CHAPTER I: INTRODACTION

1.1 Introduction

Our project was based upon a microcontroller and interfacing with other discrete components, programming microcontroller by moving the motor wheels to forward, left and right movements

The aim of this project is to the human behavior with a Robot. That is during the day time the robot moves and made an activity, at night time the robot will sleep and stop its motion. It is similar to the house pet animal. Also this project demonstrates Neurons', Nerve and action activity. When light falls (Neurons) the signals is sensed like a (Nerve) and makes the required activity (action).

The LDR first detect the falling light in the surrounding area, then the robot starts to move as per the intensity of the light in the to LDR's in the robot. At the time the robot guided by the microcontroller to move either right, left, forward else to sleep that means. So this all action is decided by the programmed direction and this process is very efficient and reliable.

1.2 Utilization of programmable light tracking Robot

This programmable light tracking Robot can be utilized in mining processing that is in a very down heal areas you can put anything on it and you can send to go to the outside area and it will go by it self by following to the destination point , so this is some of the advantages of this light tracking robot.

The coverage of this robot is done by the aluminum, by cutting and design the structure we made like this below picture.

Figure 1.1 Phisical Show of robot

CHAPTER II : MATERIALS USED

2.1 PIC16F84A Microconroller

Pin Description

PIC16F84 has a total of 18 pins. It is most frequently found in a DIP18 type of case but can also been found in SMD case which smaller from a DIP.DIP is an abbreviation for Dual in Package. SMD is abbreviation for Surface Mounted device. Holes for pins to go through when mounting are not necessary in soldering this type of a component.

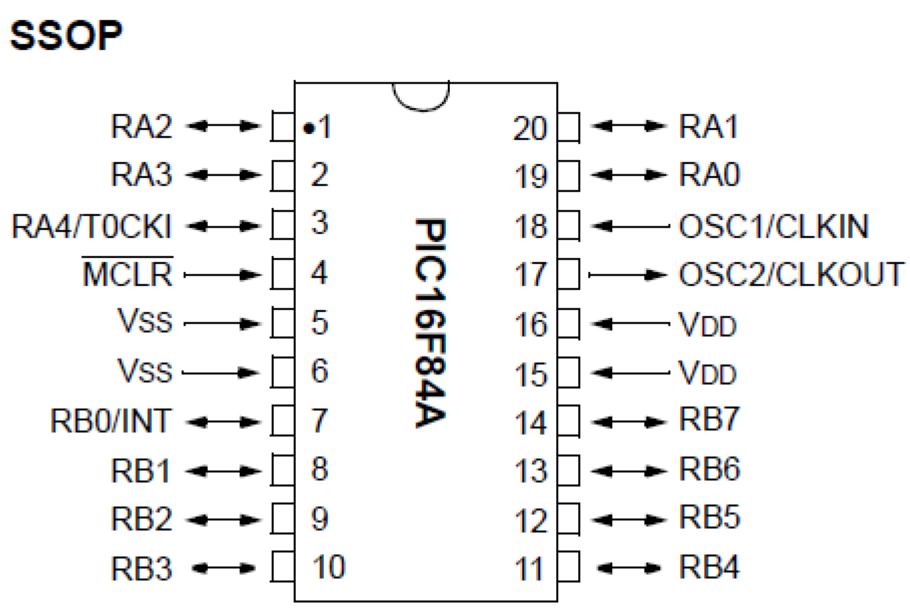


Figure 2.1 Microcontroller PIC 16F84A

Pins on PIC16F84 microcontroller have the following meaning:

Pin no.1 **RA2** Second pin on port A. Has no additional function
Pin no.2 **RA3** Third pin on port A. Has no additional function.
Pin no.3 **RA4** Fourth pin on port A. TOCK1 which functions as a timer is also found on this pin
Pin no.4 **MCLR** Reset input and Vpp programming voltage of a microcontroller
Pin no.5 **Vss** Ground of power supply.
Pin no.6 **RB0** Zero pin on port B. Interrupt input is an additional function.
Pin no.7 **RB1** First pin on port B. No additional function.
Pin no.8 **RB2** Second pin on port B. No additional function.
Pin no.9 **RB3** Third pin on port B. No additional function.
Pin no.10 **RB4** Fourth pin on port B. No additional function.
Pin no.11 **RB5** Fifth pin on port B. No additional function.
Pin no.12 **RB6** Sixth pin on port B. 'Clock' line in program mode.
Pin no.13 **RB7** Seventh pin on port B. 'Data' line in program mode.
Pin no.14 **Vdd** Positive power supply pole.
Pin no.15 **OSC2** Pin assigned for connecting with an oscillator
Pin no.16 **OSC1** Pin assigned for connecting with an oscillator
Pin no.17 **RA2** Second pin on port A. No additional function
Pin no.18 **RA1** First pin on port A. No additional function.

PIC16F84 -belongs to a class of 8 bit microcontroller of RISK (Reduced Instruction set computer) architecture. That means that it has reduced set of instructions, more precisely 35 instructions. All this instruction are executed in one cycle except for jump and branch instructions. PIC16F84 usually reaches results of 2:1 compression and 4:1 in speed relation to other 8-bit microcontrollers in its class. Its general structure is shown on the following map representing basic blocks.

Program memory(Flash)-for storing a written program. since memory made in flash technology can be programmed and cleared more than once, it makes this microcontroller suitable for device development.

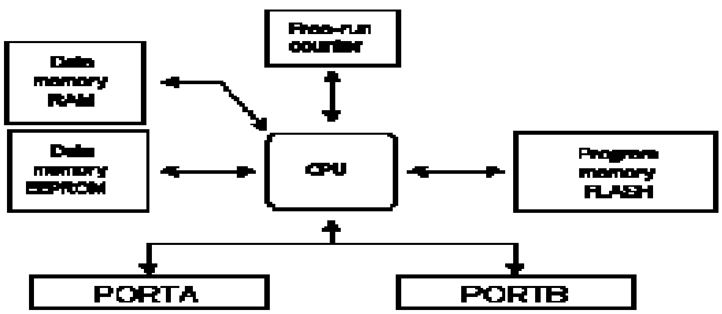
EEPROM- data memory that needs to be saved when there is no supply. It is usually used for storing important data that must not be lost if power supply suddenly stops.

RAM – data memory used by a program during it's execution. In RAM are stored all internal results or temporary data during run-time.

