الجمهورية الجزائرية الديمقراطية الشعبية
Democratic and Popular Republic of Algeria
وزارة التعليم العالي و البحث العلمي
Ministry of Higher Education and Scientific Research

Med Khider University of Biskra
Faculty of Science and Technology
Department of Electrical Engineering
Sector: Electronics
Option: microelectronics

Réf:............

Memory End of Studies

For graduation:

MASTER

theme

Mobile robot avoid obstacles with a movable head

Presented by:
BOULANOUAR ABDELHAFID
sustained: 04 Juin 2013

the jury:

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Favorable opinion Framing:

Nom Prénom *signature*

Favorable opinion of the President of the Jury

Nom Prénom *Signature*

Stamp and signature

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offered by: Boulanouar abdelhafid
directed by: Guesbaya tahar

ABSTRACTS (English)

English

The objective of this research is to develop a mysterious obstacle avoidance system independent mobile robot using sensors detect infrared. This study presents appreciate mobile robot based on behavior. Mobile robot is able to interact with the environment is unknown reaction using a strategy determined by sensory information. Current research in the field of robotics and aims to build intelligent and autonomous robots, which can plan the movement in a dynamic environment. And use autonomous mobile robots are increasingly well structured environment such as warehouses, offices and industries. Mysterious behavior able to make inferences is well suited for mobile robot navigation because of the uncertainty of the environment. Control was implemented fuzzy rule-based behavior with reaction and tested on two wheels mobile robot equipped with infrared sensor is installed on top of mobile navigation performance of the collision. This head provides the robot supple

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All thanks to my friends for them helps.

All thanks too to my family for the big support.

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ABSTRACTS (French and Arabic and English)

French

L'objectif de cette recherche est de développer un système d'évitement obstacle robot mobile autonome mystérieux utilisant des capteurs détectent infrarouge. Cette étude présente apprécient robot mobile basée sur le comportement. Robot mobile est capable d'interagir avec le milieu réactionnel est inconnue à l'aide d'une stratégie déterminée par l'information sensorielle. Les recherches actuelles dans le domaine de la robotique et vise à construire des robots intelligents et autonomes, qui peuvent planifier le mouvement dans un environnement dynamique. Et utiliser des robots mobiles autonomes sont de plus en plus l'environnement bien structuré tels que les entrepôts, bureaux et industries. Comportement mystérieux pouvoir de faire des inférences est bien adapté pour la navigation robot mobile en raison de l'incertitude de l'environnement. Contrôle a été mis en œuvre comportement floue basée sur des règles avec réaction et testé sur deux robot mobile sur roues équipée d'un capteur infrarouge est installé sur le dessus de la performance de navigation mobile de la collision. Cette tête offre aux robots souple océan plus grand autour de

Arabic

الهدف من هذا البحث إلى تطوير نظام تجنب عقبة غامض لالروبوت المتحرك مستقلة باستخدام أجهزة استشعار كشف الأشعة تحت الحمراء. ويعرض هذه الدراسة قدرة الروبوت المتحرك القائم على السلوك. الروبوت المحمول هو قادرة على التفاعل مع بيئة غير معروف يستخدم إستراتيجية رد الفعل تحددها المعلومات الحسية. البحوث الحالية في مجال الروبوتات تهدف لبناء الروبوتات المستقلة والذكية، والتي يمكنها ايجاد خطة الحركة في بيئة ديناميكية. وتستخدم الروبوتات المتحركة ذاتية الحكم على نحو متزايد في بيئة تنظيما جيدا مثل المستودعات والمكاتب والصناعات. سلوك غامض قادرة على جعل الاستدلالات هي مناسبة تماما لروبوت المتحرك الملاحة بسبب عدم التيقن من البيئة. وتم تنفيذ تحكم غامض قائم على قواعد السلوك مع رد الفعل واختبارها على الروبوت ثنائي العجلات المتحرك مزودة بأجهزة استشعار الأشعة تحت الحمراء المثبت على راس متحرك لأداء الملاحة للتصادم. وهذا الراس يوفر على الربوت نضرة اكبر على المحيط حوله

English

The objective of this research is to develop a mysterious obstacle avoidance system independent mobile robot using sensors detect infrared. This study presents appreciate mobile robot based on behavior. Mobile robot is able to interact with the environment is unknown reaction using a strategy determined by sensory information. Current research in the field of

robotics and aims to build intelligent and autonomous robots, which can plan the movement in a dynamic environment. And use autonomous mobile robots are increasingly well structured environment such as warehouses, offices and industries. Mysterious behavior able to make inferences is well suited for mobile robot navigation because of the uncertainty of the environment. Control was implemented fuzzy rule-based behavior with reaction and tested on two wheels mobile robot equipped with infrared sensor is installed on top of mobile navigation performance of the collision. This head provides the robot supple

1. Introduction

The simplest definition of a robot could be "a mechanism which moves and reacts to its environment", and there are many robot starter kits which use this definition in some form. The simplest of these I have seen is a fact file type book with a tray of electric and simple mechanical components together with an envelope of card board press out parts and stencils allowing the construction of a variety of wheeled and legged mechanisms which are crudely able to interact with the environment Although the build quality is questionable this and other such kits give a good feel for the spirit of the robot concept.

2.Why build robots?

Robots are indispensable in many manufacturing industries. The reason is that the cost per hour to operate a robot is a fraction of the cost of the human labor needed to perform the same function.

More than this, once programmed, robots repeatedly perform functions with a high accuracy that surpasses that of the most experienced human operator. Human operators are, however, far more versatile. Humans can switch job tasks easily. Robots are built and

programmed to be job specific. You wouldn’t be able to program a welding robot to start counting parts in a bin. Today’s most advanced industrial robots will soon become “dinosaurs.” Robots are in the infancy stage of their evolution. As robots evolve, they will become more versatile, emulating the human capacity and ability to switch job tasks easily. While the personal computer has made an indelible mark on society, the personal robot hasn’t made an appearance. Obviously there’s more to a personal robot than a personal computer. Robots require a combination of elements to be effective: sophistication of intelligence, movement, mobility, navigation, and purpose. [1]

3.Types of robots by profession

Types of robots come in all shapes and sizes. The purpose of each robot type is engineered to perform and carry out its given responsibility. The different types of robots are designed to operate in a fashion that helps our everyday lives. They're built with us in mind and have really improved our overall environment. Below is a list of the primary types of robots in the world today.

3.1 Maintenance robot

Maintenance robots specially designed to travel through pipes, sewers, air conditioning ducts, and other systems can assist in assessment and repair. A video camera mounted on the robot can transmit video pictures back to an inspecting technician. Where there is damage, the technician can use the robot to facilitate small repairs quickly and efficiently.

Fig. I.1: Maintenance robot

3 .2 Rescue Robot

A rescue robot is a robot that has been designed for the purpose of aiding rescue workers.

The Idea

●Support Humans
●Better possibility finding accident
victims
●Reduce risk of injurities or mortality rate
of rescue forces
●Supply victims with medicine , food
●Security [11]

- **Different types of rescue robots**

There are mainly four types of rescue robots according to that can be categorized like this:
There are mainly four types of rescue robots , that
can be categorized like this:

- **UGVs** – Unmanned Ground Vehicles. These robots works on the
ground and can help rescuers to find and interact with trapped or
hurt victims, in areas were human can not enter.
- **UAVs** – Unmanned Aerial Vehicles. These robots can easily
transport medical treatments to victims and can give the
responders a bird view of the situation.
- **UUVs** – Unmanned Underwater Vehicles. These robots can search
trough water and find victims, dangerous subject or substance.
Cannot use GPS signals yet.
- **USVs** – Unmanned Surface Vehicles. These robots works on the
water surface, and can help rescuers to locate and bring the right
equipment to the victims.

The rescue robots can further be divided in three groups,
depending on the model size. When choosing the size its
important to know what the robot should be capable of and how
soon after a disaster it might be used. The sizes are: Manpackable,
Man-portable and Maxi-sized.
Man-packable is typically small and they can easily be carried to
the disasters hot zone immediately.

Man-portable is little bigger in size and may need two person, or
a vehicle to be carried. These robots often need to wait before the path is curved up. *Maxi-sized* robots is the biggest type and they need trailers for transportation, and they can be used in the hot zone and directly on the rubble [12].

Fig. I.2 types of rescue robots

•Obviously, a system without a person in it

•It provides some form of mobility

- Flying, swimming, driving, crawling

•They come in many variants

•Some are tethered, some are not

•Some are tele-operated, some are not

•Some are autonomous, and some are more intelligent than others

3.3 Mobile Robot

These types of robots are automated machines capable of moving around in their environment. They are found in factory, military and security environments. They also appear in consumer products such as vacuum cleaners and blenders. Another great example of these robots is from a robot company called Kiva. They develop robots that have replaced humans in factories. Large companies including Amazon and Gap have jumped on the bandwagon. Here's what happens when Microsoft get a hold of a mobile robot and incorporates the Kinect into a mind-blowing reality

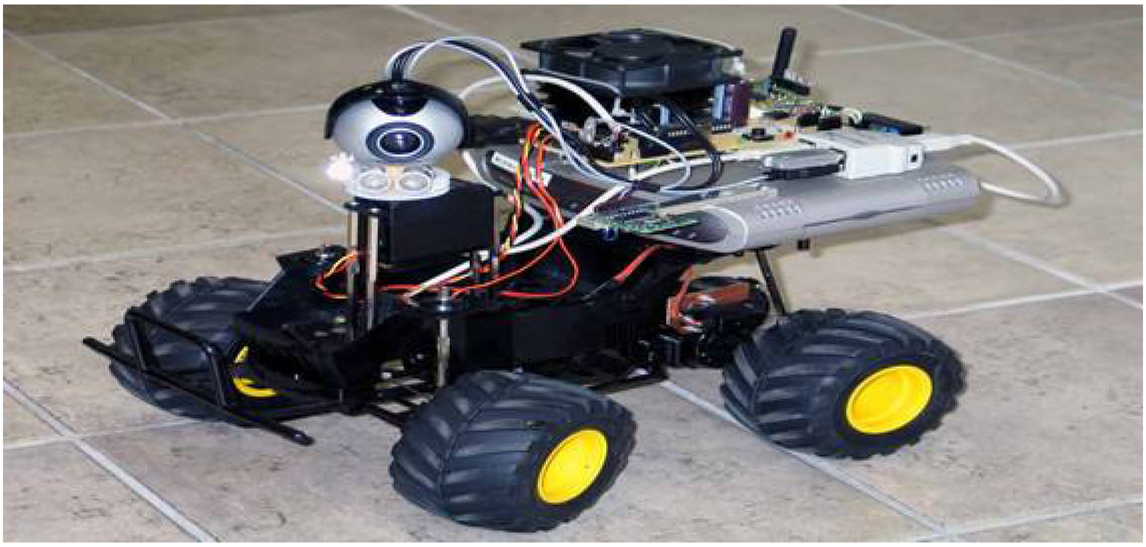


Fig. I.3 : mobile robot

3.4 Fire-fighting robots

Better than a home fire extinguisher, how about a home fire-fighting robot? This robot will detect a fire anywhere in the house, travel to the location, and put out the fire. Fire-fighting robots are so attractive that there is an annual national fire-fighting robot competition open to all robotists. The Fire-Fighting Home Robot Contest is sponsored by Trinity College, the Connecticut Robotics Society, and a number of corporations. Typically a firefighting robot becomes active in response to the tone from a home fire alarm. During the competitions, its job is to navigate through a mock house and locate and extinguish the fire.

Fig. I.4: Fire-fighting robots

3.5 Domestic robots

Domestic Robots complete household chores such as vacuuming. These types of robots are where the most growth is going to occur in the near future. In years to come, every household will have Domestic Bots which at that time will perform a substantial amount of chores. How would you like a robot that cleaned your room, took out the trash and mowed your lawn?

Until these types of robots become a reality, check out the most recognizable domestic robot on the planet. With more than 6 million sold, the iRobot Roomba Vacuum is top of its class

Fig. I.5 : Domestic Robots

3.6 Military robots

These types of Robots are already being . The purpose of these Bots is to help our military during combat and other situations. The recent advancements of military robots is amazing.

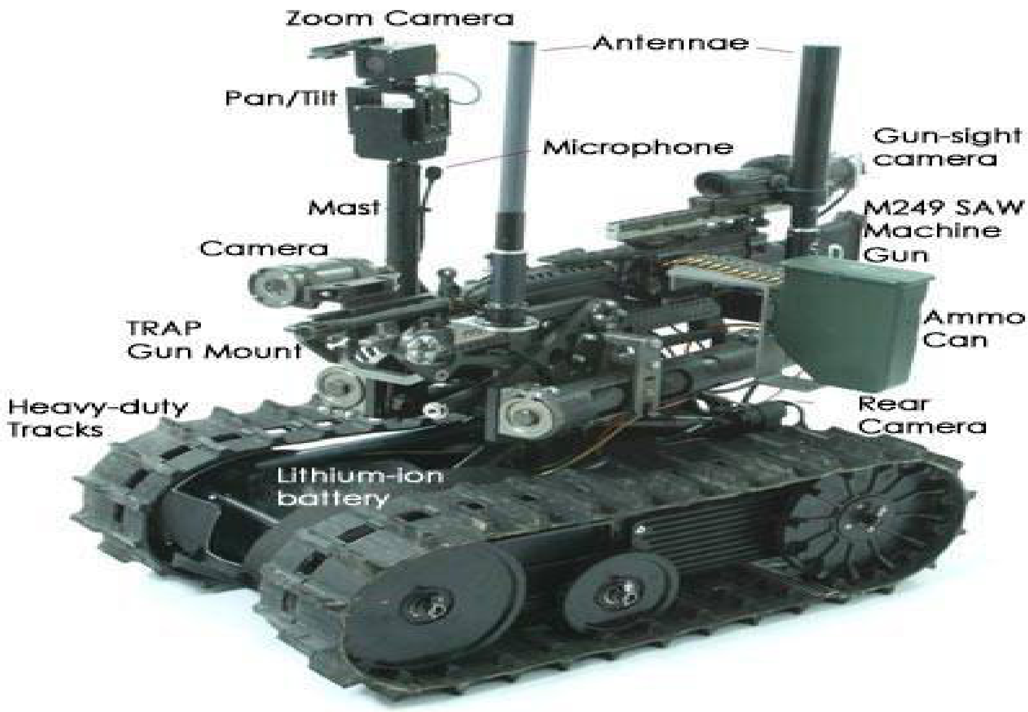


Fig. I.6 : Military Bots

3.7 Medical robots

These types of robots assist and perform medical procedures in operating rooms. This type of Robot has already taken off as surgeries have been conducted by Bots. The first Robot assisted surgery occurred in 1985 by PUMA 560. It was used to place a needle for a brain biopsy using CT guidance.

Fig. I.7 : Medical Bots

3.8 School robot

These types of robots assist teachers in getting children more motivated about learning. South Korea is the first country to develop programs to incorporate Robots in classrooms. This breakthrough personally adapts robots into our everyday lives. The children of today will grow up not knowing what the world was like when robots didn't exist. There will probably be a running joke… *"Your Daddy's so old, he had to plug in his TV to get it to work. Your Daddy's so old, he grew up without robots."*

Fig. I.8 : School Bots

3.9 Reading Robot

These types of robots aren't as interesting as the other bots however, this Robot can read newspapers, find and correct misspelled words and actually learn the literature that's it reading. They come very handy when reading bedtime stories to children. I just don't know if I'd leave them alone with your children. At least, no just yet…

Fig. I.9 : Reading Robot

3.10 Nanotechnology in robots

Nanotechnology is the control and manipulation of matter at the atomic and molecular level. It is the ability to create electronic and mechanical components using individual atoms. These tiny (nano) components can be assembled to make machines and equipment the size of bacteria. IBM has already created transistors, wires, gears, and levers out of atoms.

How does one go about manipulating atoms? Two physicists, Gerd Binnig and Heinrich Rohrer, invented the scanning tunneling microscope (STM). The tip of the STM is very sharp and its positioning exact. In 1990 IBM researchers used an STM to move 35 xenon atoms on a nickel crystal to spell the company's name, "IBM." The picture of "IBM" written in atoms made worldwide news and was shown in many magazines and newspapers. This marked the beginning of atomic manipulation. As IBM continues to improve its nanotechnology, nanotechrobotics will find many uses in manufacturing, exploration, and medicine.

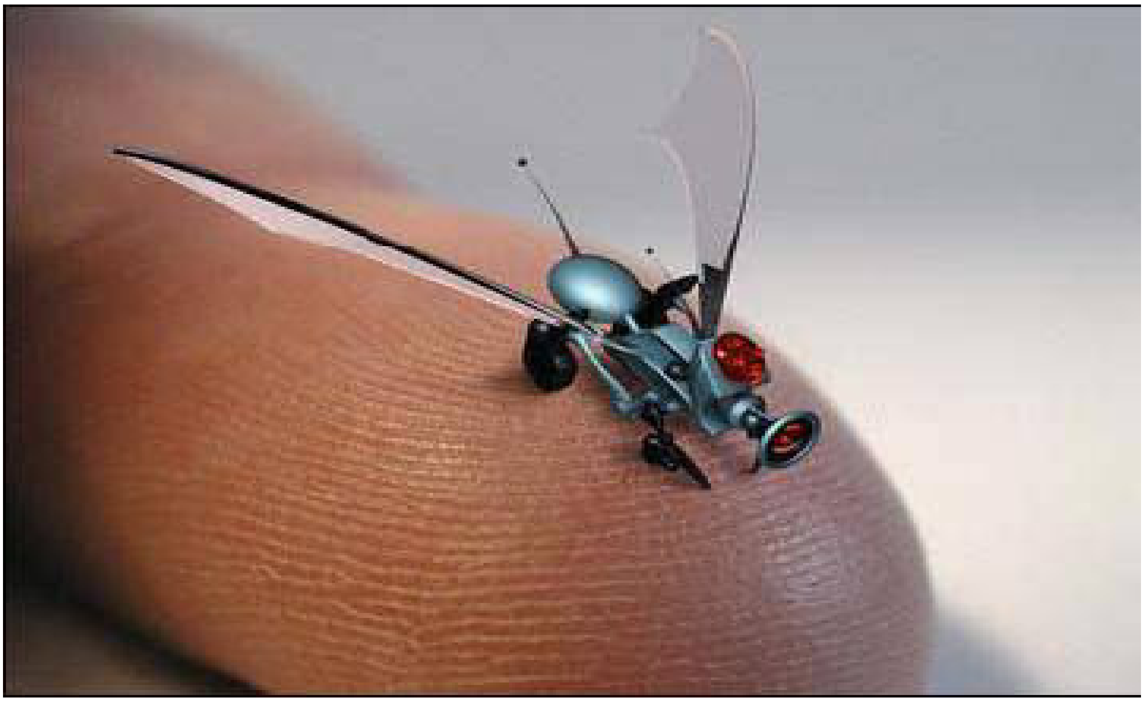


Fig. I .10: Nanotechnology in robots

4 .ROBOTS SENSORS

PROF DALE CARNEGIE

Our robots have to interact with their environment, so even what you'd think would be a dumb washing machine, that has to sense the level of water that is inside it and has to sense how heavy the clothes are. Without sensors the robot is blind, it would get no feedback, no indication of what is happening in the environment. So the sensors are the only way that the robot can find out what is happening around it.

