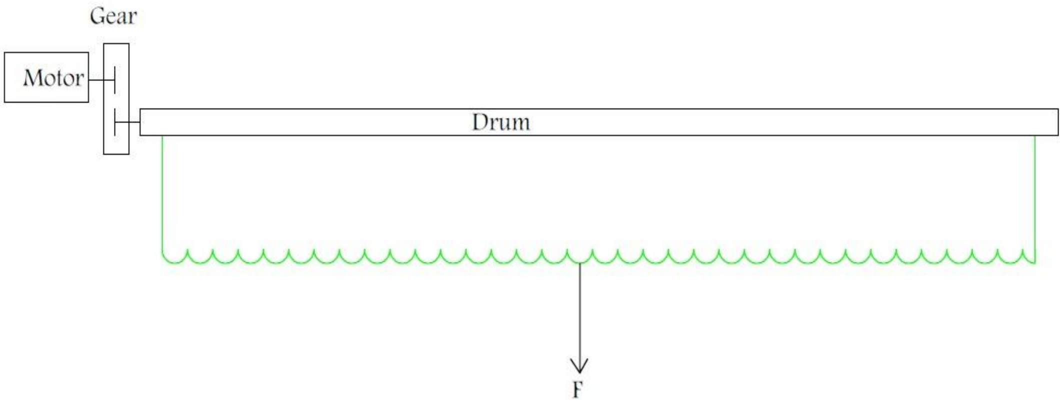


Figure 4.3: Motor and Gear design.

In the figure show the mechanical connection and describe the force of window cover in green color.
The window covers forced F can be calculating from the fowling equation:

$$F = mg \tag{4.3}$$

Where "m" is the window cover Wight and "g" is the acceleration of gravity (9.8 m/s)
The window cover approximate Wight is 10 Kg in max.
Now: $F = 10 \times 9.8 = 98\ N$
But the torque of load:

$$T_L = \frac{1}{2} \times D \times F \tag{4.4}$$

Where "D" Drum diameter in meter and the window cover drum 5cm
Now:

$$T_L = \frac{1}{2} \times (5 \times 10^{-2}) \times 98 = 0.98 \ \approx 1\ N.m$$

Therefore the motor torque should be equal 1N.m, but the speed of window cover is low speed and must not exceed 30 rpm.
Now the motor select is PM DC Motor in the following specification:
Output power: 100W

Rated voltage: 24 V DC
Speed: 3000 rpm
Module Type: 56ZYT DC Motor

From motor specification can be calculated the output motor torque:

$$T_{out} = \frac{P_{out}}{w}$$

(4.5)

Where "w" motor speed in rad/s
To convert from rpm"n" to rad/s "w" can be use the fowling equation:

$$w = \frac{2\pi n}{60} = \frac{2\pi 3000}{60} = 340\,\frac{rad}{s}$$

(4.6)

$$T_{out} = \frac{100}{340} = 0.29 \approx 0.3\ N.m$$

To reduce the speed from motor speed 3000rpm to 30 rpm use the gear box in ratio 1:100

Now the output gear speed after the motor $\frac{3000\,rpm}{100} = 30\ rpm$
And the output torque is

$$0.3 \times 100 = 30N.m$$

Therefore the select motor and gear is true.

4.2 PIC Programming

The connection between PC and PIC to download program coding from PC to PIC used PIC Programmer KIT150 and used special software (**Flow Code** 4V).

For this kit, in the following we can show the KIT150 and software:

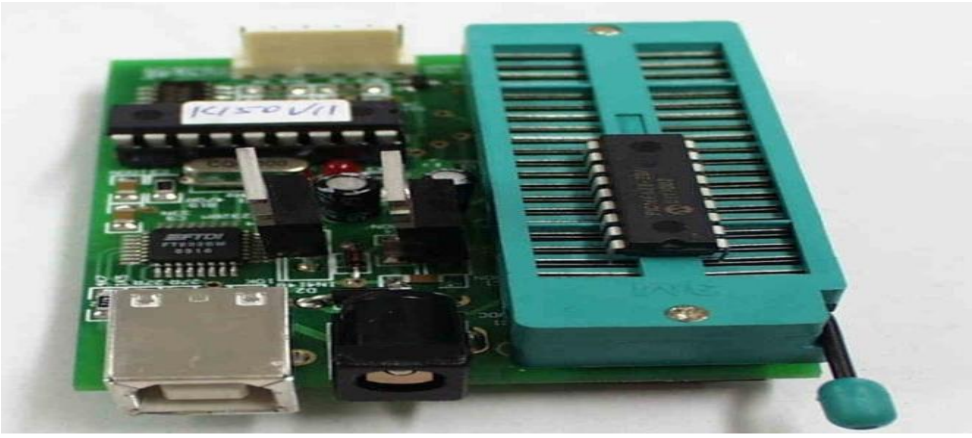


Figure 4.4: KIT150

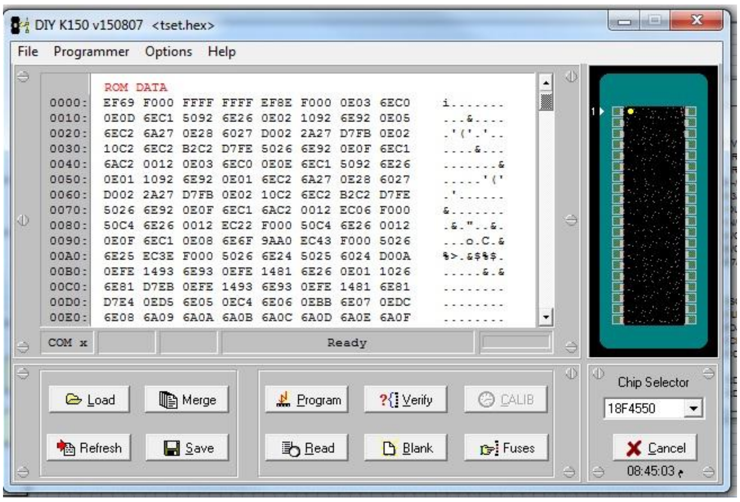


Figure 4.5: Software

The type of PIC programming language is used flowchart language used **Flow Code** 4V software .

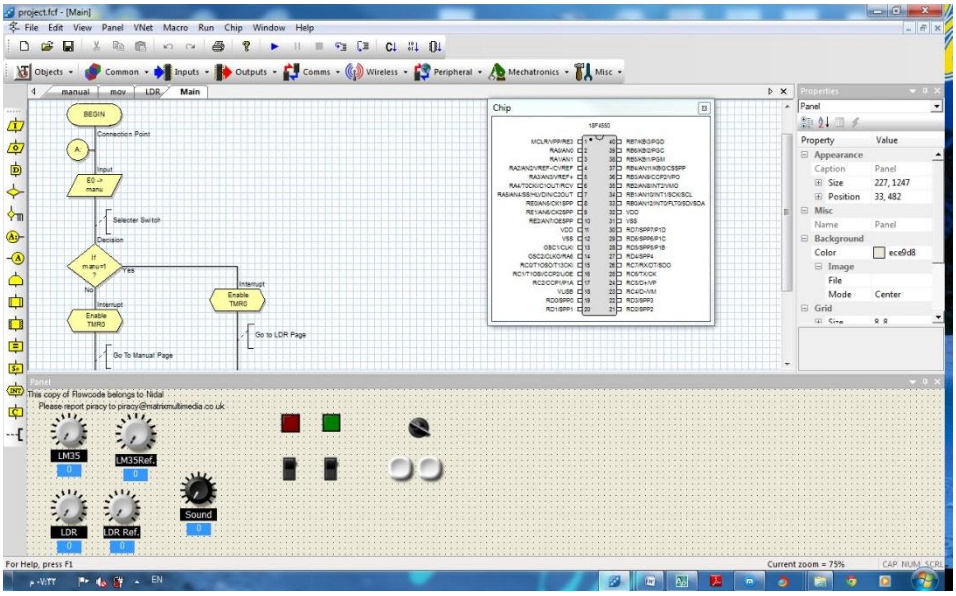


Figure 4.6: Flow Code 4V software

This software simulate and test the program after download on PIC chip, in the above figure show the potentiometer and LED and switch can be tested from this.