PORTA AND PORTB are physical connections between the microcontroller and the outside world. Port A has five and Port B has eight pins…

FREE-RUN TIMER - is an 8 bit register inside a microcontroller that works independently of the program. On every fourth clock of the oscillator it increments its value until it reaches the maximum (255),and then it starts counting over again from zero. As we know the exact timing between each two increments of the timer contents, timer can be used for measuring time which is very useful with some devices.

CENTRAL PROCESSING UNIT has a role of connective elements between other blocks in the microcontroller. It coordinates the work of other blocks and executes the user program..



PIC16F84 microcontroller outline

Applications

PIC16f84 perfectly fits many uses, from automotive industries and controlling home appliances to industrial instruments, remote sensors, electronic door locks and safety devices. It is also ideal smart cards as well as for battery supplied devices because of its low consumption.

EEPROM memory makes it easier to apply microcontrollers to devices where permanent storage of various parameters is needed (codes for transmitters, motor speed, receiver frequencies, etc).Low cost, low consumption, easy handling and flexibility make PIC16F84 applicable even in areas where microcontrollers had not previously been considered(example: timer functions, interface replacement in large systems, coprocessor applications, etc) .

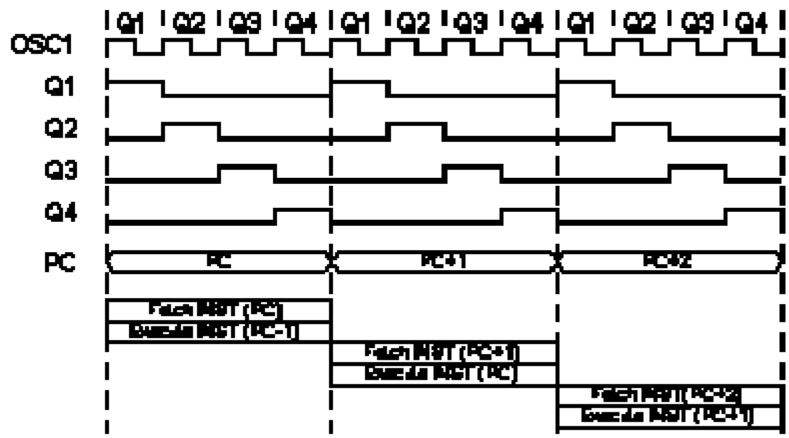
In system programming of this chip (along with using only two pins in data transfer) makes possible the flexibility of a product, after assembling and testing have been completed. This capability can be used to create assembly-line production, to store calibration data available only after final testing, or it can be used to improve programs on finished products

.CLOCK / INSTRUCTION CYCLE

Clock is microcontroller's main starter, and is obtained from an external component called an "oscillator". If we want to compare a microcontroller with a time clock, In that case, oscillator could be compared to a spring that is wound so time clock can run .Also, force used to wind the time clock can be compared to an electrical supply.

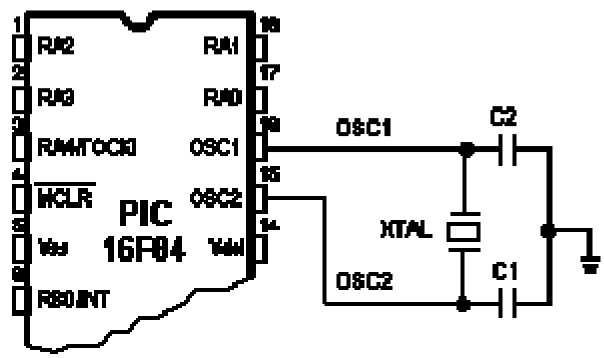
Clock from the oscillator enters a microcontroller via OSC1 pin where internal circuit of a microcontroller divides the clock into four even clocks Q1, Q2, Q3and Q4 which do not overlap. These four clocks make up one instruction cycle (also called machine cycle) during which one instruction in executed.

Execution of instruction starts by calling an instruction that is next in string. Instruction is called from program memory on every Q1 and is written in instruction register on Q4. Decoding and execution of instruction are done between the next Q1 and Q4 cycles. On the following diagram we can see the relationship between instruction cycle and clock of the oscillator (OSC1) as well as that of internal clocks Q1-Q4.Program counter (PC) holds information about the address of the next instruction.

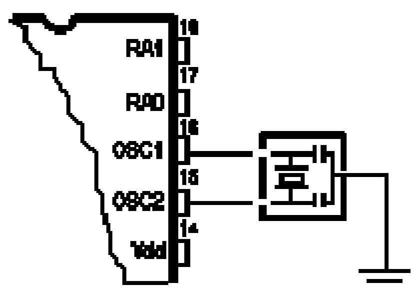


Clock/Insruction Cycle

XT - OSCILLATOR



Connecting the quartz oscillator to give clock to a microcontroller



Connecting a resonator onto a microcontroller

Crystal oscillator is kept in metal housing with two pins where written down the frequency at which crystal oscillates. One ceramic capacitor of 30pF whose other end is connected to the ground needs to be connected with each pin.

Oscillator and capacitors can packed in joint case with three pins. Such elements is called **ceramic resonator** and is represented in charts like the one above. Center pins of the element is the ground, while end pins on the microcontroller. When designing a device, the rule is to place an oscillator nearer to a microcontroller, so as to avoid any interference on lines on which microcontroller is receiving a clock.

High Performance RISC CPU Features:

• Only 35 single word instructions to learn

• All instructions single-cycle except for program

branches which are two-cycle

• Operating speed: DC - 20 MHz clock input

DC - 200 ns instruction cycle

• 1024 words of program memory

• 68 bytes of Data RAM

• 64 bytes of Data EEPROM

• 14-bit wide instruction words

• 8-bit wide data bytes

• 15 Special Function Hardware registers

• Eight-level deep hardware stack

• Direct, indirect and relative addressing modes

• Four interrupt sources:

- External RB0/INT pin
- TMR0 timer overflow
- PORTB<7:4> interrupt-on-change
- Data EEPROM write complete

Peripheral Features:

• 13 I/O pins with individual direction control

• High current sink/source for direct LED drive

- 25 mA sink max. per pin

- 25 mA source max. per pin

• TMR0: 8-bit timer/counter with 8-bit programmable prescaler

Special Microcontroller Features:

• 10,000 erase/write cycles Enhanced FLASH Program memory typical

• 10,000,000 typical erase/write cycles EEPROM Data memory typical

• EEPROM Data Retention > 40 years

• In-Circuit Serial Programming™ (ICSP™) - via two pins

• Power-on Reset (POR), Power-up Timer (PWRT), Oscillator Start-up Timer (OST)

• Watchdog Timer (WDT) with its own On-Chip RC Oscillator for reliable operation

• Code protection

• Power saving SLEEP mode

• Selectable oscillator options

CMOS Enhanced FLASH/EEPROM

Technology:

• Low power, high speed technology

• Fully static design

• Wide operating voltage range:

- Commercial: 2.0V to 5.5V

- Industrial: 2.0V to 5.5V

• Low power consumption:

- < 2 mA typical @ 5V, 4 MHz

- 15 □ A typical @ 2V, 32 kHz

- < 0.5 □ A typical standby current @ 2V

2.2 Resistor

There is another important property that can be measured in electrical systems. This is **resistance**, which is measured in units called **ohms** (□□). We also use Kilo-ohms for one thousand ohms and Mega ohms for one million ohms. Resistance is a term that describes the forces that oppose the flow of current in a conductor or wire. All materials naturally show some resistance to the flow of current. We also intentionally insert resistance to limit the value of current flowing. Thus resistors are manufactured to limit current, to divide voltage and so on. Resistance is measured using an Ohmmeter.