There is a huge variety of sensors, and sometimes we don't give our robot everything we possibly could because those sensors might be very expensive or it might take the robot so long to work out all the information coming from the sensor that the robot would spend all its time doing that and no time doing what it’s supposed to.

One of the simplest sensors that we have is an infrared range finder. With an infrared sensor, we are firing out a beam of light that we can't see. We fire out the beam, and it hits whatever the obstacle is and then it comes back, and we time how long that takes, and so from working out how long it took to hit the object and come back, we can work out how far away that object was.

Some robots need to hear. Our security robot, MARVIN, he gets his instructions by you speaking to him, so he has to hear. One of our robots is designed to detect people who have been trapped under rubble, so it might be from an earthquake or it might be from a terrorist activity. So some of our robots burrow down under the ground and they are really trying to detect if there is a human trapped under there.

So how do we do that? Well, we know that a human might be moving, so we will try to detect motion. A human is hot, unless they have been dead for a while, so we will try to detect heat. If the human is breathing, they will be consuming the oxygen, releasing carbon dioxide, so we can detect the carbon dioxide. And also if the human is conscious, they might be screaming for help, so we can put the equivalent of an ear on or a microphone there. And we need to make sure that it's a human making the sound, not just rubble or falling bricks or anything like that, so we will carefully modify that sensor to make sure that we are listening for a human and not for anything else.

Yet we've got to be careful, because sometimes our robot will go down and what it will find is a fire. A fire will also produce heat, a fire will also produce carbon dioxide, so we need to make sure that we are finding a human and not something else. And in that case, we have to take that combination of all of those sensors and work them together. [5]

4.1Tactile Bump Sensors

are great for collision detection, but the circuit itself also works fine for user buttons and switches as well.

There are many designs possible for bump switches, often depending on the design and goals of the robot itself. But the circuit remains the same. They usually implement a mechanical button to short the circuit, pulling the signal line high or low. An example is the **microswitch** with a lever attached to increase its range, as shown above.

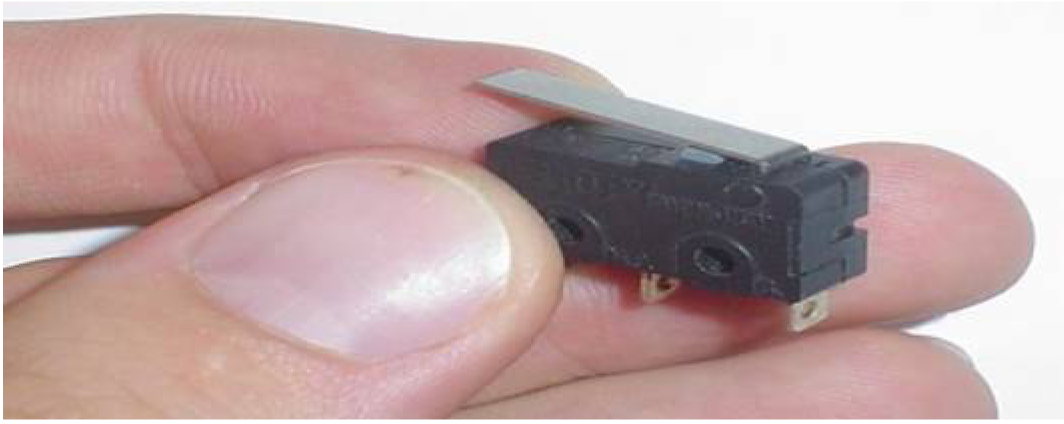
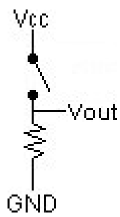


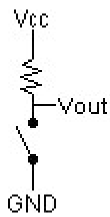
Fig. I.11: Tactile Bump Sensors

There are several versions below, depending on how you plan to use the circuit and your available switches. For the resistor use a very high value, such as 40kohms. –

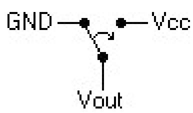
- **Tactile Bump Sensor Circuits**



Voltage <u>goes high</u> with contact



Voltage <u>goes low</u> with contact



More efficient switch for 3 lead switches
(use for microswitches)

- **Tips and Uses**

Tactile switches only work if your robot can stop instantaneously (like when moving slowly). There is no point ramming the wall, then the switch saying 'oops, wall here.' This is why more advanced robots often use sonar and IR because it gives a slowing down buffer zone. You will need several to cover the front and/or back of your robot.

- **Power Requirements**
  None. The cost is very cheap [4]

4.2The Photoresistor

Photoresistors (also called *photocells*, *photoconductors*, or *light-dependent resistors*) are very popular electronic components for sensing brightness.In particular, cadmium-sulfide or cadmium-sulfoselenide (CdS) photoresistors appear in most inexpensive light-triggered consumer electronic devices, such as automatic nightlights.

Fig. I.12: The Photoresistor

Photoresistors are nonpolarized. That is, you can connect either lead to either higher or lower voltage potential. Photoresistors function with either AC or DC voltage.

The face of a photoresistor contains a photoconductive gap (the wavy line) separating the two metallic electrodes Interdigitating (wavy halves fitting into the other) increases the total photoconductive perimeter between the two sides, which lowers the overall resistance. Conversely, a straighter gap has a lower perimeter, which results in a higher overall resistance.

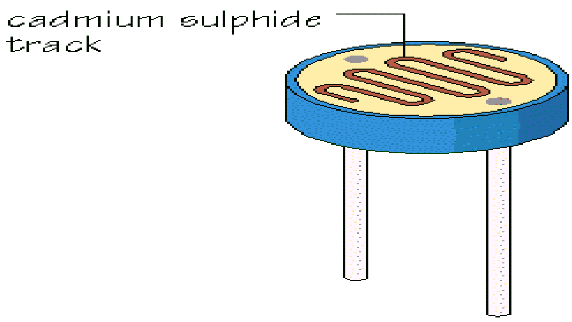


Fig. I.13: Pores of Photoresistor

Another factor is the width of the gap. An increase in gap width corresponds to an increase in resistance, but it also permits a greater maximum allowable voltage to be

applied. The manufacturer can tailor the attributes of the photoresistor by varying the waviness, gap width, and chemical composition of the photoconductive material.
It isn't possible to determine the exact attributes of a photoresistor just from its appearance, mainly because you can't tell the chemical composition of the photoconductive material. Instead, refer to the manufacturer's datasheet and then perform test measurements yourself. [14]

Photoresistor Voltage Divider Circuits

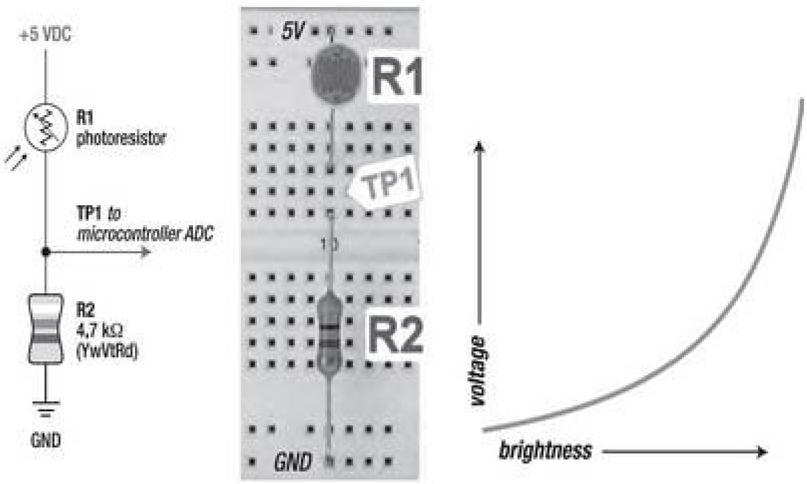


Fig. I.14: Before resistance:

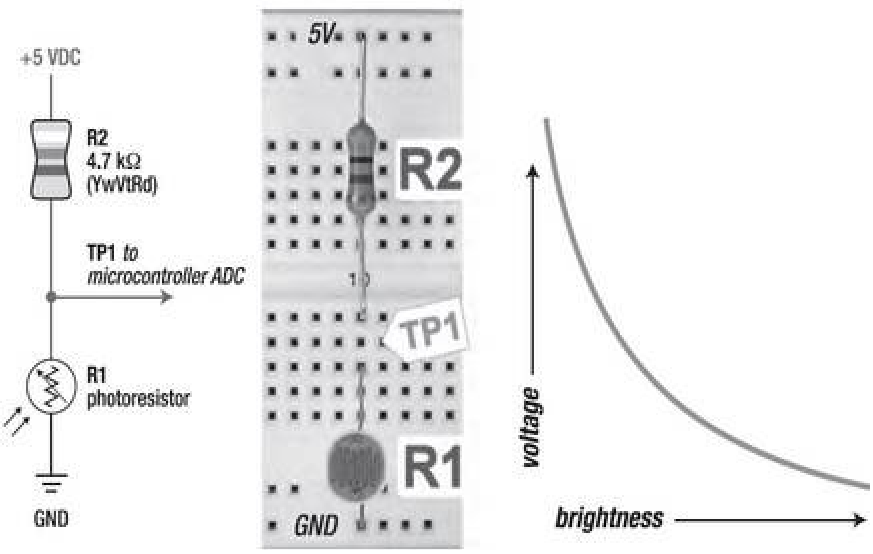


Fig. I.15: after resistance:

Solving the Equations to Determine Resistance, R

There are three steps to determining what resistor you should use for **R**. To do this, you first need to get out a multi-meter and measure the resistance across the photoresistor in two situations. The first situation is the darkest light your robot photoresistor will see. For example, if you expect your robot to function in a dark room, cover up the photoresistor entirely and measure the resistance.

The second situation is for the brightest light your robot will see. If you want your robot to operate in your kitchen, measure the photoresistor resistance in the kitchen.

Now all you do is multiply both resistance values, then find the square root of the total. This is the resistor you should use.

- **resistor = sqrt(R_dark*R_bright)**

4.3 ACCELEROMETER

- **Why Do We Need Accelerometers?**

Vibration and shock are present in all areas of our daily lives. They may be generated and transmitted by motors, turbines, machine-tools, bridges, towers, and even by the human body.
While some vibrations are desirable, others may be disturbing or even destructive. Consequently, there is often a need to understand the causes of vibrations and to develop methods to measure and prevent them. The sensors we manufacture serve as a link between vibrating

structures and electronic measurement equipment. [16]

-An accelerometer measures acceleration (change in speed) of anything that it's mounted on. How does it work? Inside an accelerator MEMS device are tiny micro-structures that bend due to momentum and gravity. When it experiences any form of acceleration, these tiny structures bend by an equivelent amount which can be electrically detected. Today, accelerometers are easily and cheaply available, making it a very viable sensor for cheap robotics hobbyists like you and me.

Applications for Accelerometers

Accelerometers are very important in the sensor world because they can sense such a wide range of motion. They're used in the latest Apple Powerbooks (and other laptops) to detect when the computer's suddenly moved or tipped, so the hard drive can be locked up during movement. They're used in cameras, to control image stabilization functions. They're used in pedometers, gait meters, and other exercise and physical therapy devices. They're used in gaming controls to generate tilt data. They're used in automobiles, to control airbag release when there's a sudden stop. There are countless other applications for them.

Possible uses for accelerometers in robotics:

_Self balancing robots
_Tilt-mode game controllers
_Model airplane auto pilot
_Alarm systems
_Collision detection
_Human motion monitoring
_Leveling sensor, inclinometer
_Vibration Detectors for Vibration Isolators
_G-Force Detectors

Axis of Acceleration

The tiny micro-structures can only measure force in a single direction, or axis of acceleration. This means with a single axis measured, you can only know the force in either the X, Y, or Z directions, but not all. So if say your X-axis accelerometer endowed robot was running around and ran into a wall (in the X direction). Your robot could detect this collision. But if say another robot rammed into it from the side (the Y direction), your robot would be oblivious to it. There are many other situations where a single axis would not be enough. It is always a good idea to have at least 2 axes (more than one axis).

- **Gravity**

Gravity is an acceleration. A such, your accelerometer will always be subject to a -9.81 m/s^2 acceleration (negative means towards the ground). Because of this, your robot can detect what angle it is in respect to gravity. If your robot is a biped, and you want it to always remain balanced and standing up, just simply use a 2-axis accelerometer. As long as the X and Y axes detect zero acceleration, this means your robot device is perfectly level and balanced.

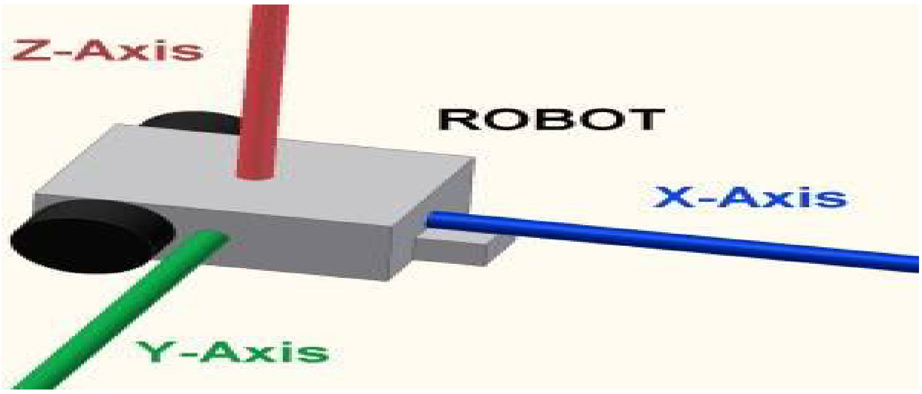


Fig. I.16: Acceleration in the case of balance

- **Accelerometers, Rated G**

When you buy your accelerometer, you will notice it saying something like 'rated at 2g' or '3g accelerometer.' This is the maximum g force your sensor can report. Gravity accelerates objects at 1g, or 9.81 m/s^2. For example, if your robot is moving at 1g upwards, then that means you sensor will detect 2g. For most robotics applications a 2g rating will be fine. So why not just get the highest rating possible? The lower the rating, the more sensitive it will be to changes in motion. You will always have a more fine tuned sensor the lower the rating. But then again, more sensitive sensors are more affected by vibration interference.

- **Calculate Acceleration and Angle wrt Gravity**

To calculate the magnitude of acceleration for a single-axis accelerometer

- acceleration_max = sqrt(x^2) = x

2-axis accelerometer

- acceleration_max = sqrt($x^2 + y^2$)

3-axis accelerometer

- acceleration_max = sqrt($x^2 + y^2 + z^2$)

To calculate the detected force on an accelerometer due to gravity:

- Force_gravity = -g*cos(angle) (depends on starting axis of sensor)

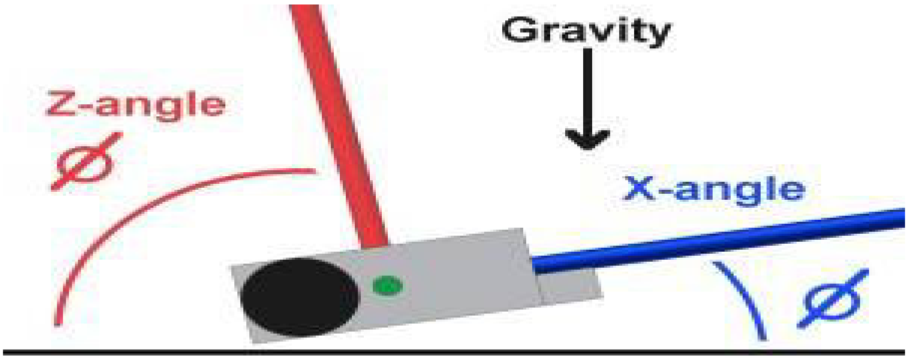


Fig. I.17: Acceleration in the case of deviation

- **Wiring Requirements**

Any accelerometer package will have a power and ground line, and a single output analog pin for each axis of acceleration. Some of the sensors come with additional features/pins, read their datasheets.

- **Additional Tips and Uses**

Placing an accelerometer on a mobile robot that experiences bumps can trigger the accelerometer unintentionally. Use a capacitor to smooth out output over several hundred milliseconds (testing required) to prevent this. Also, read the interpret sensor data tutorial to enhance your accelerator sensor accuracy.

4.4 INFRARED EMITTER DETECTOR

The Infrared emitter detector circuit is very useful if you plan to make a line following robot, or a robot with basic object or obstacle detection. Infrared emitter detector pair sensors are fairly easy to implement, although involved some level of testing and calibration to get right. They can be used for obstacle detection, motion detection, transmitters, encoders, and color detection (such as for line following).

I highly recommend reading the color sensor tutorial to understand more about infrared.

R1 is to prevent the emitter (clear) LED from melting itself. Look at the emitter spec sheet to find maximum power. Make sure you choose an R1 value so that
$Vcc^2/R1$ < Power_spec.
Or just use **R1 = 120 ohms** if you are lazy and trust me.

R2 should be larger then the maximum resistance of the detector. Measure the resistance of the detector (black) when it is pointing into a dark area and then choose the next larger resister. This means Vout is close to maximum when there is no signal.
Or just use **R2 = 11kohms**
Or use a **20kohm Pot** here in series with a **100ohm** resistor for white line following calibration

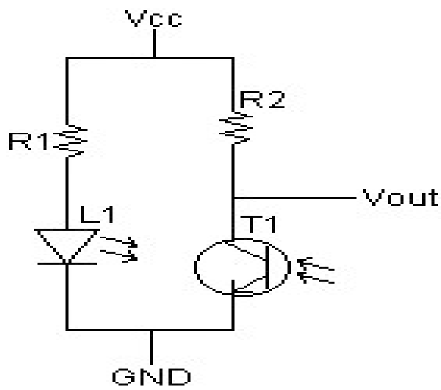


Fig. I.18: Circuit Future and infrared emitter

- **Infrared Emitter Detector Amplified Signal Circuit**

R1 = 150 ohms (calculate as above)
R2 = 220 Kohms (calculate as above, or use Pot for white line following)
R3 = 4.7 Kohms
R4 = 10 Kohms
OP1 = Operational Amplifier **LM358** package includes two op amps.
Vcc = +5 Volts

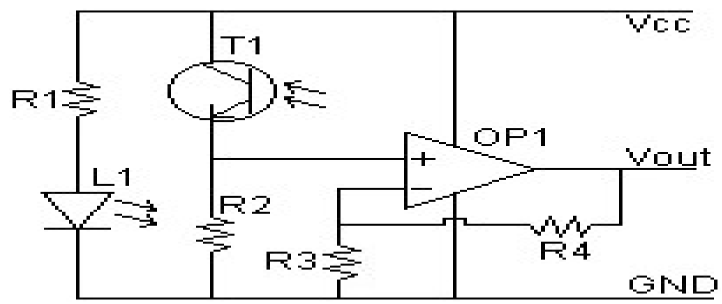


Fig. I.19: Circuit Future and infrared emitter Use the amplifier

- **Notes:**

  R3 and **R4** determine the amplification of the op amp, **gain = 1 + R4/R3**. An appropriate ratio can be determined by connecting up the circuit and measuring the voltage entering the op amp and knowing the threshold value needed at Vout. **Vout = (1 + R4/R3)Vin** so just solve for the ratio using the values for Vout and Vin.