The program dividing to four pages because use the interrupt method to less programming circular time and easy to program show this in the following:

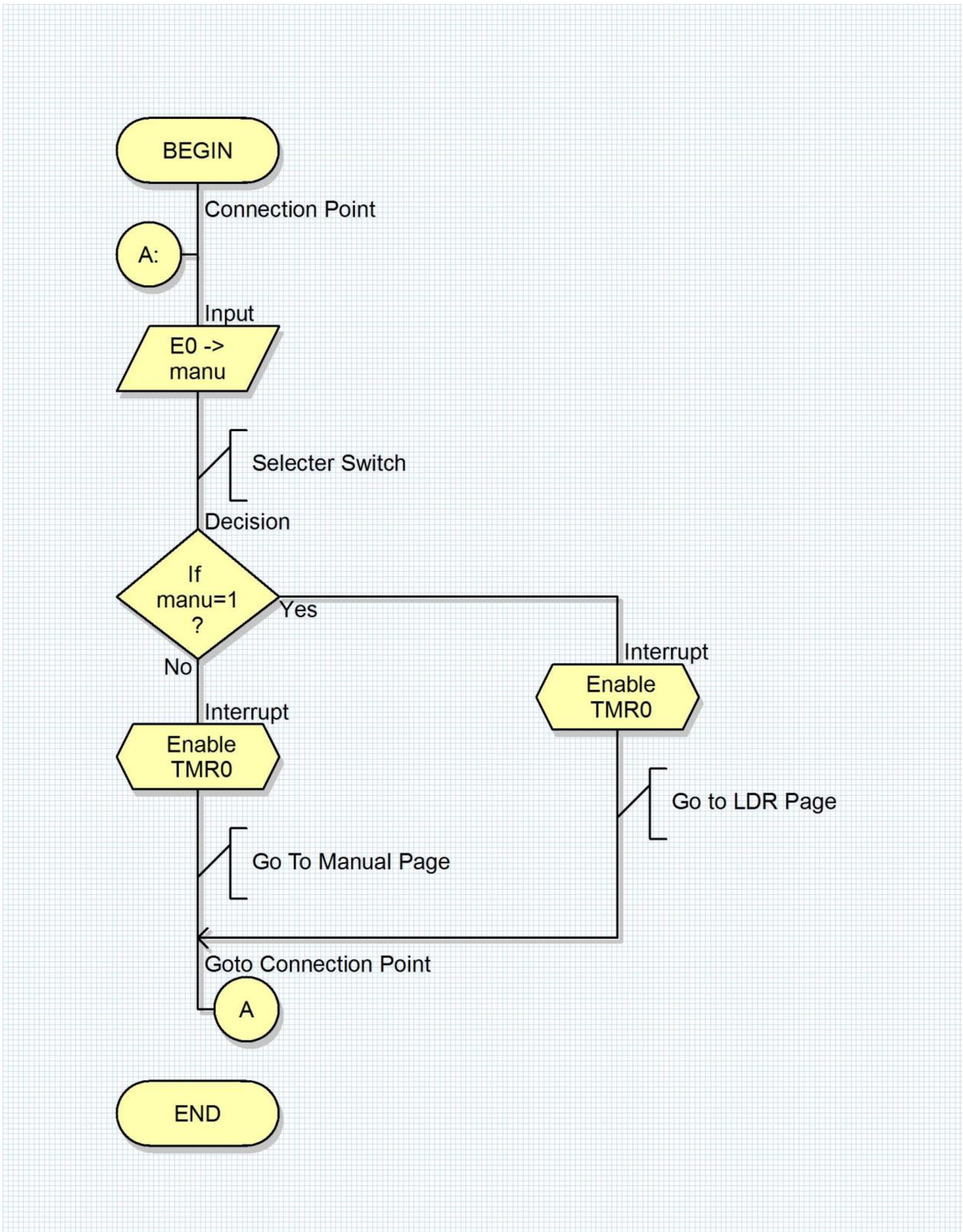