The most important mathematical relationship between voltage, current and resistance in electricity is called "Ohm's Law". This relationship is expressed in a formula shown below:

$$\mathbf{I = V/R,}$$

Where I = current, V = voltage, and R = resistance

2.3.1 Resistor type

Depending on their behaviors resistors are grouped into different types namely - ordinary resistor, temperature dependent resistor, light dependent resistor and voltage dependent resistors.

□ **Ordinary resistors** are the most common component in electronic circuits. These resistors are used to control that amount of current flowing in circuits and they are also used to divide voltages.

☐ **Temperature Dependent Resistors (TDR) -**They are also called thermistors. Thermistors could be either with positive temperature coefficients (PTC) or with negative temperature coefficient (NTC).

a) Negative temperature coefficient (NTC)- Their resistance value decreases with the rise of temperature. NTC resistors can be used in a temperature range from -50°C to +500°C. The nominal resistance is given for a temperature of 25°C.

b) Positive Temperature Coefficient (PTC)- Their resistance values increase with the rise of temperature. PTC resistor are made of barium-carbonate, strontium-oxide, titanium-oxide and other powdered materials. They are more difficult to produce and are therefore more expensive than NTC resistors.

☐ **Light Dependent Resistors (LDR) -** All **LDR** reduce their resistance as the light intensity increases. A photo of Cadmium-Sulfide (CdS) resistor is shown below. Its light sensitivity is similar to the human eye.

In this project the reristors we used are 330 ohm ,560 ohm the 330ohm resisror is applied in the main circuit diagram as a voltage controller to the transistor and it is also works in the battery charger circuit same application , the another resistor is works in the battery charger also for rediusing the in coming current from the main electric supply source.
And also we use the LDR (light depend resistor) this will explained in detailed in the below description.

2.3 LDR (light depend resistor)

LDR is one type of resistor that depended on the light fall on it, so based on that the LDR reduce their resistance as the light intensity increases. A photo of Cadmium-Sulfide (CdS) resistor is shown below. Its light sensitivity is similar to the human eye. A **photo-resistor** or **light dependent resistor** is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. It can also be referred to as a **photoconductor** or CdS device, from "cadmium sulfide," which is the material from which the device is made and that actually exhibits the variation in resistance with light level. Note that although CdS is a semiconductor, it is not doped silicon.

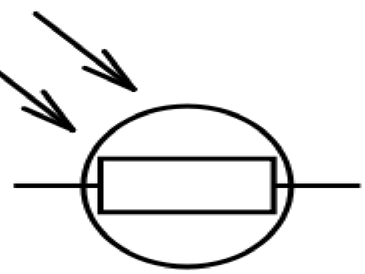


Figure 2.2 LDR Block

In this project there are two light dependent resisters , used to detect or sense the light of the environment and then give an information to the microcontroller PIC16F84A.The LDR we used in this project is the Cds(Cadmium – Sulfide) ,as shown in the above picture this type of LDR is highly sensitive to light that approached to it. As we discuses without this component this project is like a human without an eyes.

Figure 2.3 Cds LDR photo resistor cells

2.3.1 CdS photoresistor cells

As with Walter's turtle type robot, we use two CdS photo resistor cells . The CdS photo resistors (see Fig. 9.18) used in this robot have a dark resistance of about 100 kV and a light resistance of 10 k V. The CdS photo resistors typically have large variances in resistance between cells. It is useful to use a pair of CdS cells for this robot that matches, as best as one can match them, in resistance. Since the resistance values of the CdS cells can vary so greatly, it's a good idea to buy a few more than you need and measure the resistances to find a pair whose resistances are c lose. There are a few wayes you can measure the resistance. The simplest method to use a volt ohmmeter set to ohms. Keep the light intensity the same as you measure the resistance. Choose two CdS cells that are closely matched within the group of CdS cells you have.

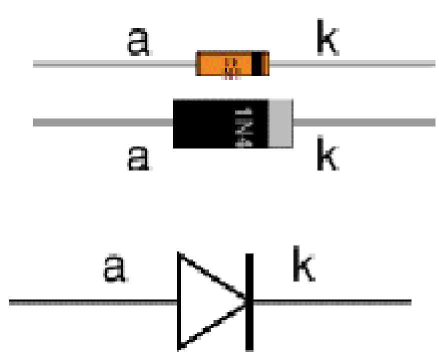
A photoresistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its whole partner) conduct electricity, thereby 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, e.g. 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 bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., 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. Photoresistors are basically photocells

2.4 Diode

A diode is a two terminal device and usually one of its terminals has a marking

(white band or colored) that identifies it as a cathode. Physically a diode looks like the picture shown below and its symbol looks like this➔



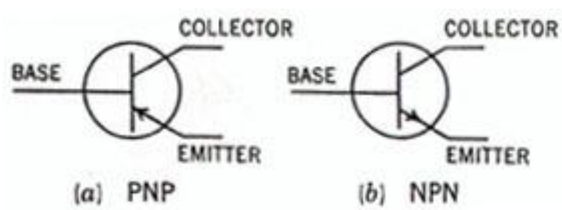
Diodes are sometimes packaged and used in electronic equipments. Such diodes are called bridge diodes.In this project we used the **1N4002** type of diode, it is very applicable in the decreasing the coming current to the battery.