Additional Notes:

- The LED and detector have very narrow emission and detection angles, so it matters a LOT how you place them. Place the LED and detector an 1/8 to a 1/4 inch apart maximum, basically **parallel** and **almost contacting**.
- Many objects are **opaque** to visible light (that means light doesn't pass through it, like wood, black plastic, metal), but are transparent to IR light. Black plastic is a good example. Many forms of black plastic are transparent to IR light, and therefore doesn't make a good shielding material. Aluminum foil covered with electrical tape works as a great shielding material.
- Most consumer **video cameras** can see IR light. This is really useful, since you can aim your video camera at the robot, and see the emitted IR light. Many emitters are strong enough that if you aim the robot at a white wall, and turn off all other lights in the room, you can see how the IR light is projected from your robot. Good debugging aid.
- Another debugging aid is an **IR detection card** that is available from Radio Shack, and other places. This little card has a material that changes the

wavelength of IR light into something you can see. When IR strikes this card, it causes the card to light up and sparkle.

- **Output** your IR values on your computer screen real time to **optimize** positioning and Pot calibration (depends on if you want range detection or white line detection). You may also want to read the **sensor interpretation tutorial**.
- Often people cannot remember whether the black or the clear LED is the emitter or detector. This is the **mnemonic** I use to remember, **dark colors absorb** more light than clear, so the dark LED is the **detector**. Please note that this isn't always true, as I've heard of a blue emitter and clear detector sold by RadioShack. The easiest way to tell is point a digital camera at it, as most cameras can see IR light.
- If you plan your robot to work outside, make sure sunlight does not interfere with your sensor readings. The general rule of thumb with sunlight shielding is if you cannot see any data reading difference inside or outside, your sheilding is effective enough to work. **Film canisters** or **electrical tape** works very well. A **modulated** signal (such as in remote controls) also reduces external interference.
- Depending on resistor values, your IR circuit can be tweaked to better detect color instead of distance.

4.5 ROBOT SONAR Ultrasonic

Fig. I.20: Ultrasonic sensors

- **Sonar** Everyone knows how sonar works. A sound gets emitted, then you 'see' your surroundings based on the sound coming echoing back. This is because sound takes time to travel distances. Farther the distance, the longer it takes for the sound to come back. This sonar tutorial will talk about how to implement sonar into your robot.

Fig. I.20: Technical approach bat

How Sonar Works

Your microcontroller tells your sonar to go. Then your sonar emits a mostly inaudible sound, time passes, then detects the return echo. It then immediately sends a voltage signal to your microcontroller, which by keeping track of the time that passes, can calculate the distance of the object(s) detected. Here I have an example of a robot that uses sonar.

Availability and Cost

Robot sonar today can be bought very cheap,

Calculating Distance vs Time

The speed of sound in air is about 343 m/s, with minor dependence on temperature and humidity. This is roughly 0.9ms/foot. The speed of sound in saltwater is about 1500 m/s, and in freshwater 1435 m/s.

- **example:**

Suppose your robot is on land and has a sonar. The sonar sends out a sound to an object that is an unknown distance away. That means the sound has to travel this unknown distance twice (there and back). Now suppose your microcontroller says the time passed was .03 seconds. How many meters away is the object from the robot?

calculating:

Speed_of_Sound * Time_Passed / 2 = Distance_from_Object

343 m/s * .03 s / 2 = 5.145 m

The Sonar Process, English Pseudo Code

Microcontroller sends square wave signal to control line of sonar

Sonar detects square wave 'go' command, starts sonar process

Several 100us delay from 'go' command passes for electronics to work

Microcontroller starts a timer (to track time it takes for sound to travel)

Sonar emits a set of pulses at some frequency

Pulses stop

A return echo is detected (or a timeout is called if no echo)

Sonar immediately emits a square wave on output line to microcontroller

Microcontroller detects square wave

Microcontroller stops timer

knowing elapsed time, use the equation to calculate distance

- **Power Requirements**

Typical sonar require ground, power, signal transmit (the 'go' command), and signal recieve (signals when a sound returns) lines.

The typical sonar module consumes roughly 100 mA in standby mode, meaning no sound pulses are being emitted. When in use, however, the power requirement jumps momentarily up to 2 Amps. Just like with motors, they can draw sudden large amounts of current resulting in sudden voltage drops on your batteries (i.e. a ping causes the microcontroller to reset). This huge jump can wreak havoc on microcontrollers and other circuitry sharing the same power supply. A microcontroller won't work and will just reset if the voltage drops too low.

However, if you design your power supply circuit with a capacitor, it should suppress these sudden but short lived voltage drops. You should already have one for your motors, but if you draw from another seperate power supply, a ~500uF capacitor across the power leads should work fine.

Range (Maximum and Minimum)

Since the ping sound is spreading out radially, the signal strength as the chirp moves farther from the transducer is reduced by 1/(distance^2). This means that the maximum measuring distance drops off rapidly at the extreme maximum of the sensor. There is usually amplification electronics built in to your sonar to adjust for this, but a typical maximum range on a cheap sonar is still no greater than 6-25 feet.

There is also a minimum range, meaning that if an object is too close (say within a inch or two) from the sonar emitter, your sonar will not detect the object (or at least not accurately). This is because sound is really fast, so fast that the electronics cannot work with in the time it takes for the sound to return back to the sensor. Make sure your sonar is an inch or more back from the front of your robot, or it will not detect wall collisions properly.

Sound Reflectance / Absorbance and Object Material Properties

Unfortunately, echos are not completely a product of distance. There are many other factors that can alter readings. The sound reflected from a pillow and from a solid wall will not be the same. If the object is at a sharp angle, much less sound would be reflected back. Surface properties of the objects can also make a difference. A carpet and a mirror would give different readings. Your sound can also 'get lost,' bounce around various walls for some extended period of time, then return to your sonar as a 'ghost echo' - or even worse, it might cause false triggering making your robot 'see' objects that arent really there.

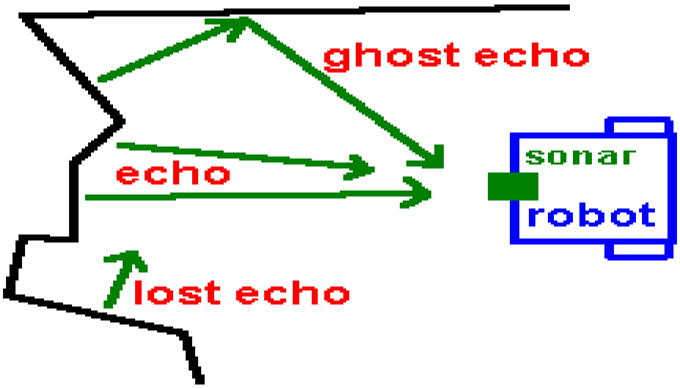


Fig. I.21: Various forms of acoustic ultrasound returning from obstructions

As an object sensor, you can use some of these 'problems' to your advantage. What if your blind robot needed to know if it is trying to kill humans with a brick or a pillow? The uses are vast.

Using Multiple Sonar Simulataneously

Now suppose your robot had multiple sonar sensors on it. How would you prevent one sonar from not detecting an echo caused by another sonar sensor? The hardware approach would be to point your sonar at different angles (outside of the viewing angle of the type of sonar you are using). Typically this would be around ~20 degrees.

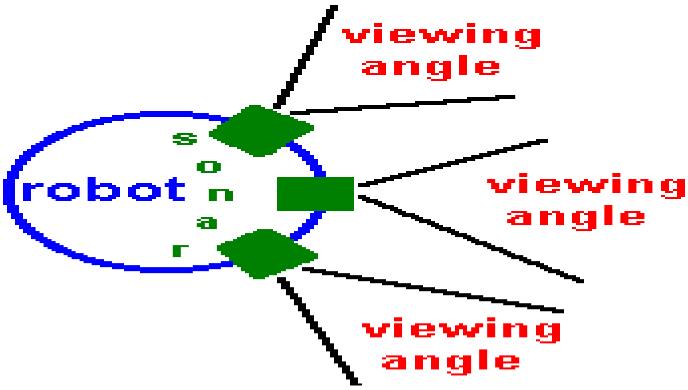


Fig. I.22: Angle ultrasonic receiver

The electronics approach to solving this problem would be to have each sonar operating at a different sound frequency (not easy to do!).

Lastly, there is the computational approach. With this method each of your sonar would fire at different times. Your robot would wait for one sonar to receive an echo, plus an additional time for ghost echos to dissipate, before the next sonar is activated. But if you have say 16+ sonar, that can take a huge amount of wasted time! Then you can do things like have only sonar on opposite sides of the robot fire together. Or do some strange sonar firing pattern so that each sonar has a small chance of interfering with each another.

5 Conclusion

Today we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.

CHAPTER II:

Microcontroller pic16f877A and flowcode

1. introduction

Microchip Corporation manufactured a series of microcontroller chips named as "**peripheral interface controller**" or simply called as PIC (also called programmable interface controller). Microchip Corporation also provides a trademark for the name PIC . The term "PIC" is normally used to describe the micro controllers developed by Microchip Corporation. Before we discuss more about PIC, you need to know the basics about microprocessors and microcontrollers.

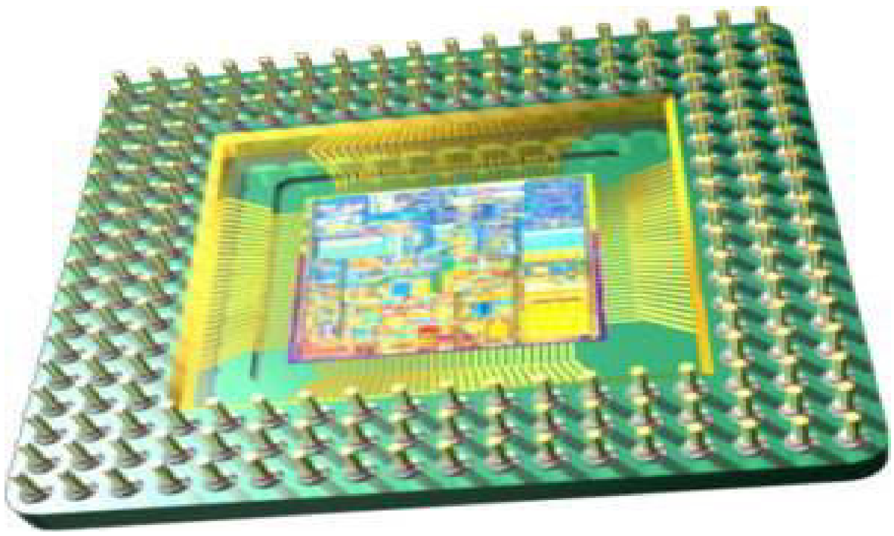


Fig. II.1 -: Microprocessor

A microprocessor is a programmable multipurpose-multitasking logic chip that fabricated by LSI, VLSI or other higher manufacturing techniques. The first microprocessor developed by the INTEL corporation in 1971 (INTEL-4004), which was only a 4 bit microprocessor .A microprocessor can accept input data's in binary forms, read binary instructions, perform data processing and provide desired output. In a modern computer system, the microprocessor is usually referred to as CPU (central processing unit). A microprocessor is basically classified by its word length (word length represented by the number of bits, that is, 4bit, 8bit, 16bit, 32bit, 64bits are normally used for micro processors). The basic block diagram of a microprocessor and a microprocessor based computer system is given below.

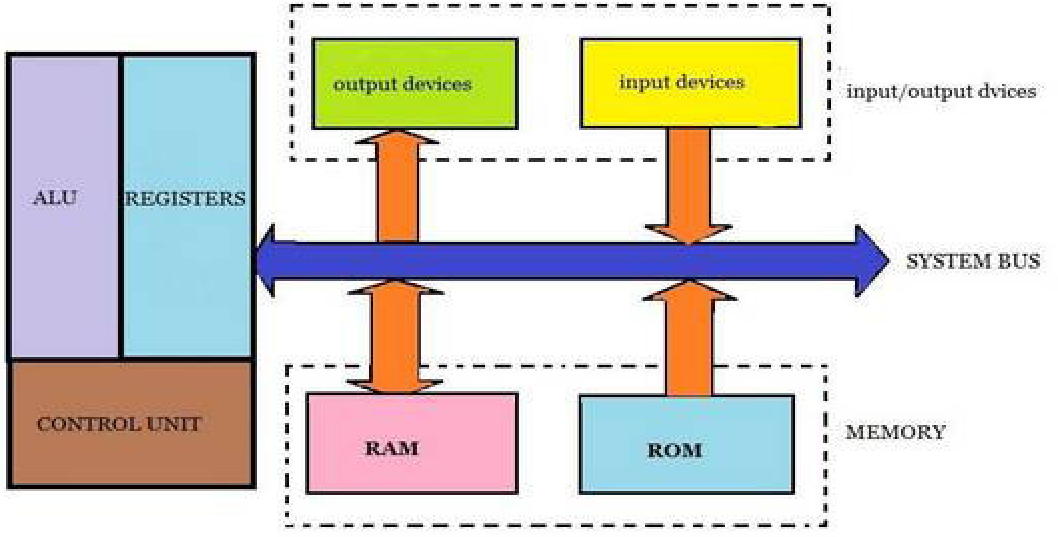


Fig. II.2 Microprocessor-Block-Diagram

1.1 Arithmetic and Logic Unit (ALU)

ALU is one of the basic units of a microprocessor. All the computing functions are maintained in this unit. As the name shows, the ALU can perform all the arithmetic operations (+,-,*,/,%,etc) and all logical operations (AND, OR, NOT, XOR, etc).

1.2 Control Unit (CU)

Control unit is another important part of a microprocessor. The CPU's control unit coordinates and times the CPU's functions, and it uses the program counter to locate and retrieve the next instruction from memory. Another purpose of control unit is, controlling the data flow between microprocessor and peripheral devices/peripheral chips.

1.3 Registers

Registers are the important section of microprocessor chip. Registers are primarily used to store the data temporarily during the execution/runtime of the program. A microprocessor contains several kinds of registers that can be classified according to the instructions provided to the processor. These instructions are called instruction sets. The registers are basically 8bit, 16bit or 32 bit according to the type. Registers can easily accessible to the user by using various commands (instructions). Some registers are used to store address of memory locations that can be easily accessed by the microprocessor.

1.4 Memory

As in the name shows, memory are used to store the information (data&instructios) as in the binary form. According to this binary information's, a microprocessor perform its operation during the execution period. A microprocessor can read the information from memory and perform the corresponding operations in its ALU. The result of each operation stored in a memory or given to any output unit associated with the system. The data stored in the memory can be use further use. But some memories used in a computer system are temporary memories or instantaneously fed to the any peripheral units. These type data can't be store in computer memory for later use. The memory unit of a microprocessor computer system consist of two types of memories. They are Read Only Memory (simply called as ROM) and Random Access Memory (simply called as RAM).

1.5 Read Only Memory (ROM)

Read-only memory is one of the computer memories. ROM memory is used to store items that the computer needs to execute when it is first turned on. For example, the ROM memory on a PC contains a basic set of instructions, called the basic input-output system (BIOS). The PC uses BIOS to start up the operating system. BIOS is stored on computer chips in a way that causes the information to remain even when power is turned off.ROM is a non-volatile memory. The program stored in ROM can only read.

1.6 Random Access Memory (RAM)

Random access memory is the other type of internal memory .RAM also called main memory because it is the primary memory that the CPU uses when processing information. The electronic circuits used to construct this main internal RAM can be classified as dynamic RAM (DRAM), synchronized dynamic RAM (SDRAM), or static RAM (SRAM).This memory is used to store user programs and data's temporarily. RAM is a volatile memory.

1.7 System Bus

A bus is the set of hardware lines or circuit lines which help the communication between the processor and other input/output units. A system bus is a flat cable with numerous parallel wires. Each wire can carry one bit, so the bus can transmit many bits along the cable at the same time. For example, a 16-bit bus, with 16 parallel wires, allows the simultaneous transmission of 16 bits (2 bytes) of information from one component to another. The system bus basically classified into three groups .

1. Control bus
2. Data bus
3. Address bus.

1.7.1 Control bus

A control bus is a bi-directional bus which is used to transfer the control signals (read, write, interrupt) and timing signals(clock pulses) between microprocessor and other peripheral components.

1.7.2 Data Bus

Data bus is also a bi-directional bus that used to transmit data bi-directionally between the microprocessor and peripherals devices.

1.7.3 Address Bus

Address bus is a unidirectional bus which is used to send the address of a peripheral from microprocessor to the peripheral device.

2. Overview of PIC 16F877

PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on. The PIC 16F877 features all the components which modern microcontrollers normally have. The figure of a PIC16F877 chip is shown below.

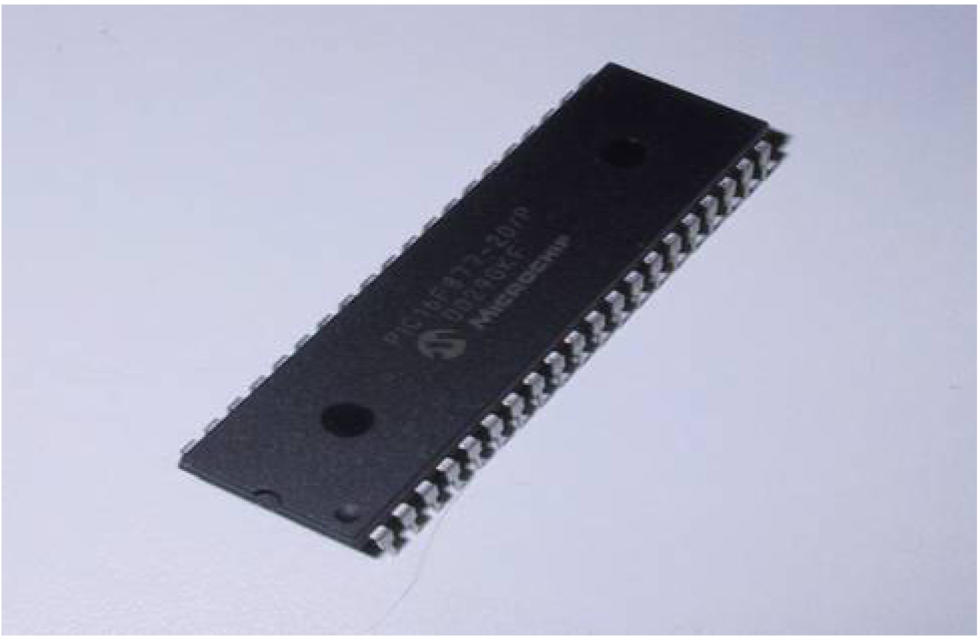


Fig. II.3 microcontrôleur *PIC 16F877*

2.1 Features of PIC16F877

The PIC16FXX series has more advanced and developed features when compared to its previous series. The important features of PIC16F877 series is given below.