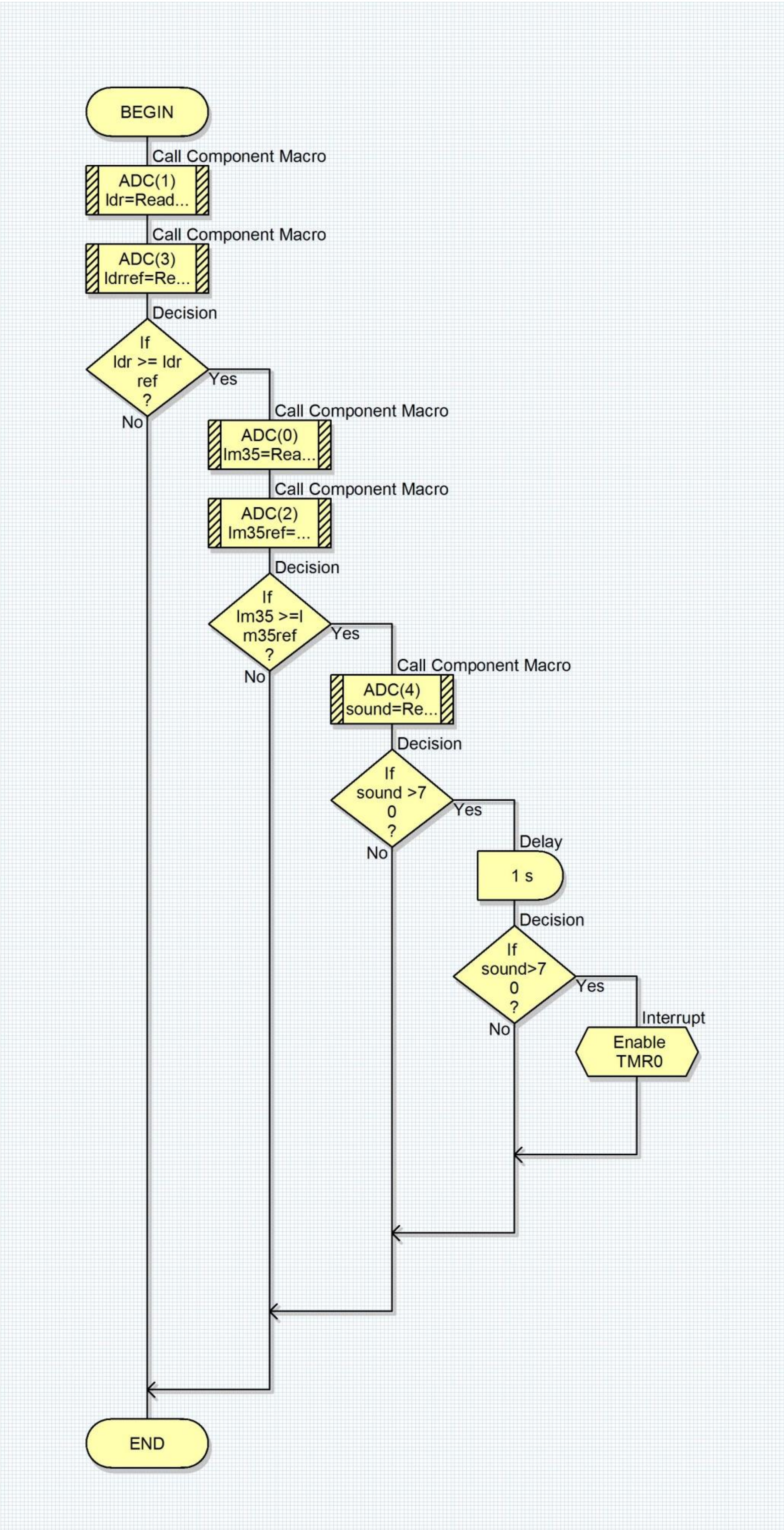
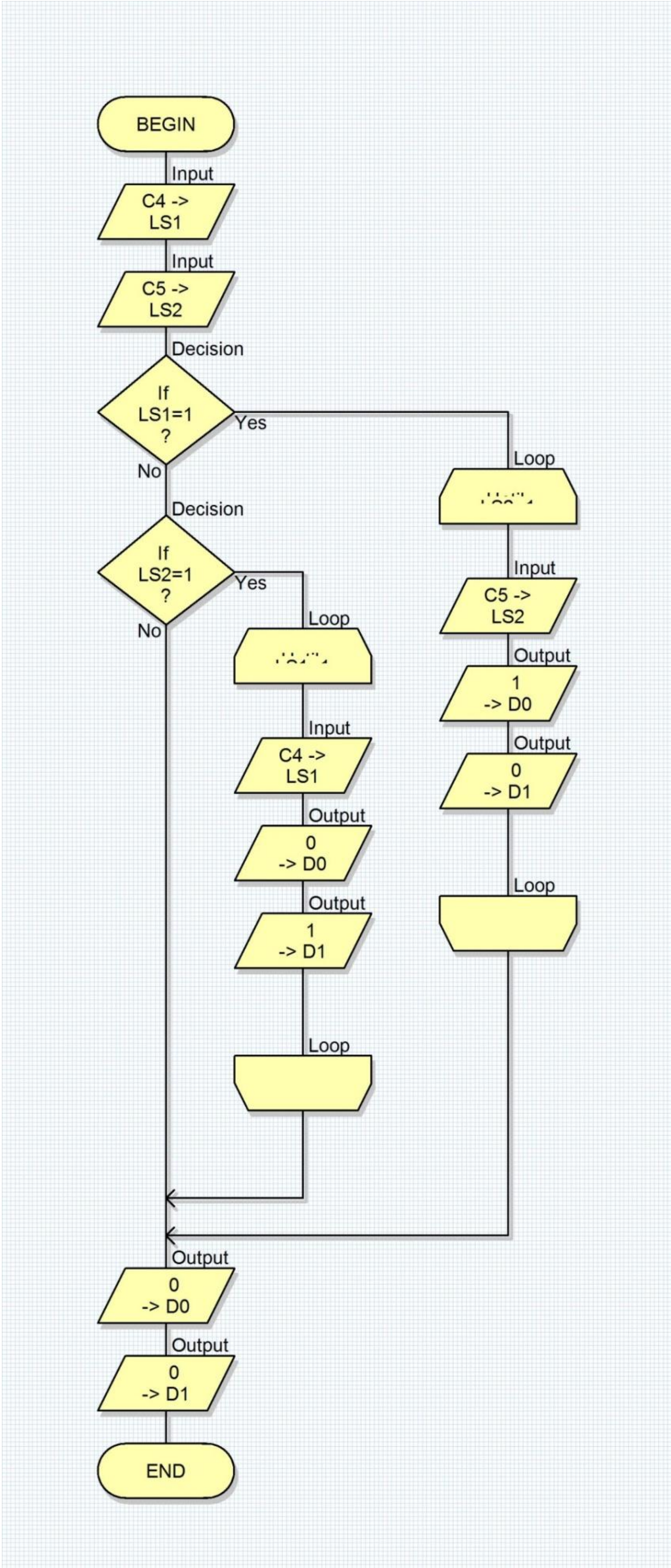
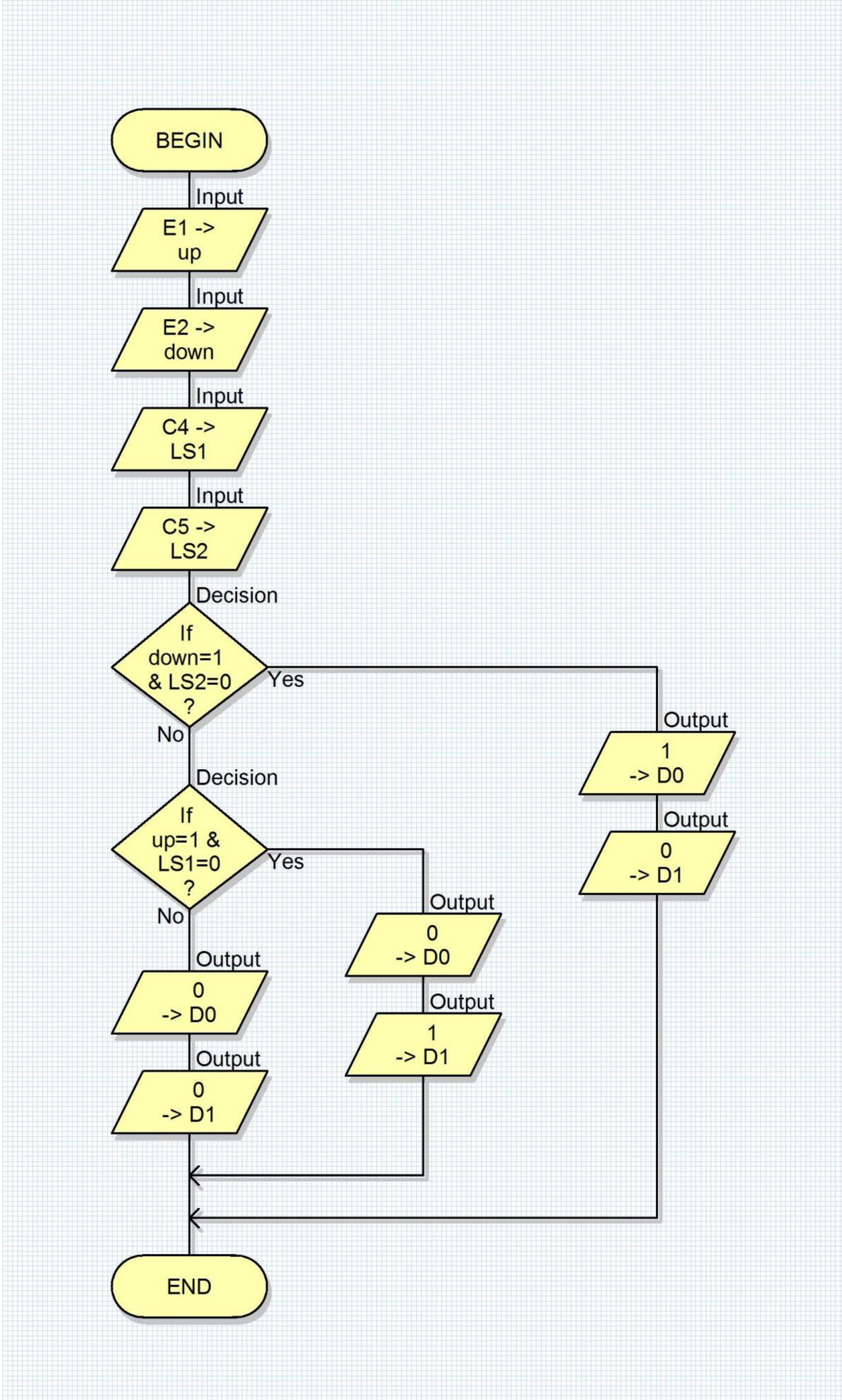