2.5 Transistor

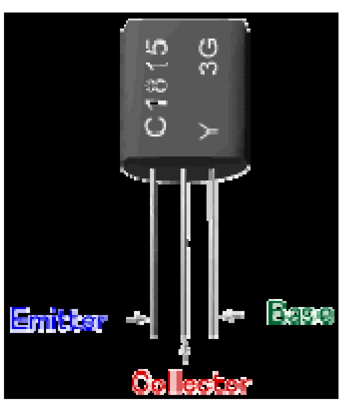
A transistor is a three terminal device. These terminals are called collector, emitter and base for one group of transistors and drain, source and gate for another group. There are different types of transistors but it suffices us to group them into bipolar and Uni-polar transistors. It is very difficult to differentiate bipolar and uni-polar transistors simply by looking at them. Usually codes or designations are printed on them that could at least give us an indication of the type of a transistor.

We shall see later the designation of transistors. Below are pictures and symbols of transistors

A) Bipolar transistor look like the pictures below.



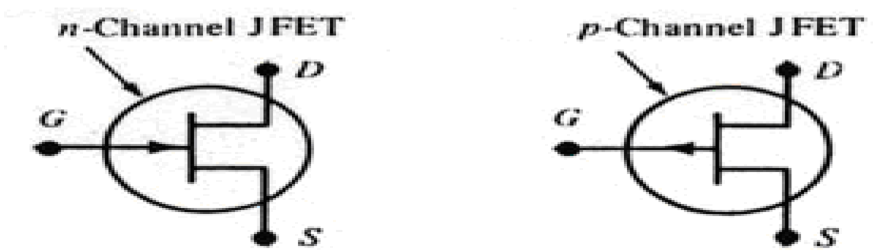
Physically they look like as shown below



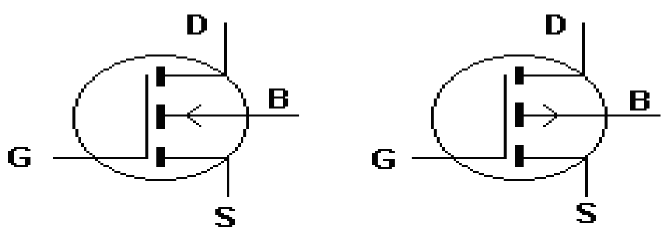
B) **Unipolar Transistors or Field Effect Transistor (FET)**

Field effect transistors are of two types : Junction field effect transistors (JFET) and Metal Oxide Semiconductor field effect transistors (MOSFET).

☐ Junction Field effect transistor (**JFET**)



☐ Metal Oxide Semiconductor FET (**MOSFET**)



2.5.1 Transistor application

1. **Transistor as an amplifier**

Amplifiers are used to increase the voltage or power amplitude of signals. The ratio of voltage or power out, to the voltage or power in is the power gain or voltage gain of the amplifier. The first amplifier which is connected to a transducer is called pre-amplifier. An amplifier which drives a load is called final or power amplifier.

Amplifiers are grouped according to the frequency range they are intended to amplify.

2. Audio Amplifier– this amplifier is designed to amplify signals having frequencies between 20Hz and 20000Hz (20 KHz).

3. Intermediate Frequency (IF) Amplifiers - these amplifiers are used in radio and television receivers.

High frequency signals are changed to the lower intermediate frequency by a *frequency—changer (Mixer*) circuit. The IF in A.M. radios is about 455 KHz. In F.M. radios it is 10.7 MHz.

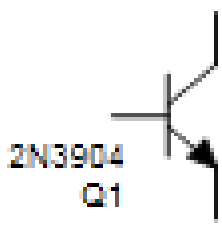
4. Radio Frequency Amplifiers- amplify high frequencies. Radio frequencies extend from about 30 KHz up to several thousand MHz. This frequency range is divided into frequency bands. These bands of frequencies are selected by a *band pass filters* or *band selector switches*.

5. Wide Band Amplifiers—are designed to amplify a very wide band of frequencies, say from a few Hertz up to several hundred Mhz.

6. Video Amplifiers—are used in television cameras, television receivers, video cassette recorders etc. The bandwidth extends from DC up to about 6MHz.

7. Differential Amplifiers– these amplifiers have two inputs and amplify the *difference* between the two input voltages.

The type of transistor we used in this project is **NPN 2N3904**. Two 2N 3904 transistors are use for two purposes in the circuit. The first thing is as an amplifier for the motors and the other is as a switch to the two motors , It means that when the light of the environment is there in the right or left of the robot. For instance,if the light is in the left side of the robot senses light the microcontroller processes and perform the programmed action for the motor output. .



$$Rb = \frac{hFE \times Vcc}{5 \times Ic} \qquad hFE > 5 \times \frac{Ic}{Ib}$$

$$Rb = \frac{200 \times 5}{5 \times 800mA} \qquad hFE > 5 \times \frac{800mA}{25mA}$$

$$Rb = 250\Omega \approx 330\Omega \qquad hFE > 160 \qquad RL = \frac{3V}{800mA} = 3.75\Omega$$

2.6 Capacitor

Capacitors **store electrical energy** in the form of an electrical field.

2.6.1 Capacitor Parameters

Capacitors are defined by their capacitance values and their voltage handling capacity. Some capacitors are also polarity sensitive and care has to be taken when connecting them in a circuit.

Capacitance values and the working voltage are imprinted on the body of a capacitor. The applied voltage has to be less than ¾ th of the working voltage of the capacitor.

Capacitors have the capability to **store energy** in the form of electrostatic field. Their ability to store energy is called its capacitance. The capacitance of a capacitor depends on the physical dimensions and type of material used to build the capacitor. The measure of capacitance of a capacitor is Farad. A capacitance of one Farad (F) is too large for most electronics applications, and components with much smaller values of capacitance are normally used. Three smaller units
are used, µ (micro), n (nano) and p (pico):

☐ µ means 10^{-6} (millionth), i.e. 1000000µF = 1F

☐ n means 10^{-9} (thousand-millionth), i.e. 1000000000 nF = 1

☐ p means 10^{-12} (million-millionth), i.e. 1000pF = 1nF

2.7 DC Motors

In general, DC motors are similar to DC generators in construction. They may, in fact, be described as generators “run backwards.” When current is passed through the armature of a DC motor, a torque is generated by magnetic reaction, and the armature revolves. The action of the commutation and the connections of the field coils of motors are precisely the same as those used for generators.

The revolution of the armature induces a voltage in the armature windings. This induced voltage is opposite in direction to the outside voltage applied to the armature, and hence is called back voltage or counter electromotive force (emf). As the motor rotates more rapidly, the back voltage rises until it is almost equal to the applied voltage. The current is then small, and the speed of the motor will remain constant as long as the motor is not under load and is performing no mechanical work except that required to turn the armature. Under load the armature turns more slowly, reducing the back voltage and permitting a larger current to flow in the armature. The motor is thus able to receive more electric power from the source supplying it and to do more mechanical work.