2.2 General Features

- High performance RISC CPU.
- ONLY 35 simple word instructions.
- All single cycle instructions except for program branches which are two cycles.
- Operating speed: clock input (200MHz), instruction cycle (200nS).
- Up to 368×8bit of RAM (data memory), 256×8 of EEPROM (data memory), 8k×14 of flash memory.
- Pin out compatible to PIC 16C74B, PIC 16C76, PIC 16C77.
- Eight level deep hardware stack.
- Interrupt capability (up to 14 sources).

- Different types of addressing modes (direct, Indirect, relative addressing modes).
- Power on Reset (POR).
- Power-Up Timer (PWRT) and oscillator start-up timer.
- Low power- high speed CMOS flash/EEPROM.
- Fully static design.
- Wide operating voltage range (2.0 – 5.56)volts.
- High sink/source current (25mA).
- Commercial, industrial and extended temperature ranges.
- Low power consumption (<0.6mA typical @3v-4MHz, 20μA typical @3v-32MHz and <1 A typical standby).

2.3 Peripheral Features

- Timer 0: 8 bit timer/counter with pre-scalar.
- Timer 1:16 bit timer/counter with pre-scalar.
- Timer 2: 8 bit timer/counter with 8 bit period registers with pre-scalar and post-scalar.
- Two Capture (16bit/12.5nS), Compare (16 bit/200nS), Pulse Width Modules (10bit).
- 10bit multi-channel A/D converter
- Synchronous Serial Port (SSP) with SPI (master code) and I2C (master/slave).
- Universal Synchronous Asynchronous Receiver Transmitter (USART) with 9 bit address detection.
- Parallel Slave Port (PSP) 8 bit wide with external RD, WR and CS controls (40/46pin).
- Brown Out circuitry for Brown-Out Reset (BOR).

2.4 Key Features

- Maximum operating frequency is 20MHz.
- Flash program memory (14 bit words), 8KB.
- Data memory (bytes) is 368.
- EEPROM data memory (bytes) is 256. [20]

- 5 input/output ports.
- 3 timers.
- 2 CCP modules.
- 2 serial communication ports (MSSP, USART).
- PSP parallel communication port
- 10bit A/D module (8 channels)

2.5 Analog Features

- 10bit, up to 8 channel A/D converter.
- Brown Out Reset function.
- Analog comparator module.

2.6 Special Features

- 100000 times erase/write cycle enhanced memory.
- 1000000 times erase/write cycle data EEPROM memory.
- Self programmable under software control.
- In-circuit serial programming and in-circuit debugging capability.
- Single 5V,DC supply for circuit serial programming
- WDT with its own RC oscillator for reliable operation.
- Programmable code protection.
- Power saving sleep modes.
- Selectable oscillator options.

2.7 Pin Diagrams

PIC16F877 chip is available in different types of packages. According to the type of applications and usage, these packages are differentiated. The pin diagrams of a PIC16F877 chip in different packages is shown in the figure below.

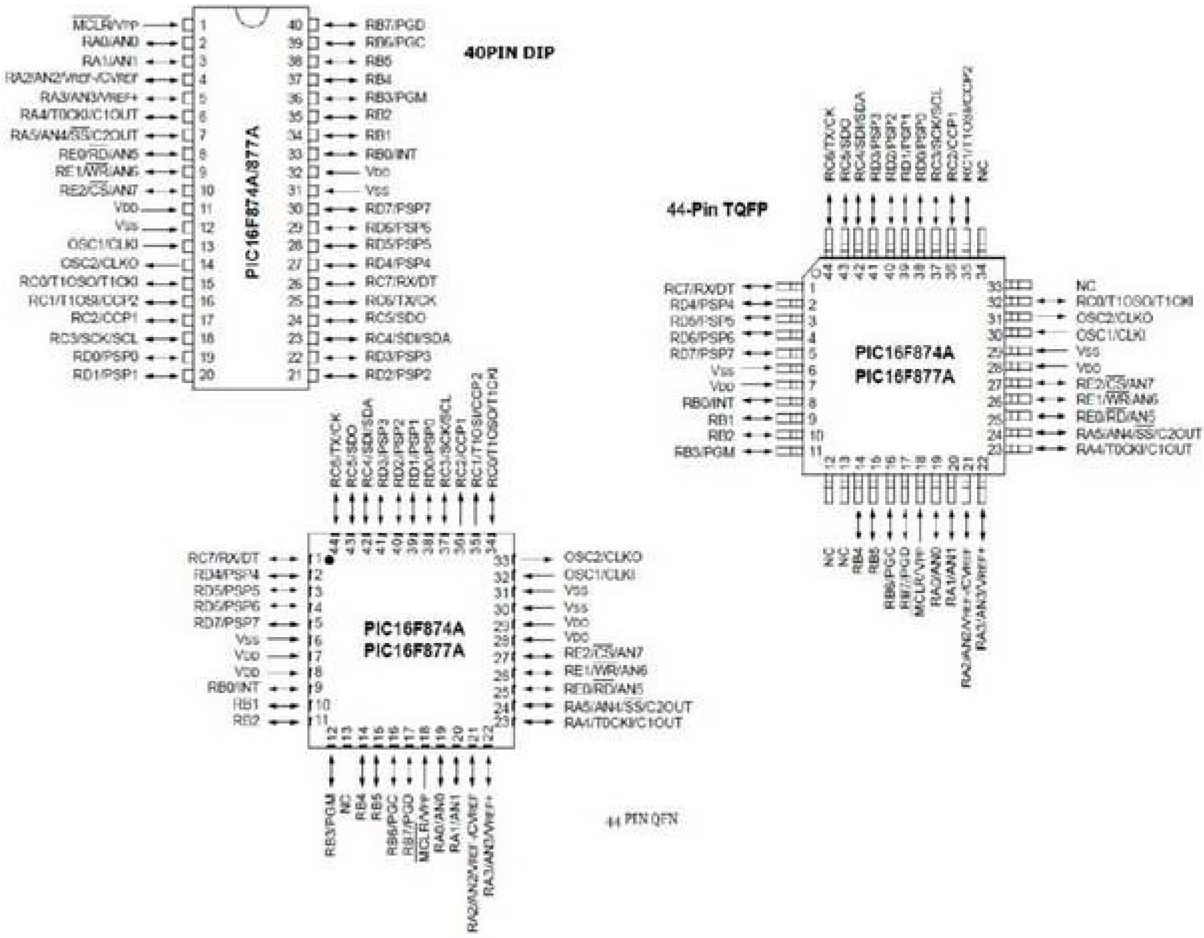


Fig. II.3 microcontrôleur *PIC 16F877*

2 .8 Input/output ports

PIC16F877 has 5 basic input/output ports. They are usually denoted by PORT A (R A), PORT B (RB), PORT C (RC), PORT D (RD), and PORT E (RE). These ports are used for input/ output interfacing. In this controller, “PORT A” is only 6 bits wide (RA-0 to RA-7), ”PORT B” , “PORT C”,”PORT D” are only 8 bits wide (RB-0 to RB-7,RC-0 to RC-7,RD-0 to RD-7), ”PORT E” has only 3 bit wide (RE-0 to RE-7).

Table II 1 Microcontrôleurs pattes recensement

PORT-A	RA-0 to RA-5	6 bit wide
PORT-B	RB-0 to RB-7	8 bit wide
PORT-C	RC-0 to RC-7	8 bit wide
PORT-D	RD-0 to RD-7	8 bit wide
PORT-E	RE-0 to RE-2	3 bit wid

All these ports are bi-directional. The direction of the port is controlled by using TRIS(X) registers (TRIS A used to set the direction of PORT-A, TRIS B used to set the direction for PORT-B, etc.). Setting a TRIS(X) bit ‘1’ will set the corresponding PORT(X) bit as input. Clearing a TRIS(X) bit ‘0’ will set the corresponding PORT(X) bit as output.
(If we want to set PORT A as an input, just set TRIS(A) bit to logical ‘1’ and want to set PORT B as an output, just set the PORT B bits to logical ‘0’.)

3 Why use a microcontroller?

The microcontroller’s ability to store and run unique programs makes it extremely versatile. For instance, one can program a microcontroller to make decisions (perform functions) based on predetermined situations (I/O line logic) and sensor readings. Its ability to perform math and logic functions allows it to mimic sophisticated logic and electronic circuits. Still other programs can make the microcontroller behave like a neural or fuzzy logic controller.
The output of the microcontroller can control direct current (DC) motor drives [using DC or pulse-width modulation (PWM)], servo motor positioning, stepper motors, etc. Programming a robot’s microcontroller to respond to sensor readings or a communication link creates an intelligent, responsive robot. Microcontrollers are responsible for the “intelligence” in most smart devices on the consumer market and will be the intelligence in our robots. [17]

4 PIC programming overview

4 .1 What is Flowcode

Flowcode allows you to create simple microcontroller applications by dragging and dropping icons on to a flowchart to create simple programs. These programs can control external devices attached to the microcontroller such as LED's, LCD displays etc.

Once the flowchart has been designed, its behaviour can be simulated in Flowcode before the flowchart is compiled, assembled and transferred to a Chip.

To achieve this using Flowcode, perform the following steps:

1. Create a new flowchart, specifying the microcontroller that you wish to target.
2. Drag and drop icons from the toolbar onto the flowchart to program the application.
3. Add external devices by clicking on the buttons in the components toolbar, editing their properties, how they are connected to the microcontroller and call macros within the device.
4. Run the simulation to check that the application behaves as expected.
5. Transfer the application to the microcontroller by compiling the flowchart to C, then to assembler code and finally to object code. [21]

5 An overview of how to use flowcode

Open the flow code either in you desktop with logo. Or you may find it in you program file manual.

A window will pop up asking to create new flowcode or open existing files.

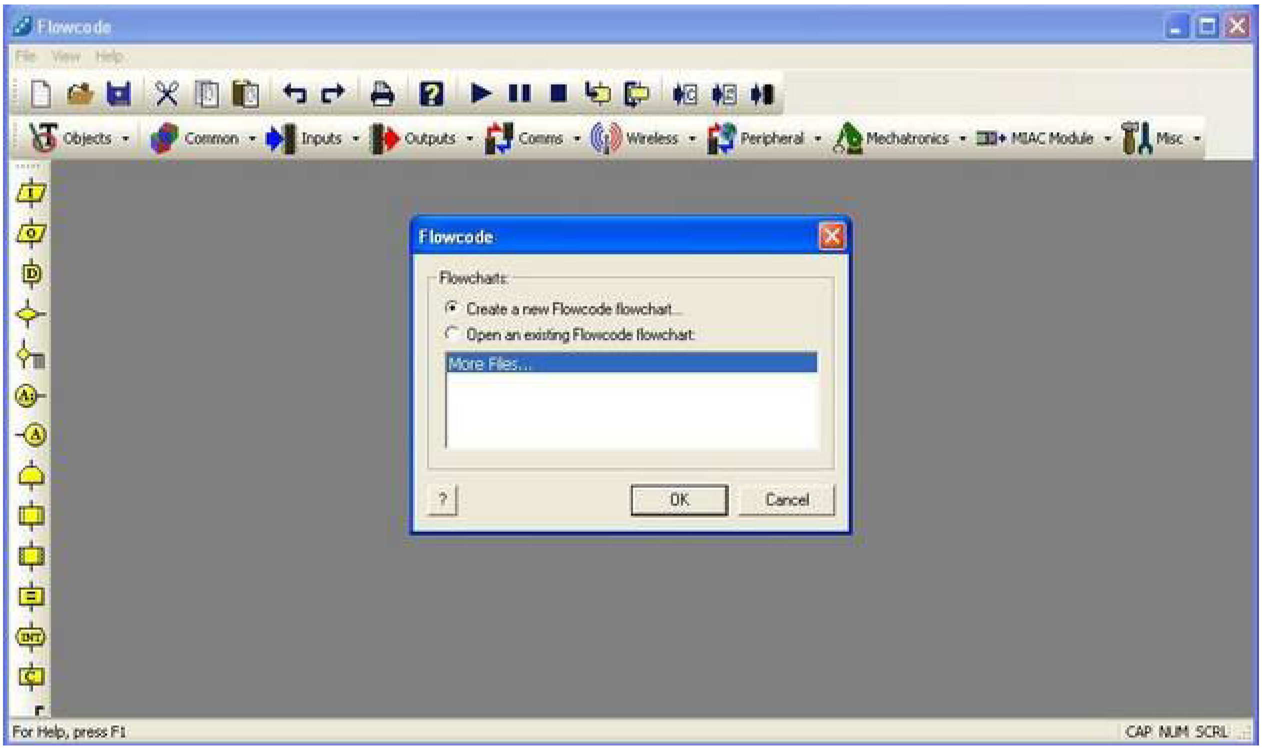


Fig. II.5 first screen in flowcode

Click on the create a new Flowcode flowchart and press ok

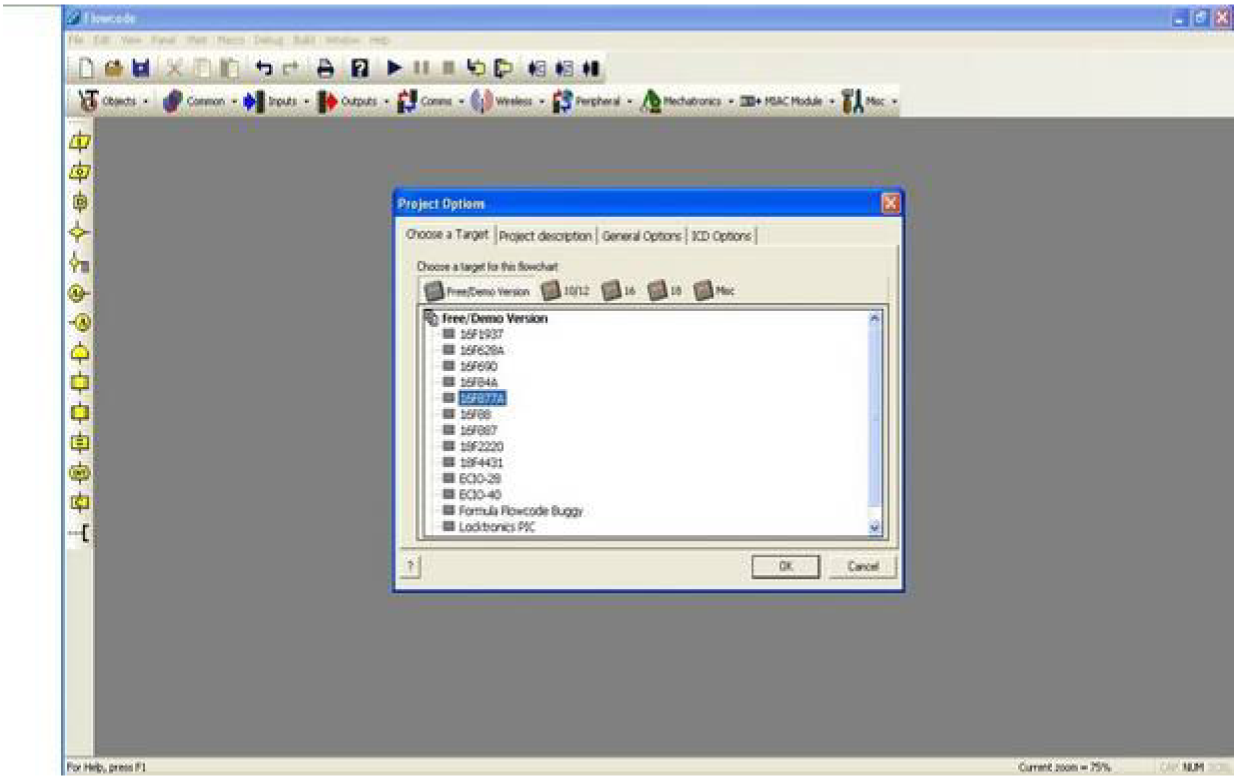


Fig. II.6 Device selection screen

Choose the PIC you would like to use. In this part I am using the PIC16F877A. Then press ok.

It will lead you to the starting panel to start your project like below picture. Start you program…

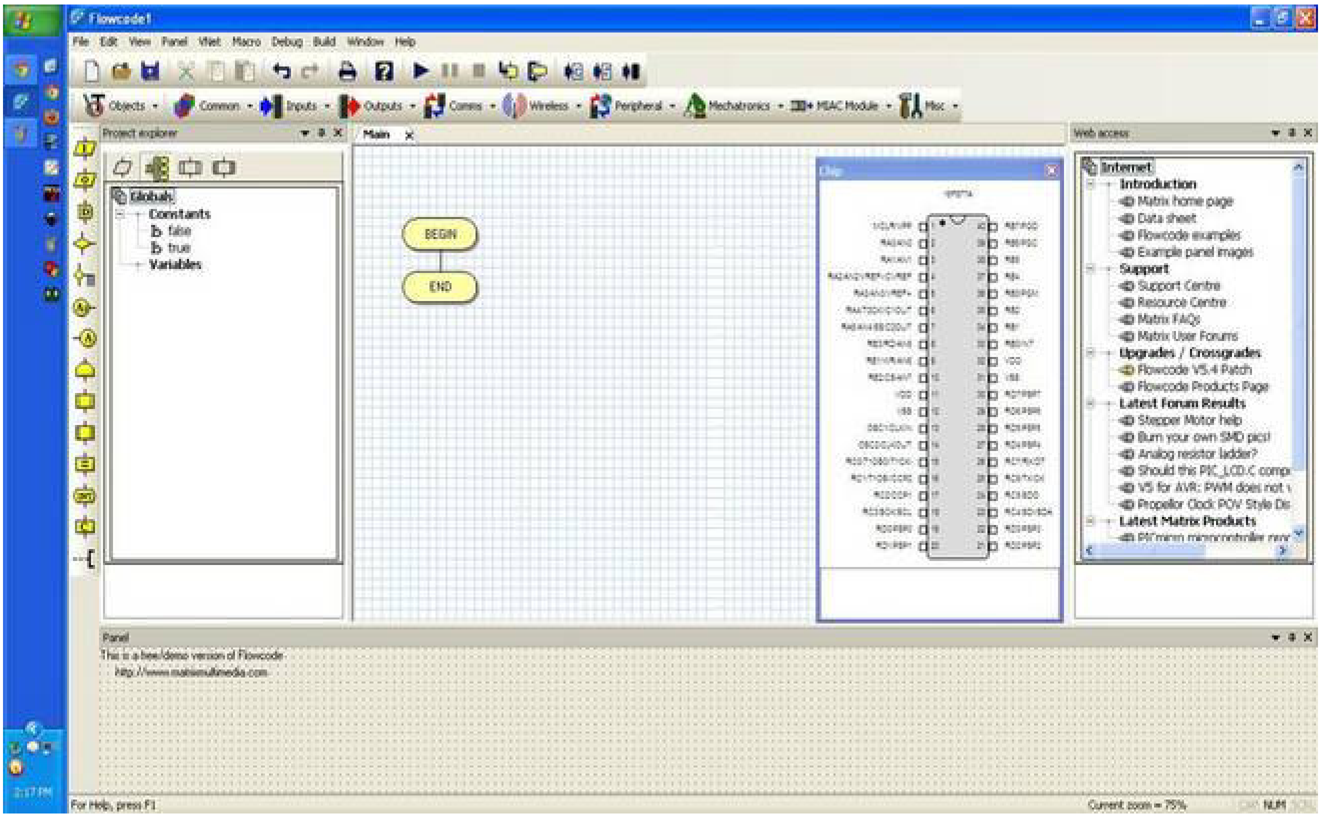


Fig. II.7 interface programme flowcode

5.1 The Flowcode Process

'Flowcode' offers an easy way to program PICmicro chips, as you will see. Once the flowchart is designed, on-screen, press a button and the software translates it into numerical code.