Figure 4.7: The main page software


BEGIN
Call Component Macro
ADC(1)
ldr=Read...
Call Component Macro
ADC(3)
ldrref=Re...
Decision
If
ldr >= ldr
ref
?
Yes
No
Call Component Macro
ADC(0)
lm35=Rea...
Call Component Macro
ADC(2)
lm35ref=...
Decision
If
lm35 >=l
m35ref
?
Yes
No
Call Component Macro
ADC(4)
sound=Re...
Decision
If
sound >7
0
?
Yes
No
Delay
1 s
Decision
If
sound>7
0
?
Yes
No
Interrupt
Enable
TMR0
END



BEGIN
Input
C4 -> LS1
Input
C5 -> LS2
Decision
If LS1=1 ?
Yes
No
Loop
Input
C5 -> LS2
Output
1 -> D0
Output
0 -> D1
Loop
Decision
If LS2=1 ?
Yes
No
Loop
Input
C4 -> LS1
Output
0 -> D0
Output
1 -> D1
Loop
Output
0 -> D0
Output
0 -> D1
END


BEGIN
Input
E1 -> up
Input
E2 -> down
Input
C4 -> LS1
Input
C5 -> LS2
Decision
If down=1 & LS2=0 ?
Yes
No
Output
1 -> D0
Output
0 -> D1
Decision
If up=1 & LS1=0 ?
Yes
No
Output
0 -> D0
Output
1 -> D1
Output
0 -> D0
Output
0 -> D1
END

5

Chapter Five

Conclusions

5.1 Conclusions

1- Design automatic system to control of shutter.
2- Design automatic system in low cost and perfect work.
3- Design automatic system provides a comfortable sleep for children and adults.
4- Design system easy to appliance and installed.
5- Use cheaply sensors and Microcontroller to applied automatic system.

5.2 References

Books

[2] Oberg, E., F. Jones, and H. Horton, 1986: *Machinery's Handbook,* 22d ed. New York: Industrial Press.

[3] Nadjer, K. W., 1958: *Machine Designer's Guide,* 4th ed. Ann Arbor, Mich.: Edwards Bros.

Papers

[1] Kristy Beauvais, "Research Experience for Teachers Center for Materails Science and Engineering August 2003.

[4] Spotts, M. F., 1953, "A practical method for designing gear trains," *Product Engineering,* February, p. 211.

[6] [7] Hall, A. S., A. R. Holowenko, and H. G. Laughlin, 1961: *Machine Design, Theory and Problems.* New York: McGraw-Hill.

Website

[5] http://www.instructables.com/id/Sound-Pressure-sensor-for-Arduino-based-on-ZX-soun/