Because the speed of rotation controls the flow of current in the armature, special devices must be used for starting DC motors. When the armature is at rest, it has virtually no resistance, and if the normal working voltage is applied, a large current will flow, which may damage the commutation or the armature windings. The usual means of preventing such damage is the use of a starting resistance in series with the armature to lower the current until the motor begins to develop an adequate back voltage. As the motor picks up speed, the resistance is gradually reduced, either manually or automatically.

The speed at which a DC motor operates depends on the strength of the magnetic field acting on the armature, as well as on the armature current. The stronger the field, the slower is the rate of rotation needed to generate a back voltage large enough to counteract the applied voltage. For this reason the speed of DC motors can be controlled by varying the field current.

Figure 2.4 DC motor

2.8 Battery

2.8.1 Normal Battery

Battery, also electric cell, device that converts chemical energy into electricity. Strictly speaking, a battery consists of two or more cells connected in series or parallel, but the term is also used for single cells. All cells consist of a liquid, paste, or solid electrolyte and a positive electrode, and a negative electrode. The electrolyte is an ionic conductor; one of the electrodes will react, producing electrons, while the other will accept electrons. When the electrodes are connected to a device to be powered, called a load, an electrical current flows.

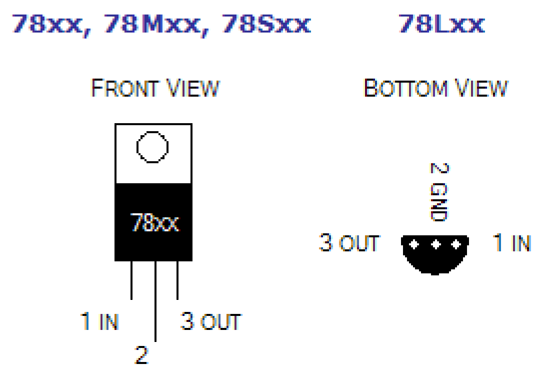
2.8.2 Chargeable Battery

Batteries in which the chemicals cannot be reconstituted into their original form once the energy has been converted (that is, batteries that have been discharged) are called primary cells or voltaic cells. Batteries in which the chemicals can be reconstituted by passing an electric current through them in the direction opposite that of normal cell operation are called secondary cells, rechargeable cells, storage cells, or accumulators.

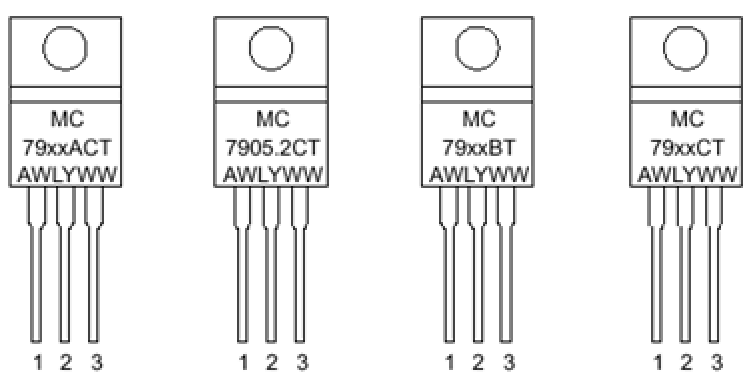
2.9 Regulator

There are two types of regulator

A, negative voltage regulator



B, positive voltage regulator



2.9.1 Regulator LM7805

The LM78XX IC's are regulator IC's and regulated positive respective XX outputs. The LM79XX IC's also regulators but with Negative outputs and mostly used with dual power supply circuits.

The regulator LM7805 is used to convert unregulated DC supply to regulated 5volt output. This regulator has a minimum voltage of 8Volts and maximum voltage of 34Volt range. The LM7805 has a voltage reference, opamp (comparator), and switching transistor in side. Heat sink can be installed with the regulator IC for a current up to 1A.but for low current applications the IC can be connected without heat sink.

2.10 Switch

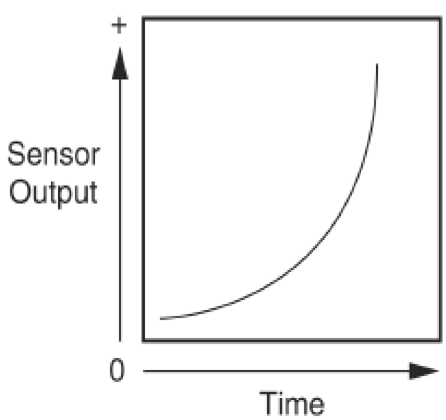
Switch is a passive component which is used to turn on and off the current passing through and from any power supply to a circuit. In this project we use two switches, one for the whole circuit to on and off the power coming from the battery source. And the second switch is used in the chargeable battery that controls from the main power supply.

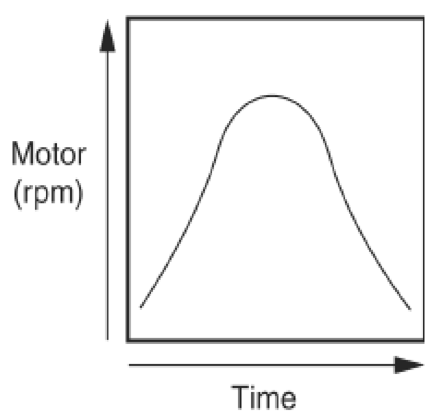
CHAPTER III: METEDOLOGY

3.1 Block diagram

The working principle of this Programmable light tracking robot is based on the inputs of the LDR, First the LDR is connected in series with the capacitor. The other end of the capacitor is also connected to the ground and the LDR pin is connected with the microcontroller…