There is a process here that you need to understand: Flowcode passes your program through a number of processes before it gets sent into your PICmicro device: the flowchart is first processed into C code, then into Assembler, and finally into hexadecimal numbers or 'Hex'. The PICmicro device 'understands' Hex code. The Hex code is then sent into your PICmicro device. To send the Hex code into your PICmicro Flowcode runs a subsidiary program called 'PPP'. When you select CHIP...CONFIGURE from the Flowcode menu the program PPP is what you see. PPP controls a number of PICmicro options and configurations by setting the value of registers inside the device when you download a program.

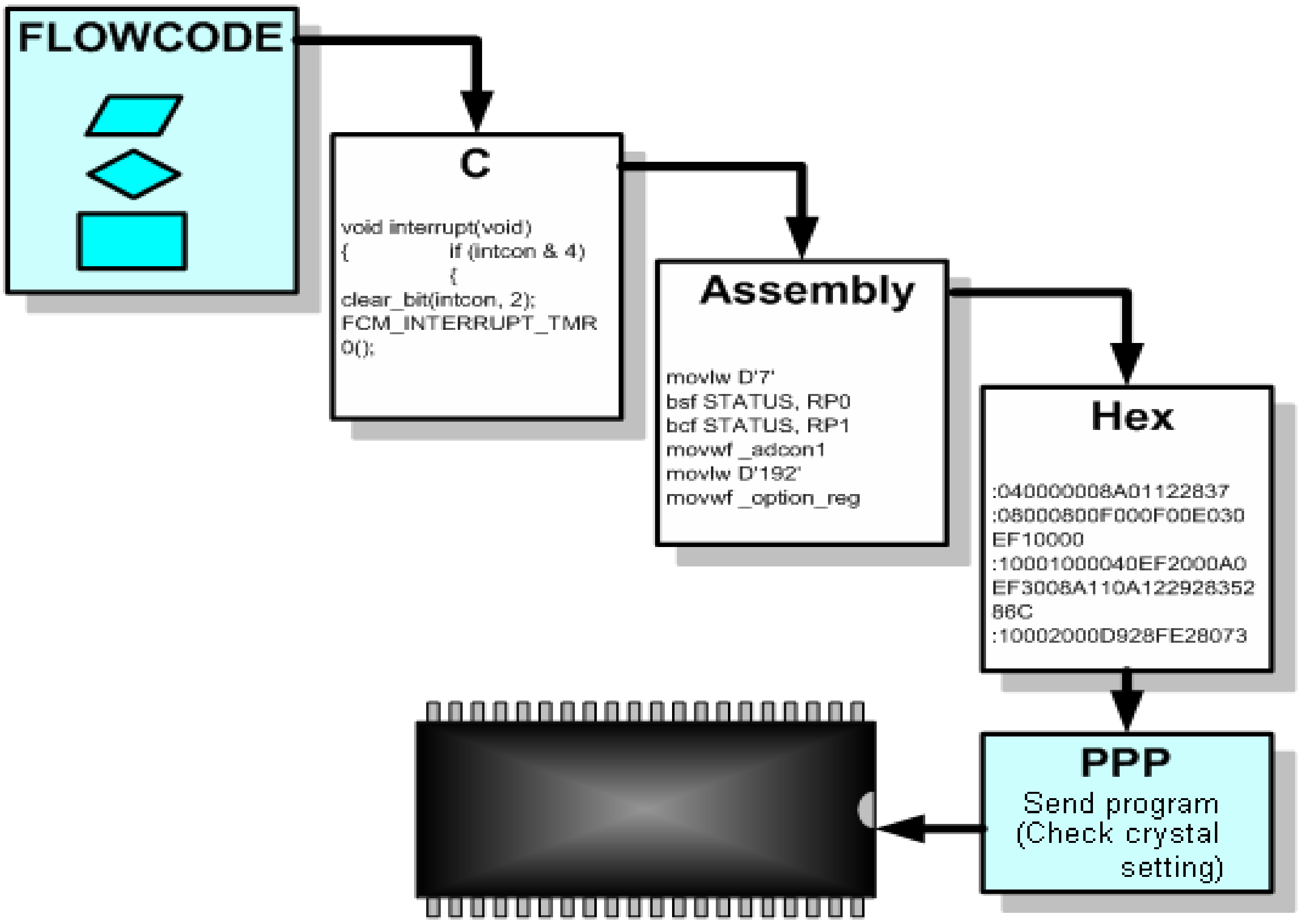


Fig. II.8 Programming stages pic

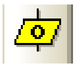
5.2 Example: Run led

- ✓ Open program 
- ✓ Choose the type of pic

See the picture: Fig. II.6 Device selection screen

After selection press the button 

- ✓ Show us Fig. II.7 interface programme flowcode

- ✓ Choose output icon 

  Click on the icon and then drag

- ✓ Double click on the icon

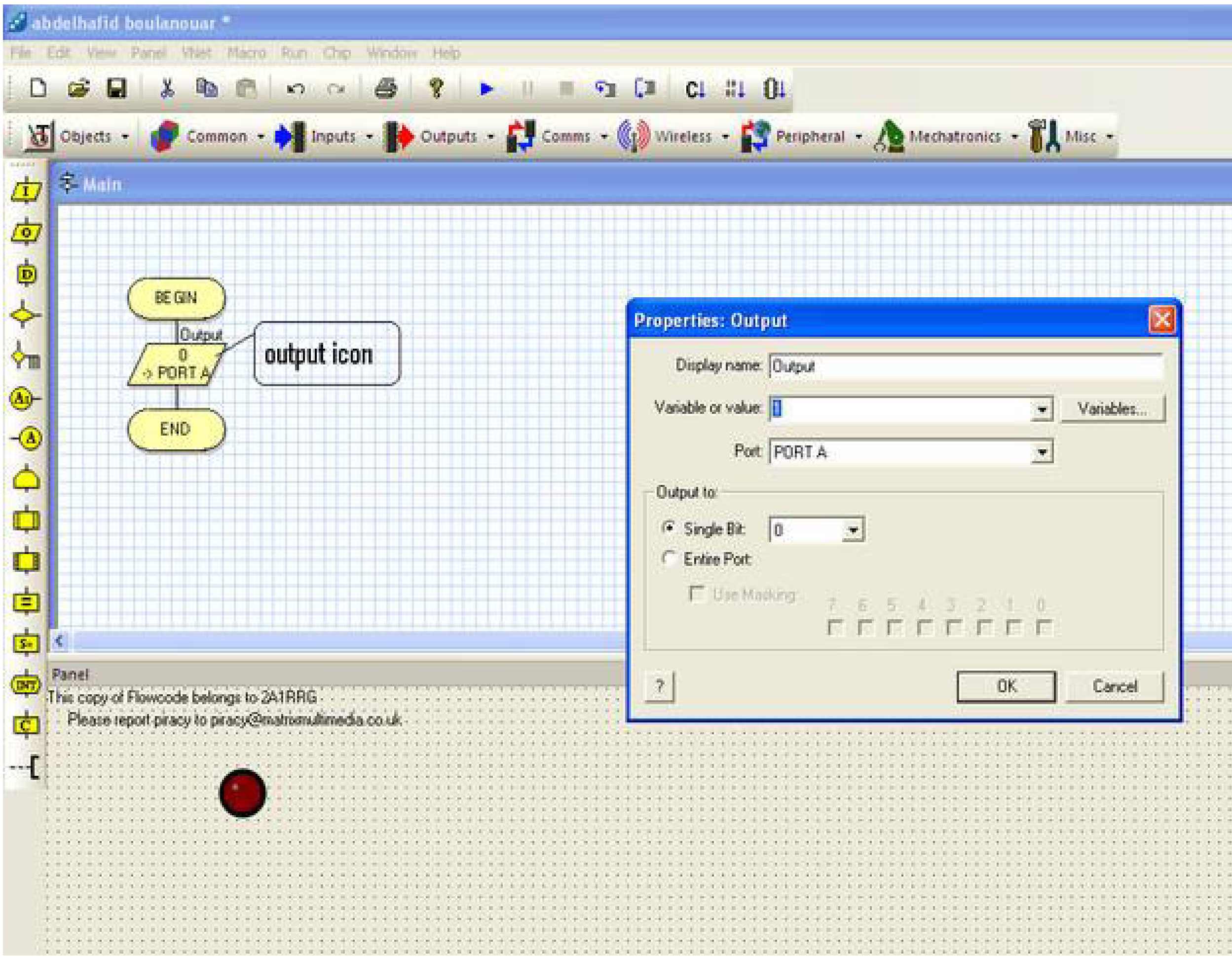
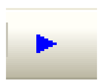


Fig. II.9 Run led

From this window the user choose the pin and output 1 or 0

- ✓ After you install the simulation stage settings

  From the top of the program click on the icon simulation run 

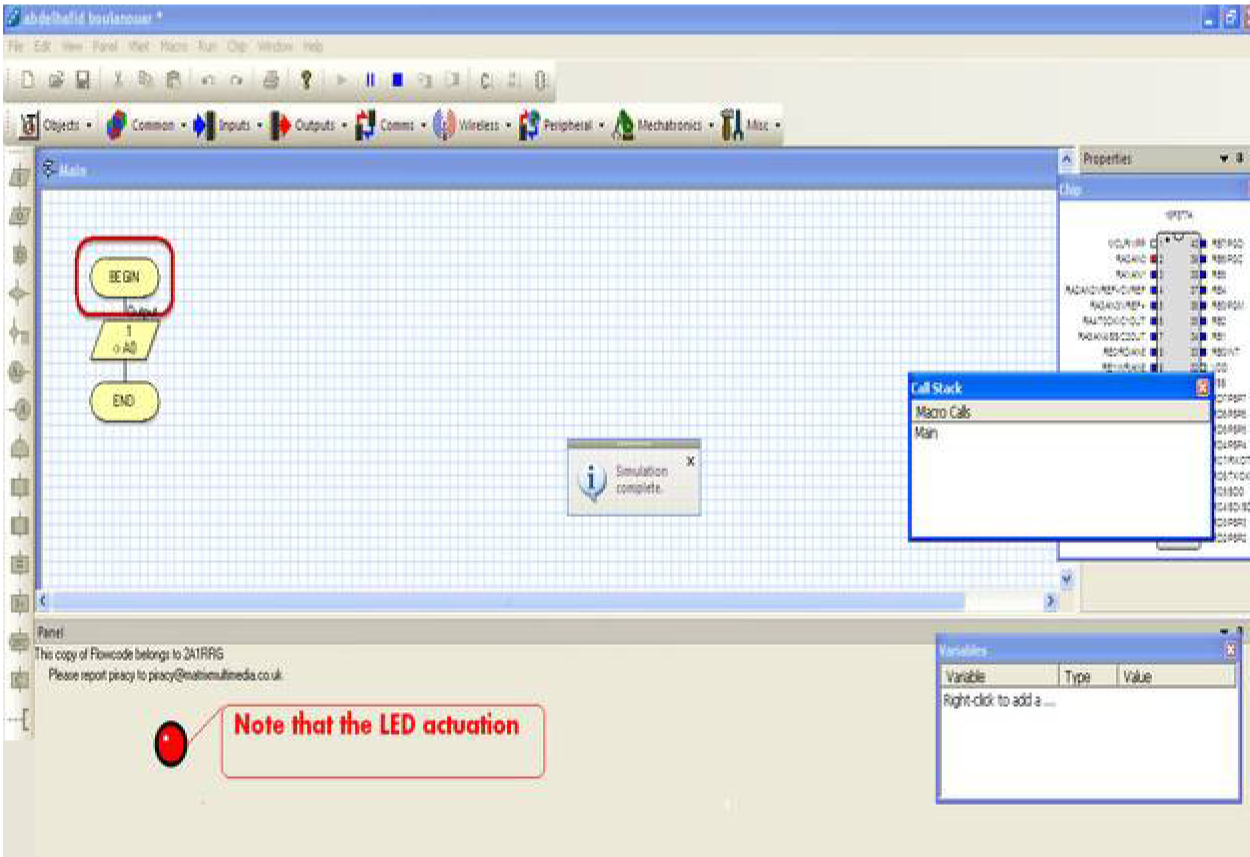


Fig. II.10 Simulation stage

✓ Production stage hex file

At the top of the program click on the icon: chip

Then choose : compile to HEX

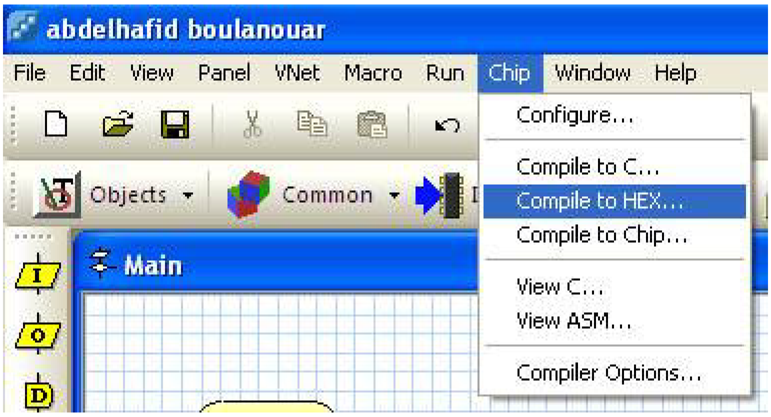


Fig. II.11 Hex output

- ✓ Wait to be finished this last stage

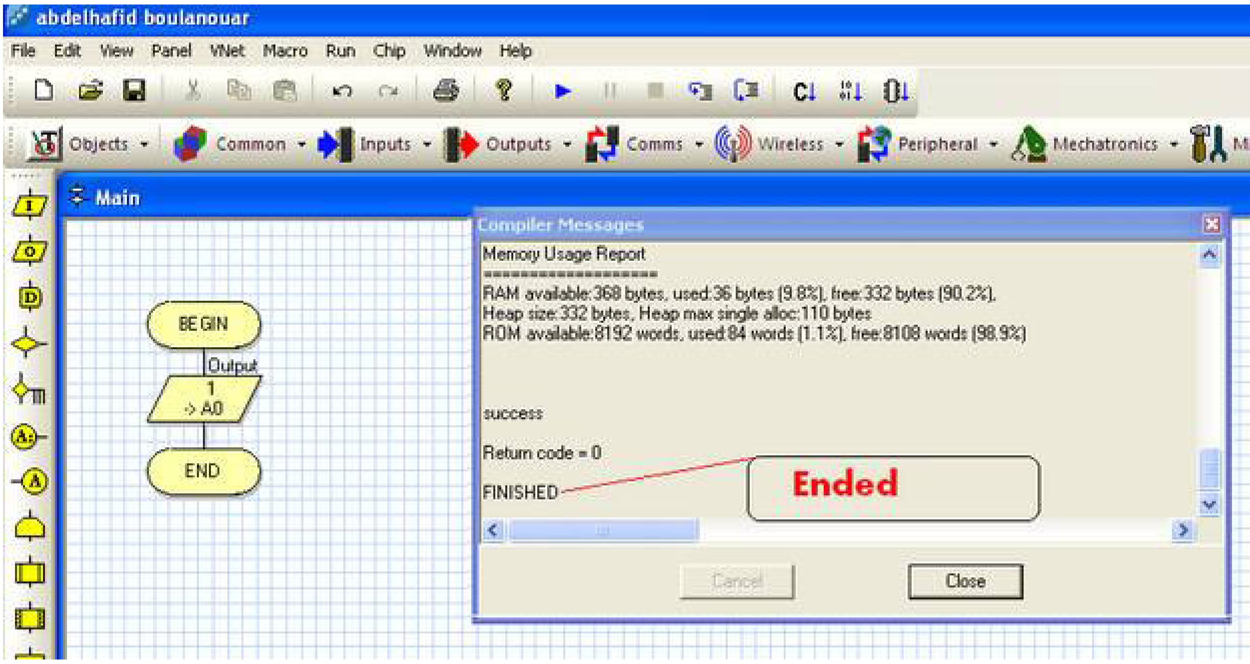


Fig. II.12 Hex output FINISHED

6 Conclusion

The microcontrollers robot's brain and substrate but without the basic program is not worth anything

As that programming microcontrollers granted planning in Flowcode program gives the user convenient interface but depends on the imagination

CHAPTER III:

Components and robot work

1. Introduction

Any robot needs to do his job a set of necessary components and other luxury For example, for walking to wheels and Programming is one of the important things in Robot But also other essential components such as wheels and electronic components, structure .... Etc.

In this part we will discuss the components of the robot

From electronic components to the piece structure components we will talk about some of the components in more detail

2 block Diagram

This diagram shows the stages that make up our mobile robot:

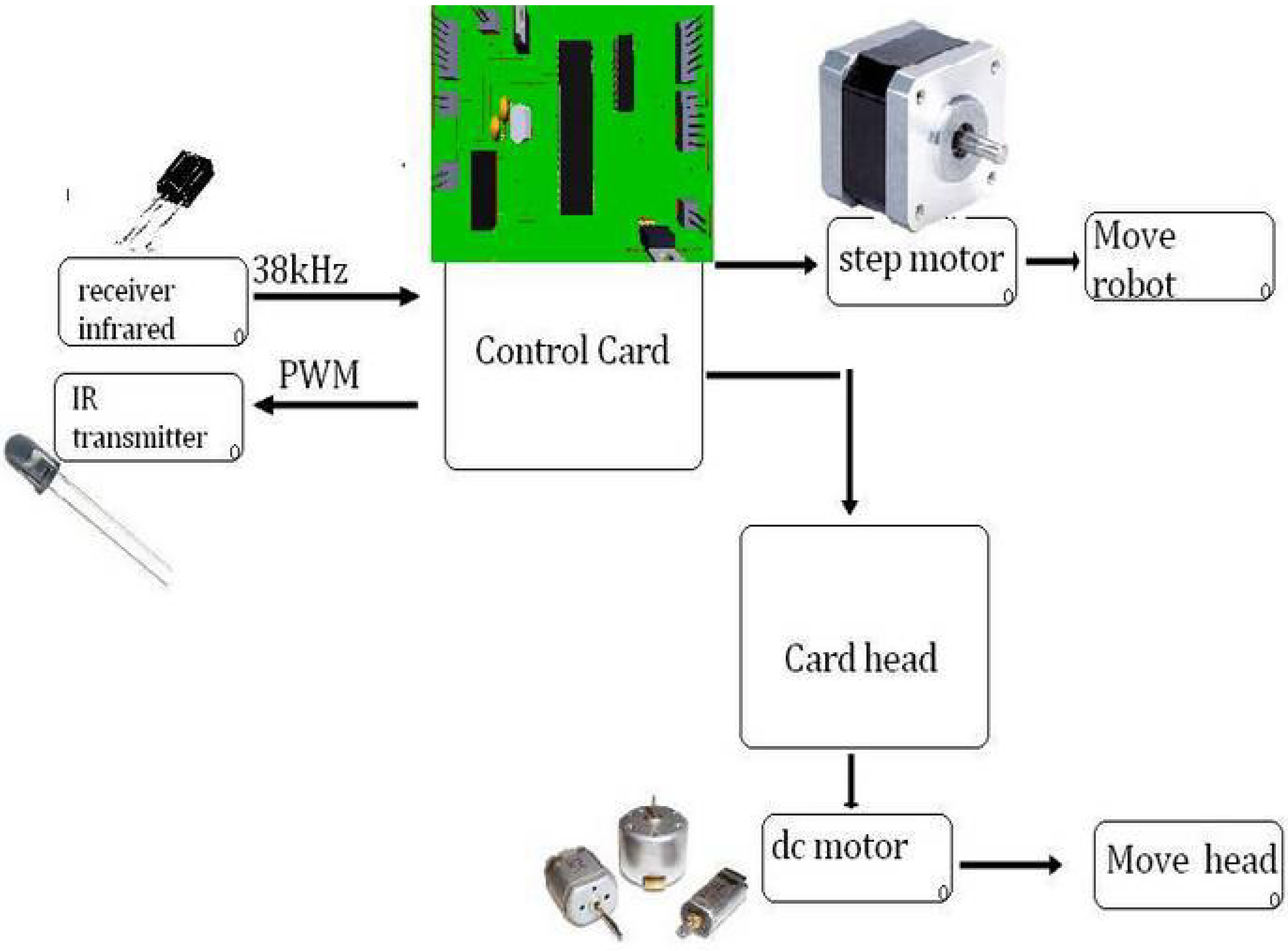


Fig. III 1 Block diagram of the mobile robot

We also note the chart shows the stages experienced by the robot in order to perform his function

Of the chart can see that the robot depends mainly on the infrared, which in turn relate to the control card

While assumes control card for each treatment information portal

3 Components of the Robot

3.1 Components of the control card

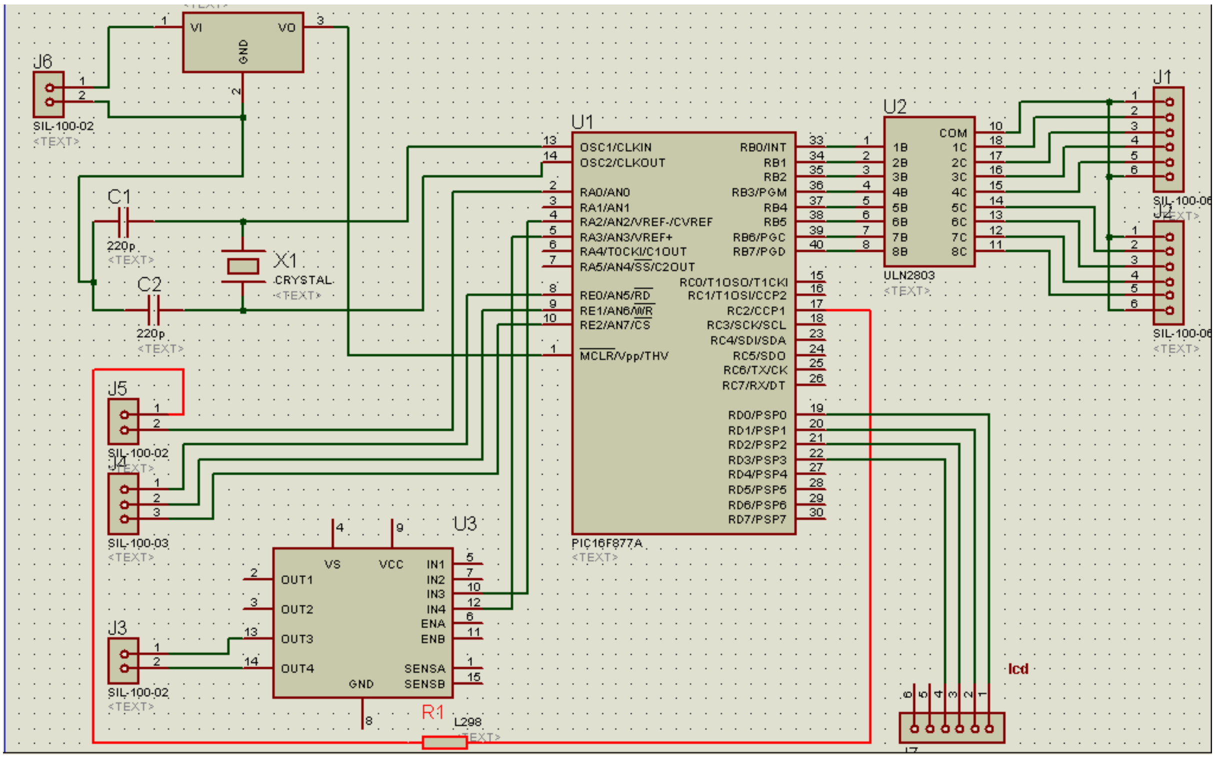


Fig. III 2 Electrical circuit diagram the Proteus simulation program

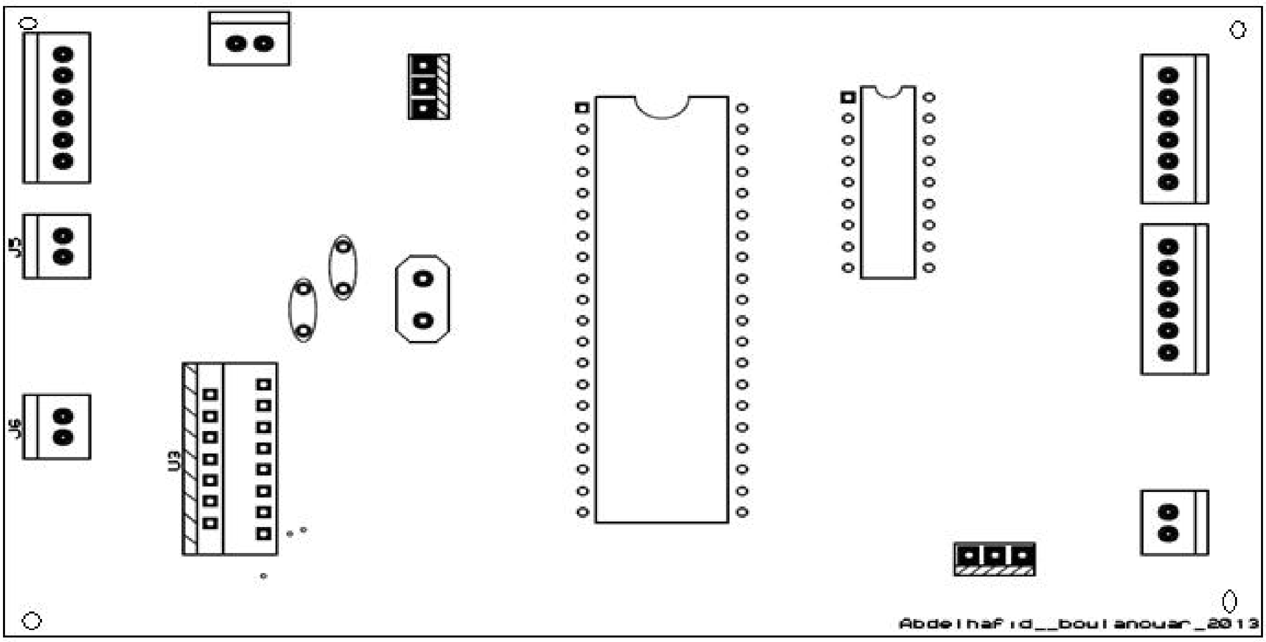


Fig. III 3 Circuit print(components)

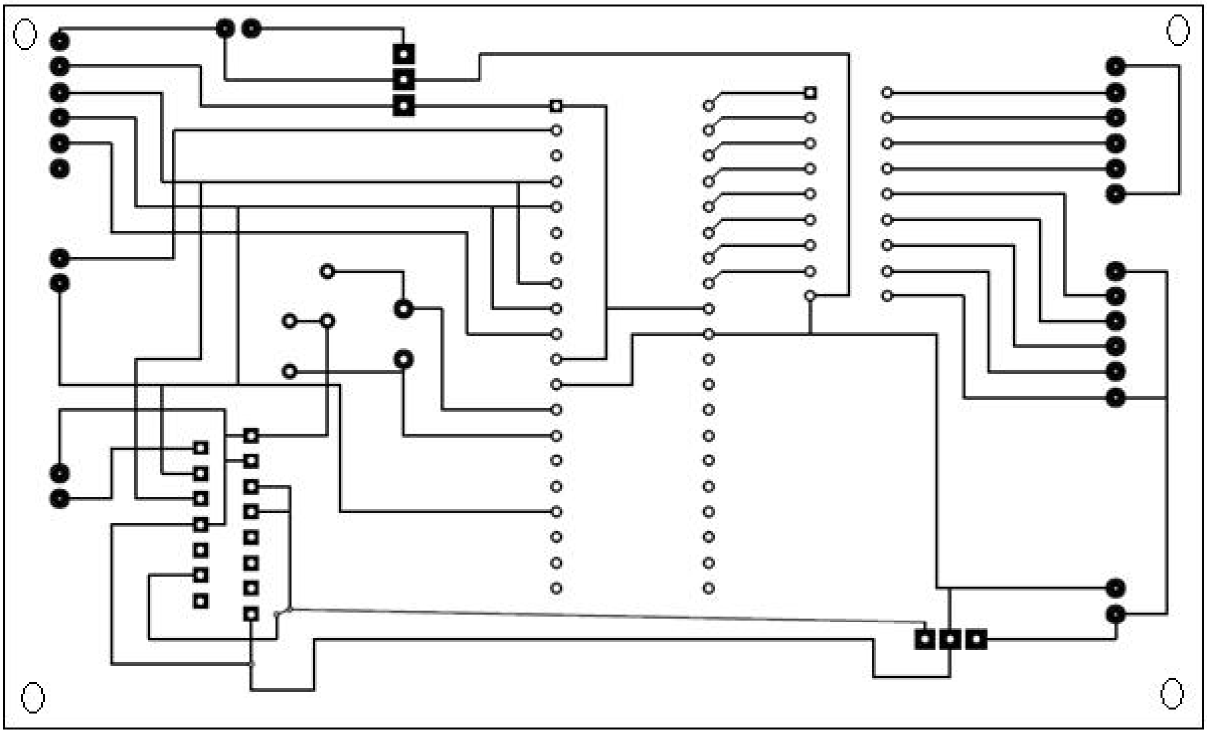


Fig. III 4 Circuit print (copper)

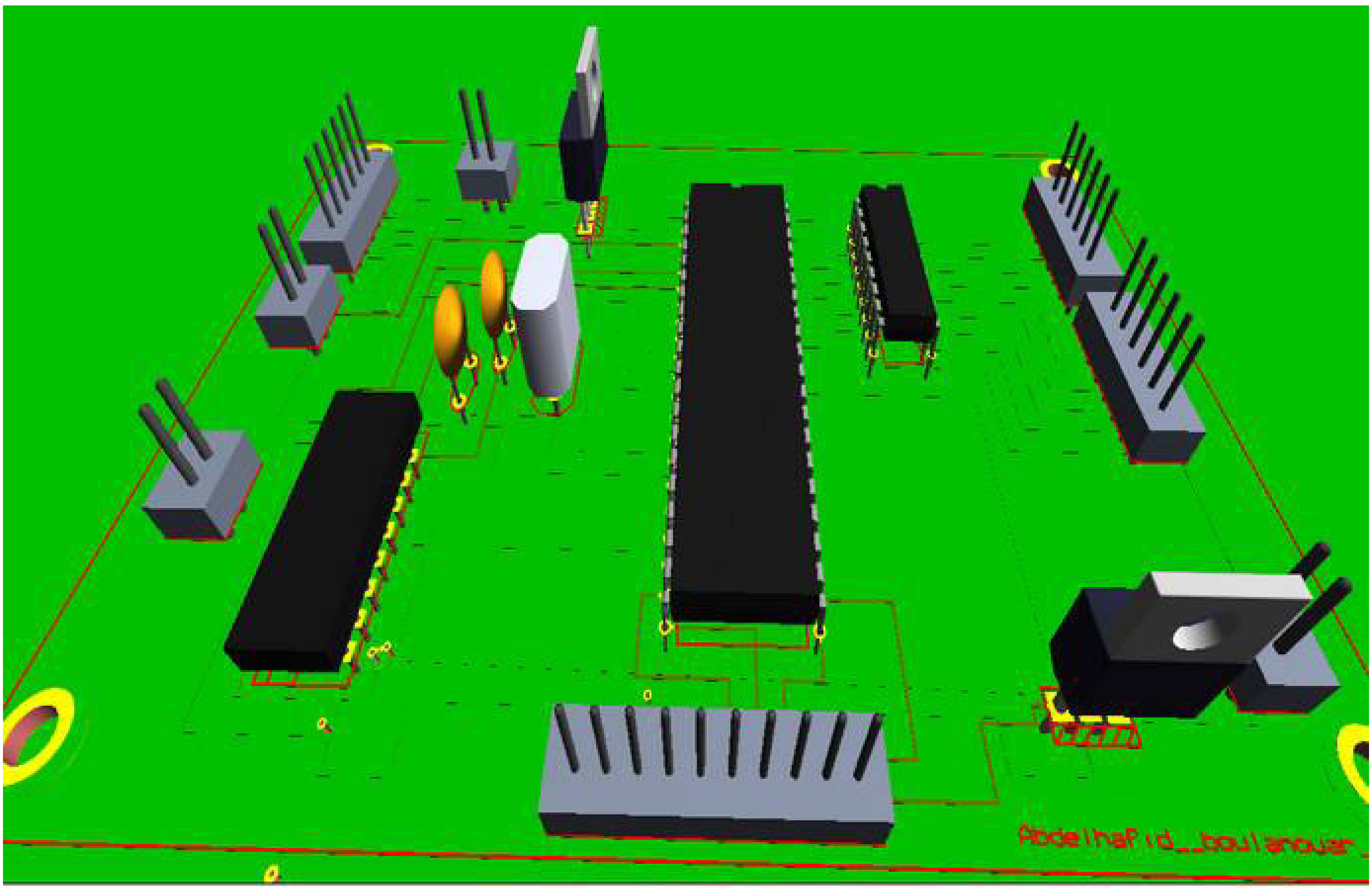


Fig. III 5 3D drawing electrical circuit

Table III 1 Robot components

Order	Amount	Name
1	1	Pic16F877A
2	1	ULN2803
3	1	L298
4	2	7805 for 5v
5	1	IR Receiver Module
6	1	DC motor
7	2	stepper motor
8	1	Resistance 100Ω
9	2	IR LED
10	1	OSCILLATOR 20MHz
11	2	Capacitor 22pF
12	1	Glcd Nokia 6610

3.1.1- pic microcontrôleur 16F877A

Explanation in the second **CHAPTER**

3.1.2 - ULN2803

The eight NPN Darlington connected transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry (such as TTL, CMOS or PMOS/NMOS) and the higher current/voltage
requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications. All device feature open–collector outputs and free wheeling clamp diodes for transient suppression.
The ULN2803 is designed to be compatible with standard TTL families
while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

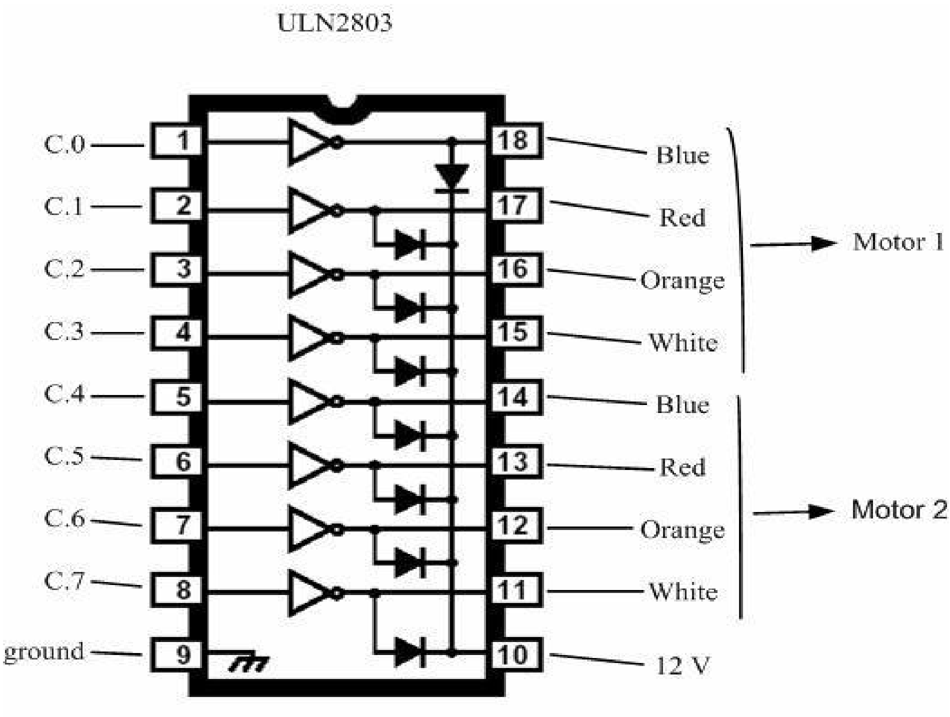


Fig. III 6 Pin Connection (top view)

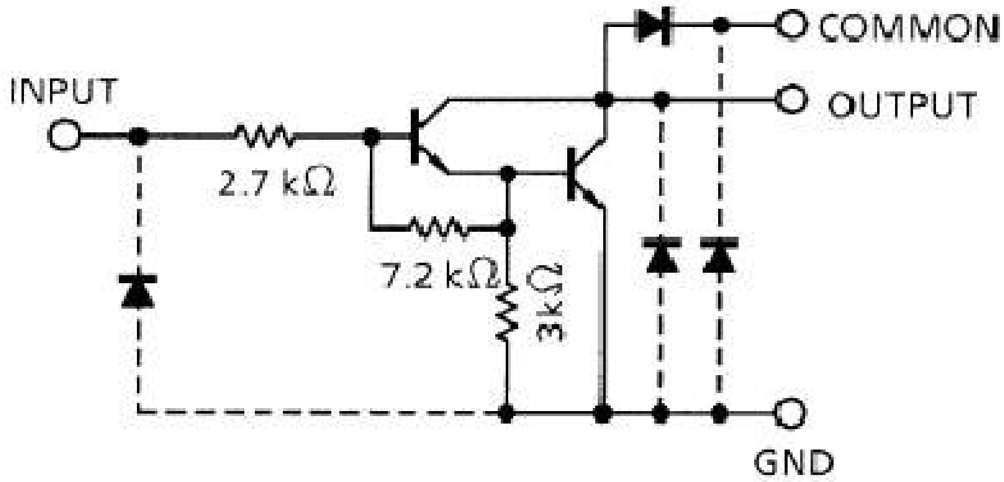


Fig. III 7 The input and output parasitic diodes cannot be used as clamp diodes.