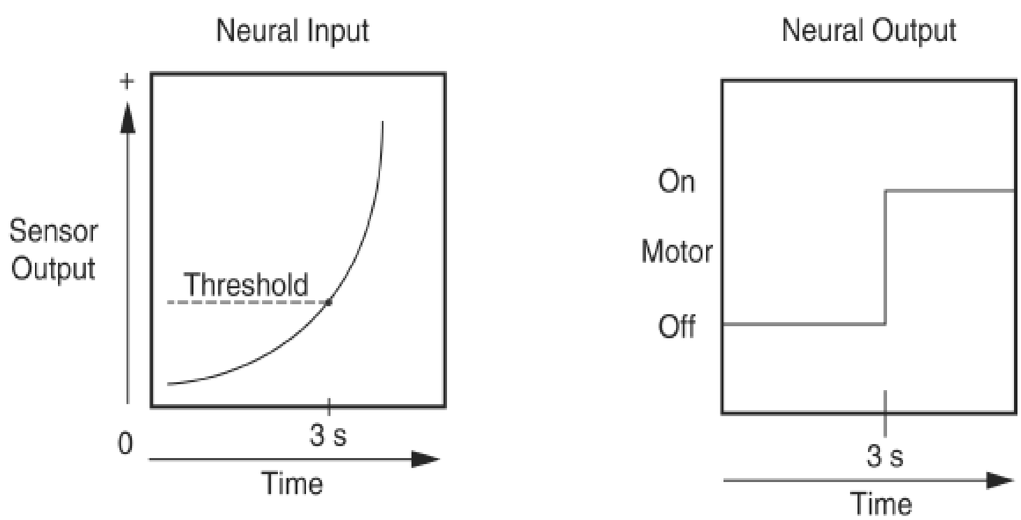
When light falls on the LDR the resistance of the LDR varies from 10K ohm-100K ohms. This charges the capacitor at a time of T=RC (Time sec, R=ohms, C=farad). The time duration to discharge the capacitance is measured by the microcontroller and is compared between the two LDR and Capacitive circuits.





The microcontroller process registers and in codes the data according to the program written by the programmer. Then this microcontroller decides according to the program and made the output pins high or low respectively. The microcontroller output through pins is either (high or low, true or false,1 or 0). When the output pin is high this represents five volts and when the output is low this represents zero volts.

The output of the microcontroller is directed to the base resistor of the transistor (2N3904).when the output gives true or 5V and current of 25mA to the base of the transistor amplifies the current from collector to emitter. This transistor is also used as a switch between the collector and emitter to the motor.



In order to protect the transistor from back EMF from the motor, the transistor is connected with a diode. That is the P type of the diode is connected to the emitter and the N type of the diode is connected to the collector. when the back EMF is generated from the motor the voltage discharged through the diode to the source.

Power supply : The power supply of this programmable light tracking robot project is first supplied with a 9 volt DC battery. This 9 volt battery is feed to the input of IC (LM7805). The LM7805 regulates the input voltage at an output of positive 5 volts. This +5volts is given to supply the microcontroller.

The LM7805 in put is connected with a capacitor of (10uf 20V) and output capacitor (100uf 20V).This capacitors are used to discharge noise and keep the output filtered.

A chargeable battery (4V, 900mA) is connected with the collector of the two outputs of the transistors in series connected with a silicone diode. The negative terminal of the battery is connected to the ground. The chargeable battery supplies the output motors. The chargeable battery is connected with the charging circuit in series with a switch. The charger have an input voltage of 220V AC and an output of 12V DC.

3.2 Circuit Diagram

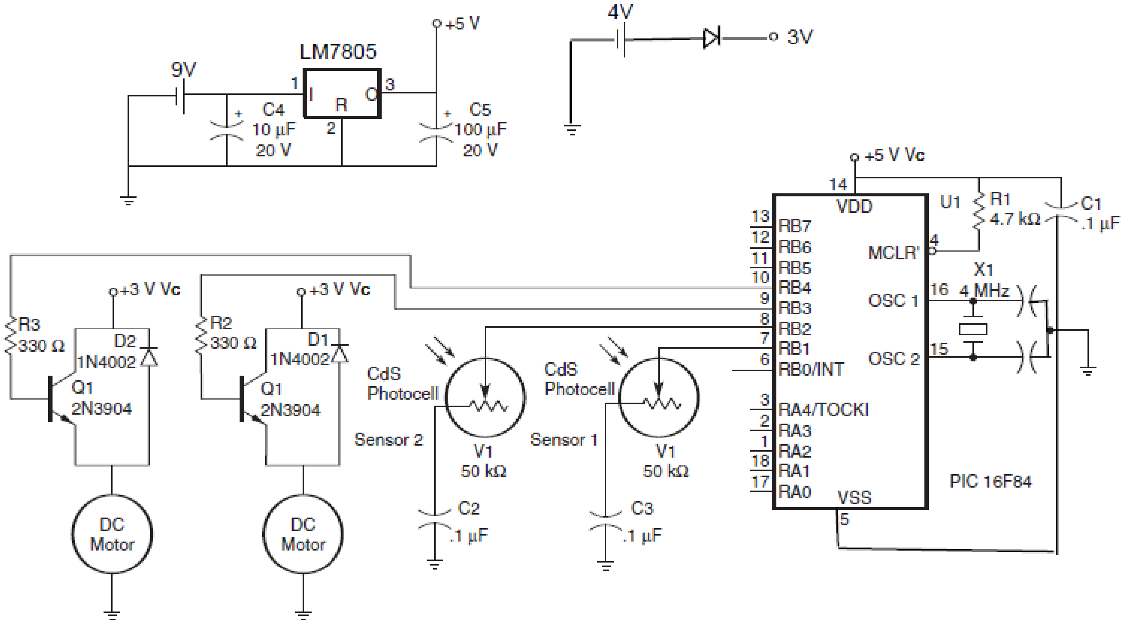


Figure. 3.1 PROGRAMMABLE LIGHT TRACKING ROBOT CIRCUIT DIAGRAM.

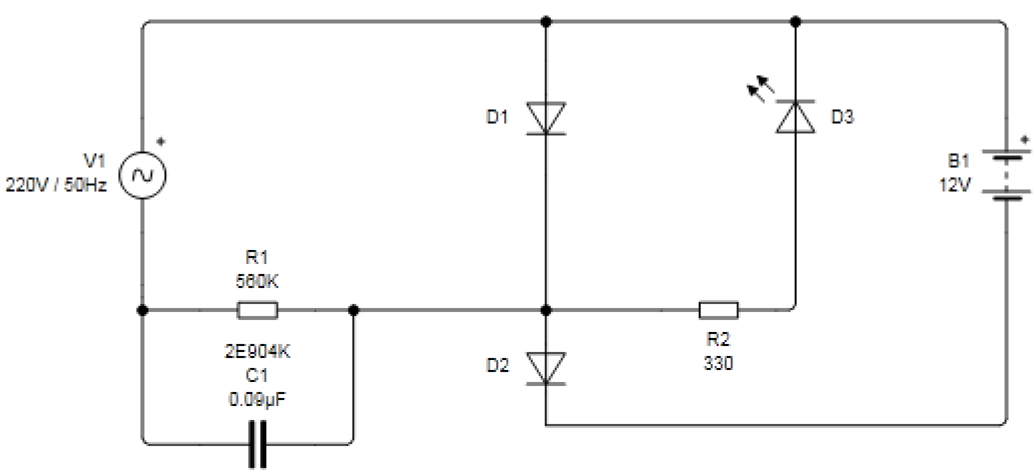


Figure 3.2 BATTERY CHARGER CIRCUIT DIAGRAM.

3.2.1 Battery Charger:

The battery charger charges the 4 Volt Chargeable battery supply of the motors. This battery supply have an input voltage of 220VAC. The AC voltage rectifies through D1 and D2 and filtered by the C1 (2E904K) capacitor. The light emitting diode (LED) indicates the supply power is ON and also when the battery charger starts to charge and the battery is charged up to 4Volts it indicates a dim light indicating the battery is fully charged.

3.2,2 Software Development:

The PIC16F84 microcontroller is programmed by the Hi tech C Compiler software of PIC 10/12/16.To Program a microcontroller first the program must be written according to the language of the compiler. When the codes are written to the compiler the compiler checks for syntax and Error in the program according to the rule's set of the library of the compiler.

The program is then converted to an assembly language (.ASM) and finally to a machine language called HEX by the Assembler. The HEX machine language is programmed through a programming board (Pik Kit 2) using a software.

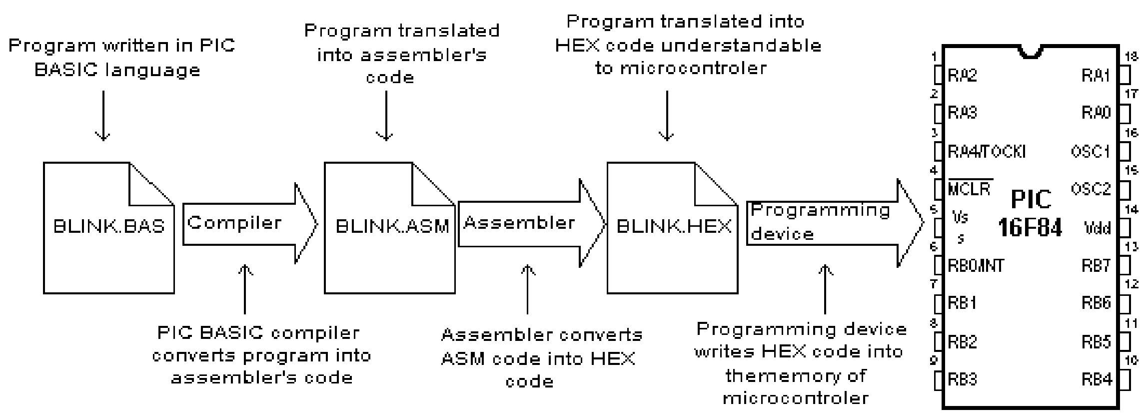


Figure 2.3 Soft ware Block diagram

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The HEX will be simulated to check the logic of the program by a simulating software. The simulating software reads the low level HEX file and tests the microcontroller with it,s external discrete components. This could be an input or an output. If the logic of the designed compiled program is correct the simulator shows the exact desired output to the programmer Otherwise the programmer must return to the compiler and correct the codes to acquire the needed output. In our project we use **Real Pic Simulator** software as a simulator.

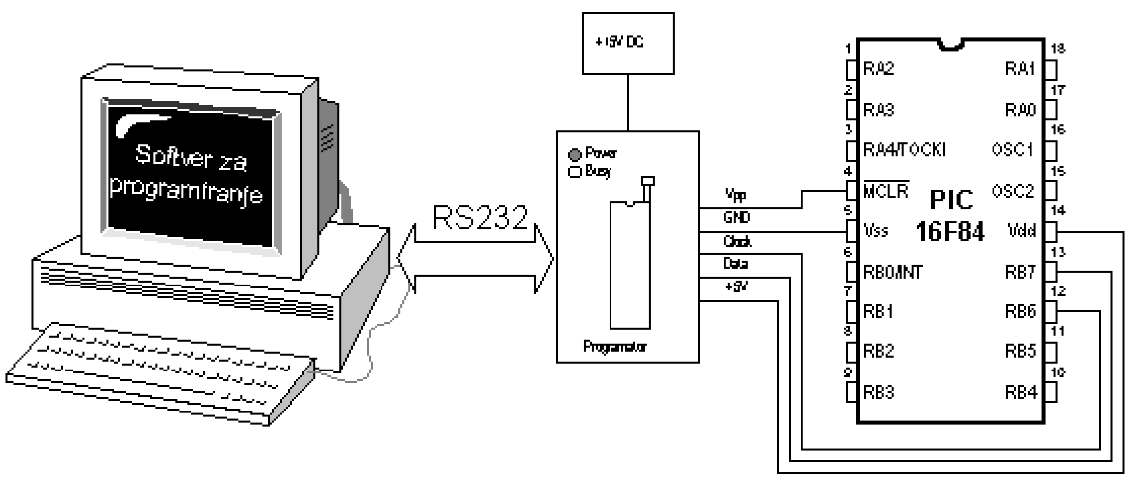

Figure 3.4 Burring the microcontroller

Project Codes:

C programmed

```
#include<htc.h>
__CONFIG(0x3FF1);

#define PORTBIT(adr, bit)       ((unsigned)(&adr)*8+(bit))
#define _XTAL_FREQ 4000000
static bit LD1 @ PORTBIT(PORTB,2);
static bit LD2 @ PORTBIT(PORTB,3);
void init(void)
{
TRISB=0b00001100;
OPTION_REG = 0b10000000;  //Diable the pull ups resistor
INTCON= 0b01000000;
T0IE=  0b00000001;
}
void forward();
void right();
void left();
void sleep();
void avoid();
unsigned char LDR;
unsigned char LDR1;

void main(void)
{
init();
while(1)
{
```

```
PORTB=0b00000100;
__delay_ms(10);
TMR0=0x00;
while(!LD1)
{
LDR=TMR0;
}
PORTB=0b00001000;
__delay_ms(10);          //delay for 10 ms
TMR0=0x00;               //Initialize timer zero
while(!LD2)
{LDR1=TMR0;}
if(LDR<12)               //Bright Light
{avoid();}
else if (LDR1>230)       //Dark Light discharge cap longer
{sleep();}
if ((LDR>=12)||(LDR1<=230))
{if(LDR==LDR1)           //Same Light
{forward();}
else if(LDR>LDR1)
{right();}
else{left();}}}}

void forward()
{PORTB=0b00000011;
__delay_ms(1000);
};

void right()
{unsigned char a;
a=LDR-LDR1;
```

```
if(a>15)
{PORTB=0b00000001;
__delay_ms(1000);}
else {forward();}};

void left()
{unsigned char b;
b=LDR1-LDR;
if (b>15)
{PORTB=0b00000010;
__delay_ms(1000);}
else {forward();}};

void avoid()
{PORTB=0b00000011;
__delay_ms(1000);
PORTB=0b00000010;
__delay_ms(2000);
PORTB=0b00000001;
__delay_ms(2500);
};

void sleep()
{PORTB=0b00000000;
__delay_ms(1000);};

void interrupt my_isr(void)
{while(T0IF)
{T0IF=0;}
}
```