- Notes on Contents

1. Equivalent Circuits

The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatorypurposes.

2. Test Circuits

Components in the test circuits are used only to obtain and confirm the device characteristics. These components and circuits are not guaranteed to prevent malfunction or failure from occurring in the application equipment.

-IC Usage Considerations

Notes on Handling of ICs

(1)The absolute maximum ratings of a semiconductor device are a set of ratings that must not be

exceeded, even for a moment. Do not exceed any of these ratings.

Exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required

.

(3) If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF.

IC breakdown may cause injury, smoke or ignition.

Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition. [23]

3.1.3 - L298 DUAL FULL BRIDGE DRIVER

Features

OPERATING SUPPLY VOLTAGE UP TO 46 V

TOTAL DC CURRENT UP TO 4 A

LOW SATURATION VOLTAGE

OVERTEMPERATURE PROTECTION LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V (HIGH NOISE IMMUNITY)

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

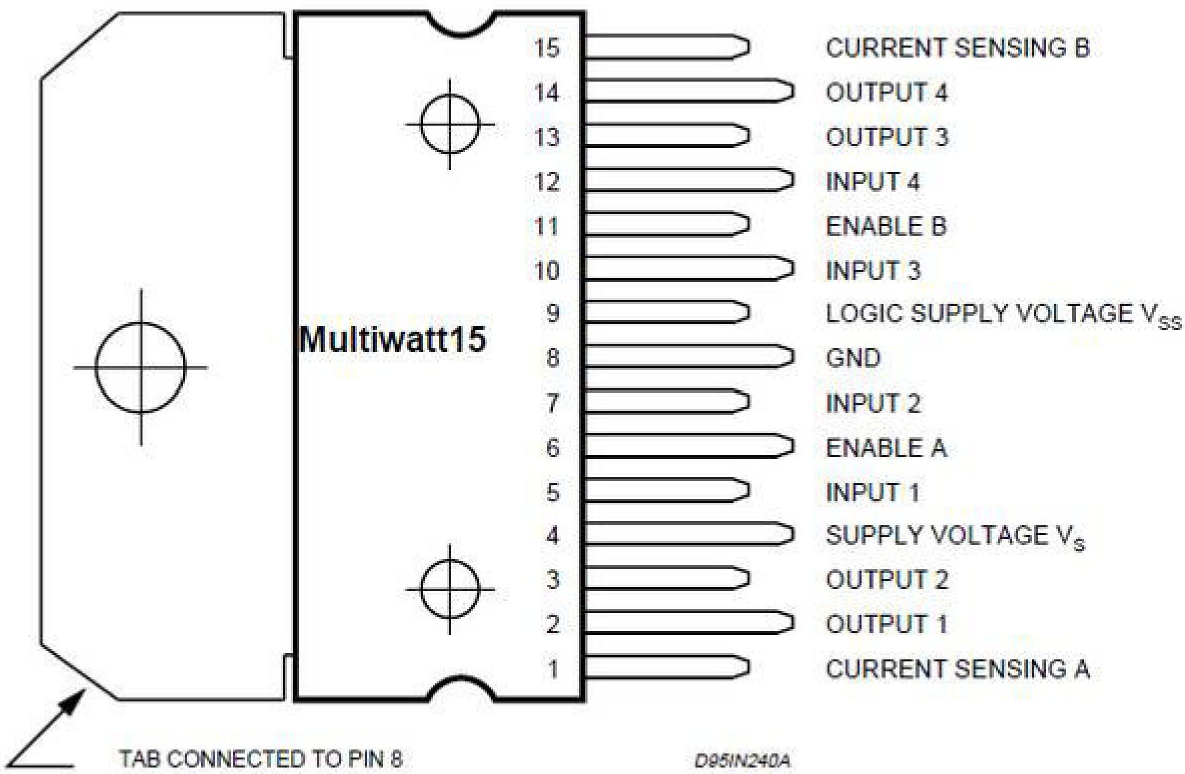


Fig. III 8 L298 element

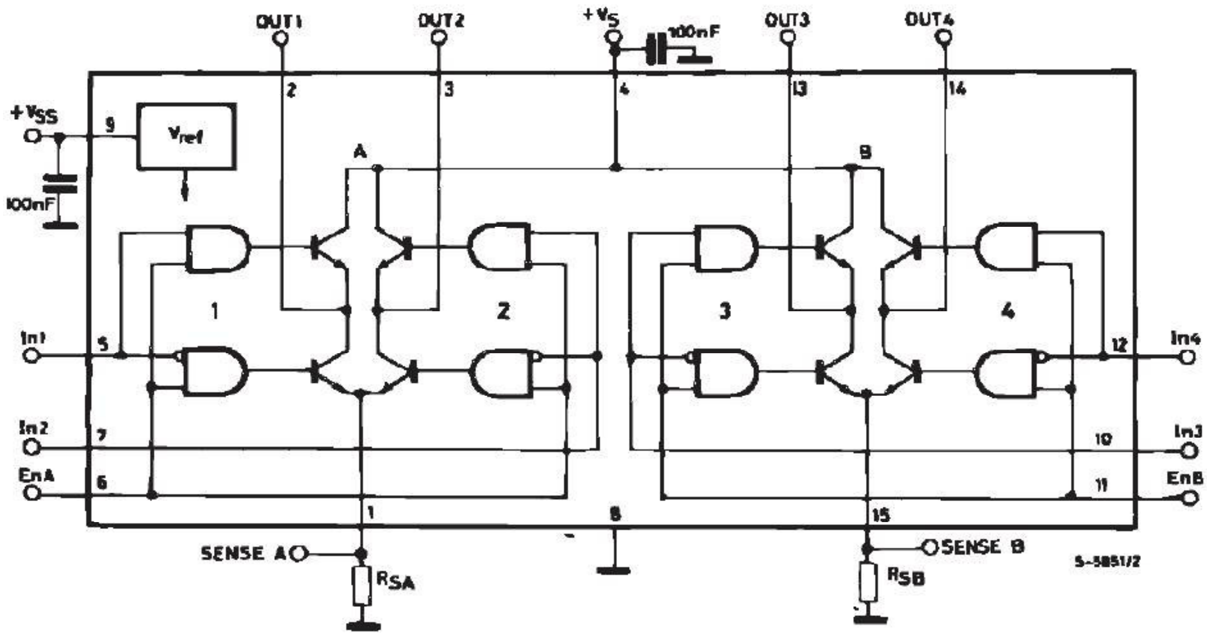


Fig. III 9 BLOCK DIAGRAM

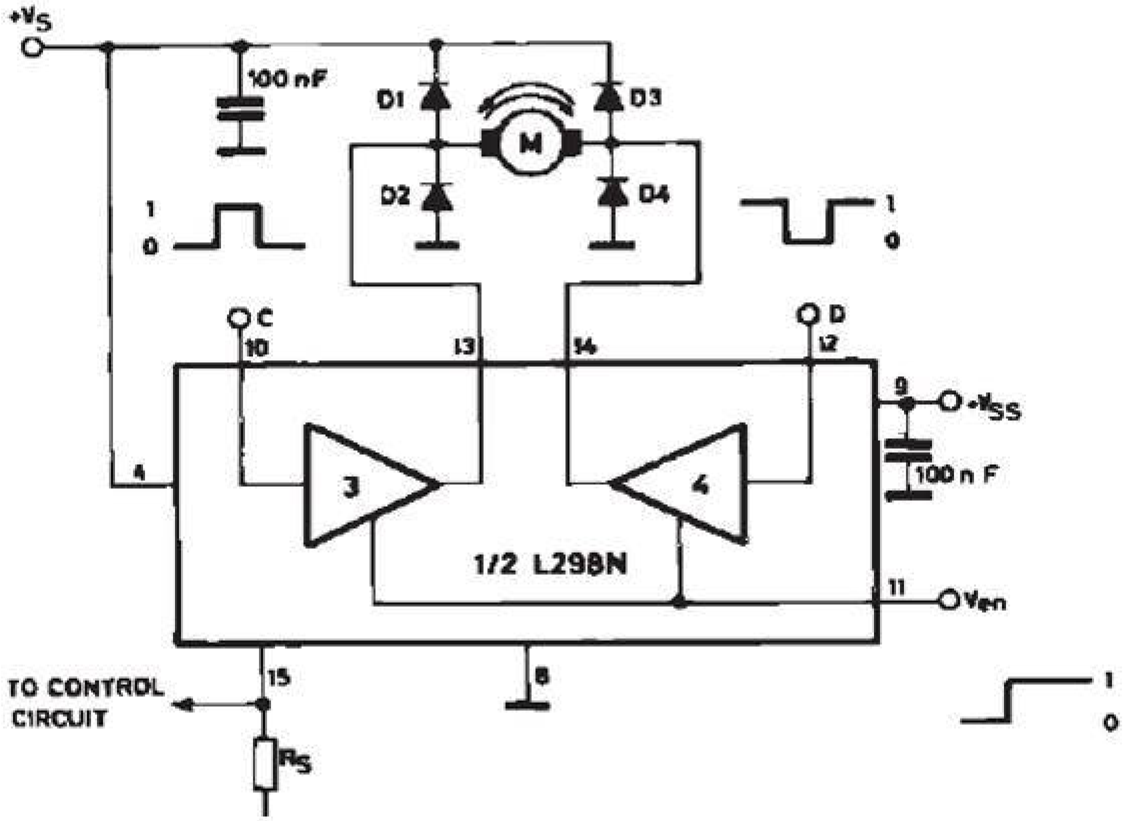


Fig. III 9 BidirectionalDC Motor Control.

Inputs		Function
$V_{en} = H$	C = H ; D = L	Forward
	C = L ; D = H	Reverse
	C = D	Fast Motor Stop
$V_{en} = L$	C = X ; D = X	Free Running Motor Stop

L = Low H = High X = Don't care

DESCRIPTION

The L298 is an integrated monolithic circuit in a 15-lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

APPLICATION INFORMATION

POWER OUTPUT STAGE

The L298 integrates two power output stages (A; B).The power output stage is a bridge configuration and its outputs can drive an inductive load in common or differential mode, depending on the state of the inputs. The current that flows through the load comes out from the bridge at the sense output an external resistor (RSA; RSB.) allows to detect the intensity of this current.

INPUT STAGE

Each bridge is driven by means of four gates the input of which are In1;In2; EnA and In3; In4; EnB. The In inputs set the bridge state when The En input is high; a low state of the En input inhibits the bridge. All the inputs are TTL compatible.

SUGGESTIONS

A non-inductive capacitor, usually of 100 nF, must foreseen between both Vs and Vss, to ground, as near as possible to GND pin. When the large capacitor the power supply is too far from the IC, a second smaller one must be foreseen near theL298.The sense resistor, not of a wire wound type, must be grounded near the negative pole of Vs that must be near the GND pin of the I.C. Each input must be connected to the source of the driving signals by means of a very short path. Turn-On and Turn-Off: Before to Turn-On the Supply Voltage and before to Turn it OFF, the Enable input must be driven to the Low state. [22]

3.1.4-THREE TERMINAL POSITIVE VOLTAGE REGULATORS 7805

The 78xx (sometimes L78xx, LM78xx, MC78xx...) is a family of self-contained fixed linear voltage regulator integrated circuits. The 78xx family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ICs within the family, the xx is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5 volt output, while the 7812 produces 12 volts). The 78xx line are positive voltage regulators: they produce a voltage that is positive relative to a common ground. There is a related line of 79xx devices which are complementary negative voltage regulators. 78xx and 79xx ICs can be used in combination to provide positive and negative supply voltages in the same circuit.
78xx ICs have three terminals and are commonly found in the TO220 form factor, although smaller surface-mount and larger TO3 packages are available. These devices support an input voltage anywhere from a couple of volts over the intended output voltage, up to a maximum of 35 to 40 volts depending on the make, and typically provide 1 or 1.5 amperes of current (though smaller or larger packages may have a lower or higher current rating).

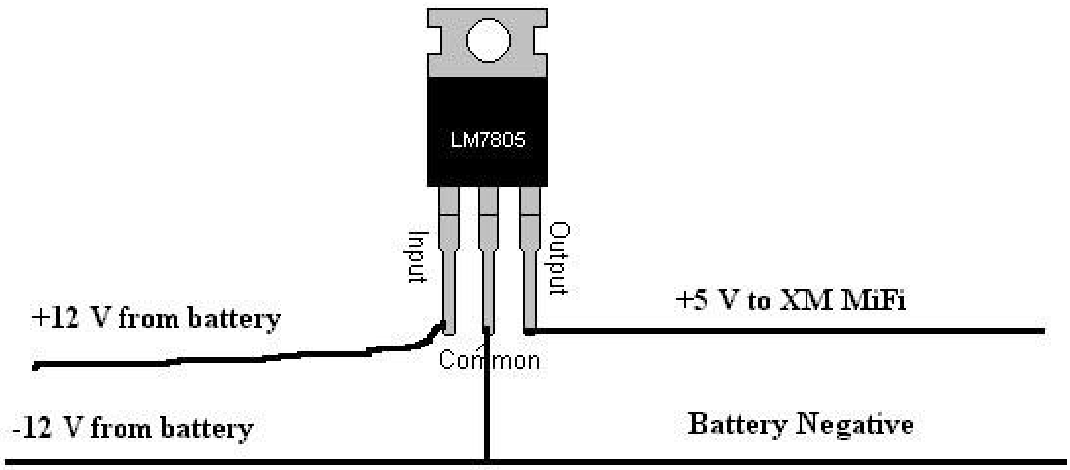


Fig. III 10 Way connection between the upstream and the circuit

78xx series ICs do not require additional components to provide a constant, regulated source of power, making them easy to use, as well as economical and efficient uses of space. Other voltage regulators may require additional components to set the output voltage level, or to assist in the regulation process. Some other designs (such as a switched-mode power supply) may need substantial engineering expertise to implement.

78xx series ICs have built-in protection against a circuit drawing too much power. They have protection against overheating and short-circuits, making them quite robust in most applications. In some cases, the current-limiting features of the 78xx devices can provide protection not only for the 78xx itself, but also for other parts of the circuit. [26]

3.1.4- IR Receiver Module

There are a large variety of light sensors: photoresistive, photovoltaic, photodiodes, and phototransistors. Light sensors can be used for navigation and tracking. Some robots use an infrared light source and detector to navigate around obstacles and avoid crashing into walls. The infrared source and detector are placed in front of the robot facing in the same direction. When the robot encounters an obstacle or wall, the infrared light is reflected off the surface causing an increase in the infrared light detected. The robot's CPU interprets this increased radiation as an obstacle and steers the robot around it. Filters can be placed in front of light sensors to inhibit their response to some wavelengths while enhancing their response to others. One example of the use of filters is as flame detectors used in fire-fighting robots. One would try to enhance the response to light from a fire while inhibiting the response to light from other sources.

Another example is the use of colored gels as filters to promote color response. One could imagine a robot that separates or picks ripened fruit based on the fruit's skin color.

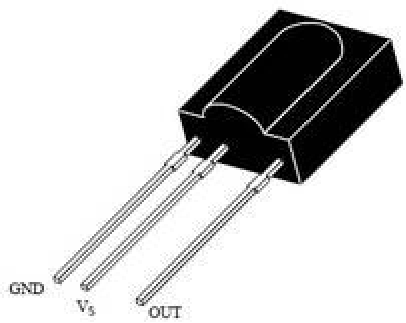


Fig. III 11 IR Receiver Module

Infrared (IR) sensors detect low-frequency [900-nanometer (nm) and longer] light.
They deserve special consideration because they are widely used in robotics for tracking, collision avoidance, and communication.
Using infrared sensors has never been easier. Infrared receiver modules that incorporate modulation detection, shown in Fig. III 11 , are available through a number of electronic distributors. The Sensors

FEATURES

• Low supply current
• Photo detector and preamplifier in one package
• Internal filter for 38 kHz IR signals
• Shielding against EMI
• Supply voltage: 2.7 V to 5.5 V
• Visible light is suppressed by IR filter
• Insensitive to supply voltage ripple and noise
• Component in accordance to RoHS 2002/95/EC and
WEEE 2002/96/EC

DESCRIPTION

The TSOP58038 is a compact IR receiver for sensor applications. It has a high gain for IR signals at 38 kHz. The detection level does not change when ambient light or strong IR signals are applied. It can receive continuous 38 kHz signals or 38 kHz bursts.