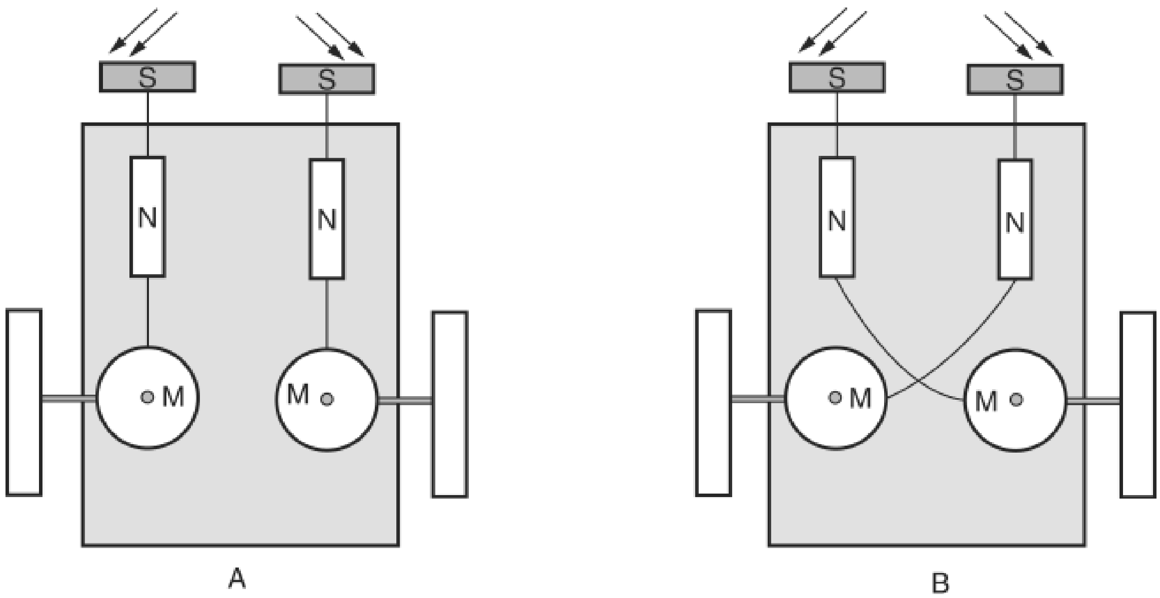

Figure 3.5 Block diagram of the external robot

The gearbox motor is a 918D type. The gearbox motor at the top of the picture has an orange cowl that is covering the gears. Notice the flat mounting bracket that is perfect for securing to the vehic le base. The doublesided tape is cut lengthwise to fit the base of bracket to the gearbox motor. The exposed side of the tape is immediately secured to the gearbox motor brac ket.

Then the motor is positioned on the bottom of the vehic le base, the protective covering of the tape is removed, and the gearbox motor is firmly placed onto the bottom of the vehicle base. The second gearbox motor is secured to the other side in a similar manner .

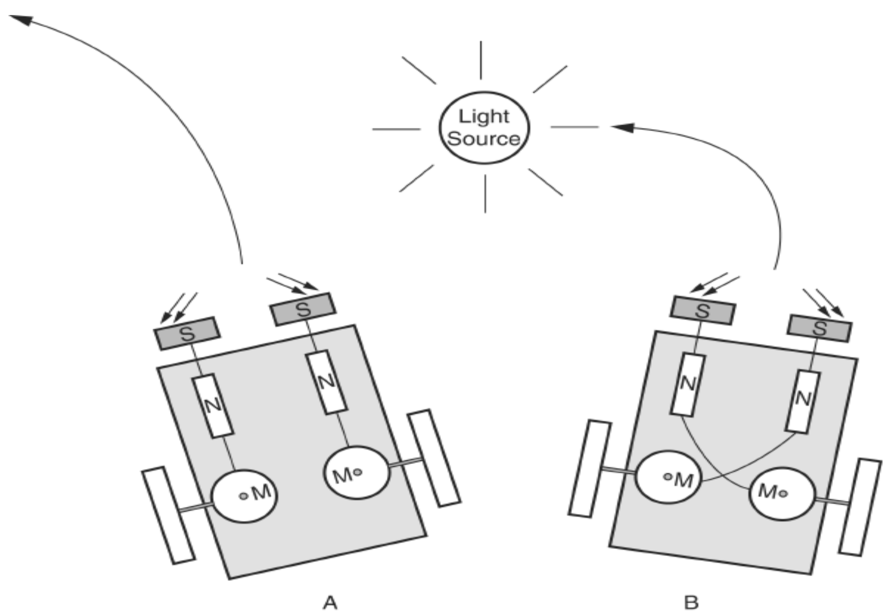

Figure 3.6 Movement of the robot

CHAPTER IV:
FUTURE DEVELOPMENT AND CONCULUSION

4.1 Future development

In the developing world of robotics, more advanced robots are been developed in many ways to help the human being. This robot for instance can be made in large size and can help in mining and tunnel workstations for transporting of materials as well as goods.

This kind of robot is the basic for other advanced robots, and it can be improved for advanced robots. Samples are vacuum cleaner robot, satellite based robot, theft security robot with a camera systems….etc

Figure 3.7 Future development

CONCULUSION

The programmable light tracking robot that we develop in the MPLAB-IDE studio using embedded c language is to send a commanding signal to the motors, when deem light and high light has fall to the LDR it send a varied voltage to the microcontroller based on the program the motors will get an action.

In this project we used two LDR and two motors, those two pairs of components are interfaced by the Neuron (nerve) that is the microcontroller.

The interfacing technique is the left side LDR connected to the right side motor, and the right side LDR is connected to the left motor. The reason of this is that when the robot wants to turn right the Neuron ordered the lift side motor and vice verse.

REFERENCE BOOK

1. PIC microcontrollers, for beginners too by Nebojsa Matic
2. Pic robotics by John Lovine
3. Pic in practice by D.W Smith

Web sites

1 www.mplab.com