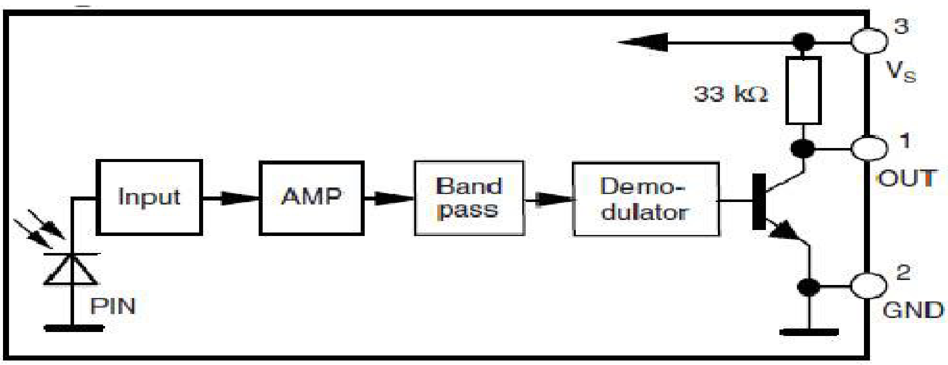


Fig. III 12 Block diagram

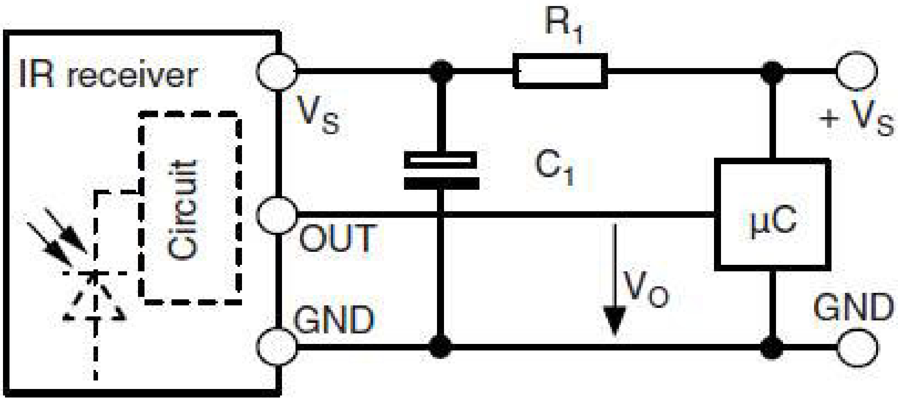


Fig. III 13 Block diagram

The external components R1 and C1 are optional
to improve the robustnes against electrical overstress
(typical values are R1 = 100 Ù, C1 = 0.1 ìF).
The output voltage VO should not be pulled down to a level
below 1 V by the external circuit.
The capacitive load at the output should be less than 2 nF.

TYPICAL CHARACTERISTICS

f0 : Primary frequency
(IR diode TSAL6200, IF = 0.4 A, 30 pulses, f = f0, t = 10 ms)

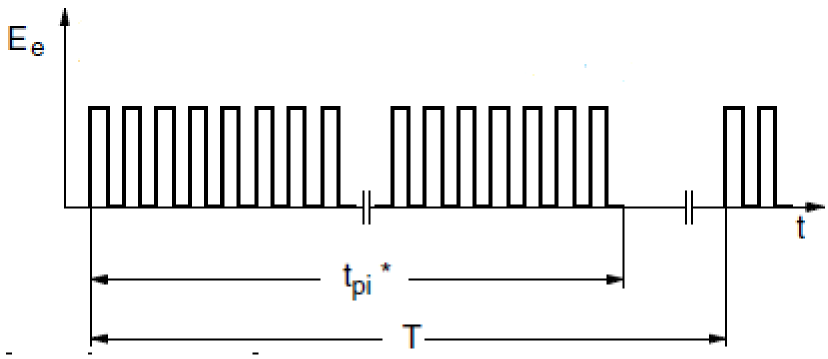


Fig. III 14.A Output Active Low

* tpi ≥10/f0 is recommended for optimal function

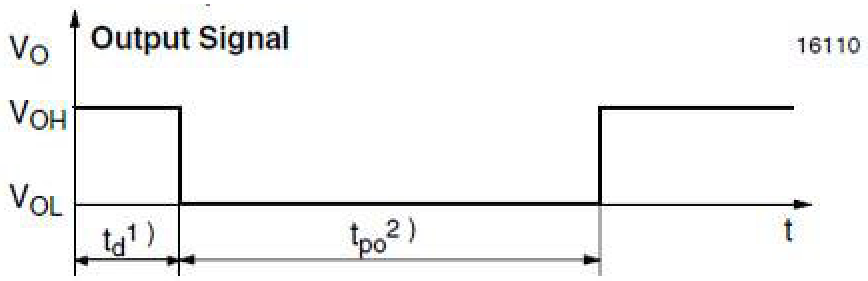


Fig. III 14.B Output Active Low

1) 7/f0 < td < 15/f0
2) tpi - 5/f0 < tpo < tpi + 6/f0

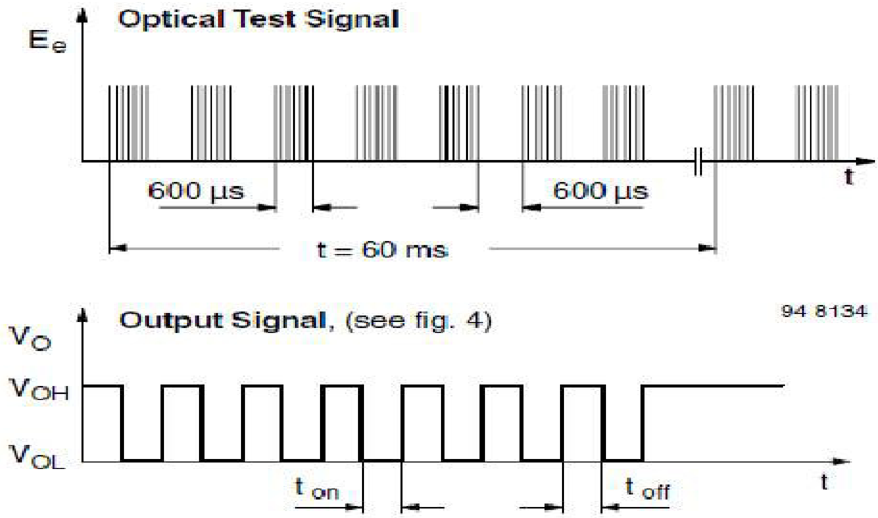


Fig. III 15 Output function

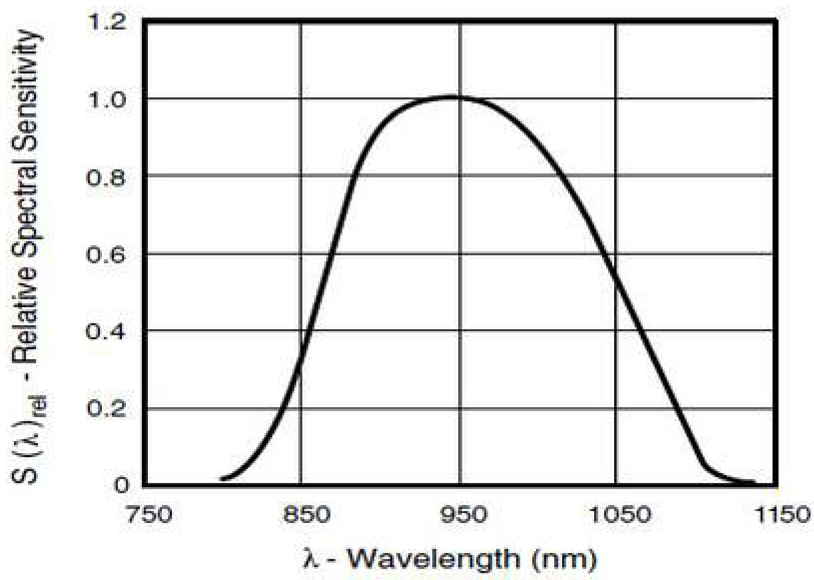


Fig. III 16 Relative Spectral Sensitivity vs. Wavelength

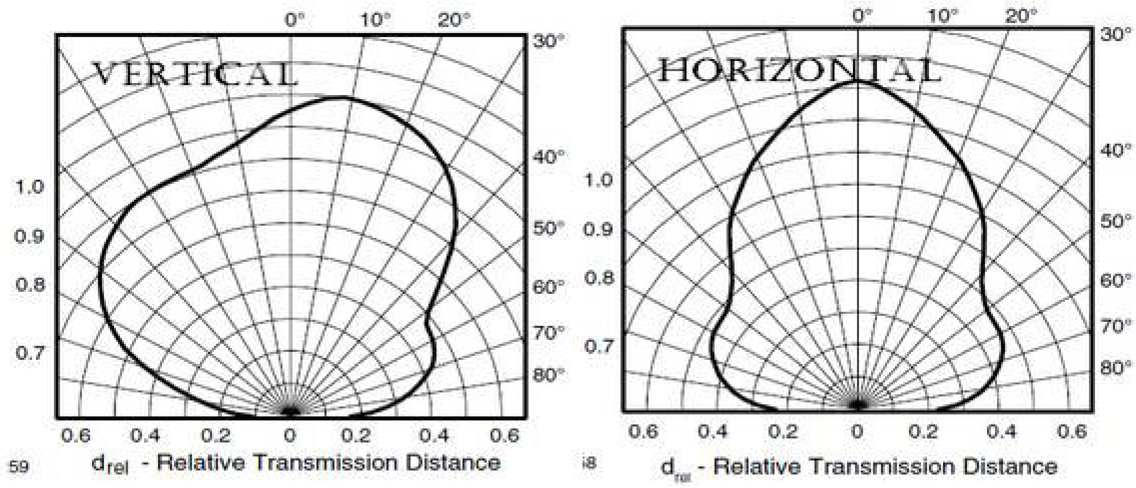


Fig. III 16 Horizontal and vertical Directivity

3.1.5- 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 so is its current. The current in the rotor is switched by the commutator 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 but non-rotating armature magnetic field and a static field winding 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. The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. [27]

Fig. III 17 DC motor

3.1.6- stepper motor

heavy driven in fixed angular steps.

This mean that a digital signal is used to drive the motor and every time it receives a digital pulse it rotates a specific number of degrees in rotation.

•Each step of rotation is the response of the motor to an input pulse (or digital command).

•Step-wise rotation of the rotor can be synchronized with pulses in a command-pulse train, assuming that no steps are missed, thereby making the motor respond faithfully to the pulse signal in an open-loop manner.

•Stepper motors have emerged as cost-effective alternatives for DC servomotors in high-speed, motion-control applications (except the high torque-speed range) with the improvements in permanent magnets and the incorporation of solid-state circuitry and logic devices in their drive systems.

•Today stepper motors can be found in computer peripherals, machine tools, medical equipment, automotive devices, and small business machines, to name a few applications.

stepper motor

Fig. III 18 stepper motor

ADVANTAGES OF STEPPER MOTORS

•Position error is noncumulative. A high accuracy of motion is possible, even under open-loop control.

•Large savings in sensor (measurement system) and controller costs are possible when the open-loop mode is used.

•Because of the incremental nature of command and motion, stepper motors are easily adaptable to digital control applications.

•No serious stability problems exist, even under open-loop control.

•Torque capacity and power requirements can be optimized and the response can be controlled by electronic switching.

•Brushless construction has obvious advantages.

DISADVANTAGES OF STEPPER MOTORS

•They have low torque capacity (typically less than 2,000 oz-in) compared to DC motors.

•They have limited speed (limited by torque capacity and by pulse-missing problems due to faulty switching systems and drive circuits).

•They have high vibration levels due to stepwise motion.

•Large errors and oscillations can result when a pulse is missed under open-loop control.

STEP ANGLE

The step angle, the number of degrees a rotor will turn per step, is calculated as follows:

$$\text{StepAngle}(\emptyset s) = \frac{sss}{s}$$

$$S = m \times N_r$$

m = numberofphases

N_r = numberofrotorteeth

STEP SEQUENCING

There are three modes of operation when using a stepper motor. The mode of operation is determined by the step sequence applied. The three step sequences are:

Wave

Full H = HIGH = +V

Half Stepping L = LOW = 0V

- <u>WAVE STEPPING</u>

  The wave stepping sequence is shown below.

  Table III 2 WAVE stepping sequence motor

STEP	L1	L2	L3	L4
1	H	L	L	L
2	L	H	L	L
3	L	L	H	L
4	L	L	L	H

Wave stepping has less torque then full stepping. It is the least stable at higher speeds and has low power consumption.

- **FULL STEPPING**

  The full stepping sequence is shown below.

  Table III 3 full stepping motor

STEP	L1	L2	L3	L4
1	H	H	L	L
2	L	H	H	L
3	L	L	H	H
4	H	L	L	H

Full stepping has the lowest resolution and is the strongest at holding its position. Clock-wise and counter clockwise rotation is accomplished by reversing the step sequence.

Table III 4 half-step motor

STEP	L1	L2	L3	L4
1	H	L	L	L
2	H	H	L	L
3	L	H	L	L
4	L	H	H	L
5	L	L	H	L
6	L	L	H	H
7	L	L	L	H
8	H	L	L	H

The half-step sequence has the most torque and is the most stable at higher speeds. It also has the highest resolution of the main stepping methods. It is a combination of full and wave stepping. [28]

3.1.7 Glcd

- **LCD Display Orientation**

The Nokia 6100 display has 132 x 132 pixels; each one with 12-bit color (4 bits RED, 4 bits GREEN and 4 bits BLUE). Practically speaking, you cannot see the first and last row and columns. The normal orientation is as follows:

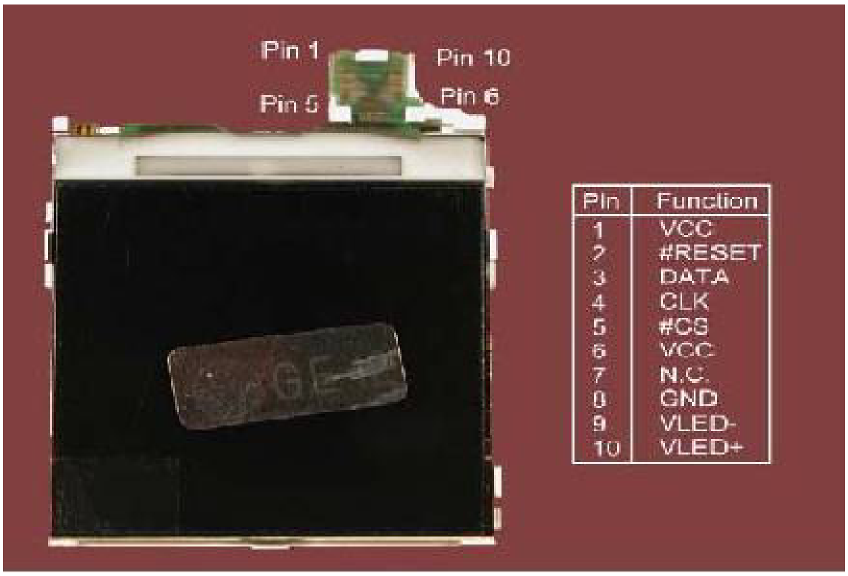


Fig. III 18 Nokia 6100 LCD Display

The important specifications for this display are as follows:

132 x 132 pixels

12-bit color rendition (4 bits red, 4-bits green, 4-bits blue)

3.3 volts

9-bit SPI serial interface (clock/data signals)

The Nokia 6100 uses a two-wire serial SPI interface (clock and data). The ARM7 microcontroller SPI peripheral generates the clock and data signals and the display acts solely as a slave device. Olimex elected to not implement the MISO0 signal that would allow the ARM microcontroller to read from the LCD display (you could read some identification codes, status, temperature data, etc). Therefore, the display is strictly **write-only**!

We send 9 bits to the display serially, the ninth bit indicates if a command byte or a data byte is being transmitted. Note in the timing diagram below from the Philips manual, the ninth bit (command or data) is clocked out first and is LOW to indicate a command byte or HIGH to indicate a data byte.

How fast can this SPI interface be run? Since the PCF8833 data sheet specifies that the serial clock SCLK period be no less than 150 nsec, dividing the board's master clock (48054841 Hz) by 8 gives a period of 166 nsec. Thus we can safely run the SPI interface at 6 MHz. I have run the SPI interface at 16 MHz and it still worked, but that is tempting fate. [29]

3.2 Components of the head card

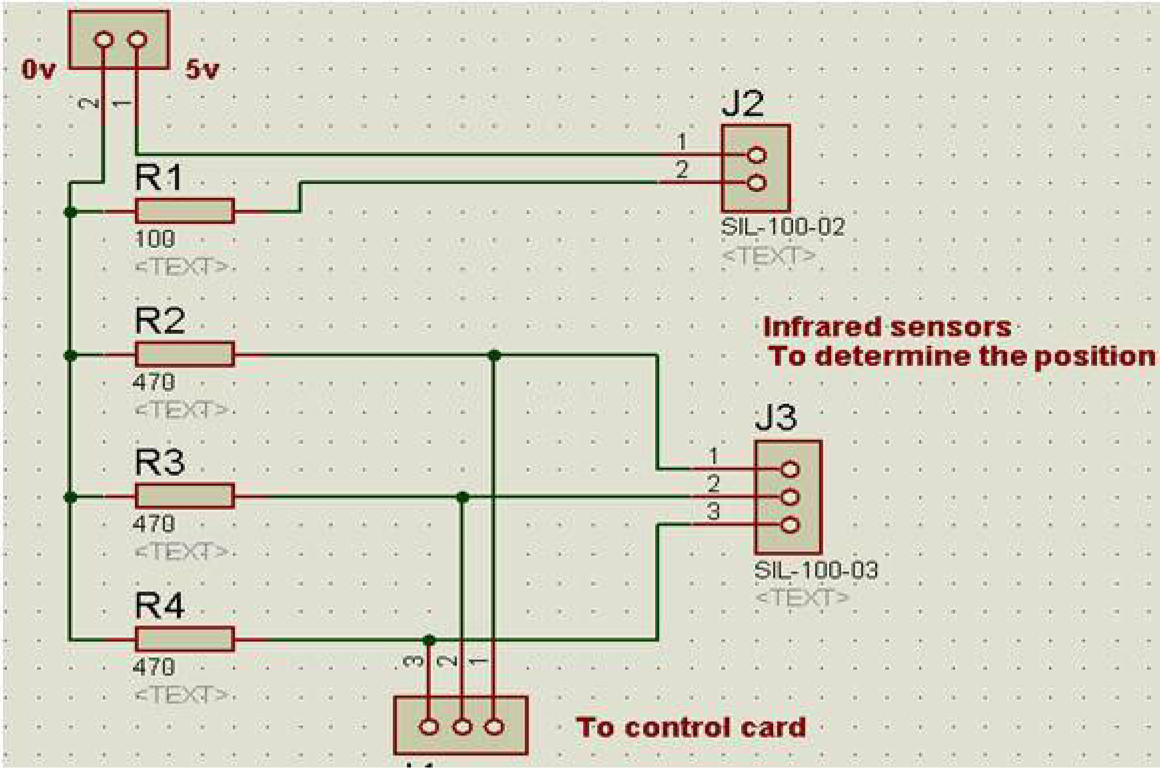


Fig. III 19 Electrical circuit diagram the Proteus simulation program

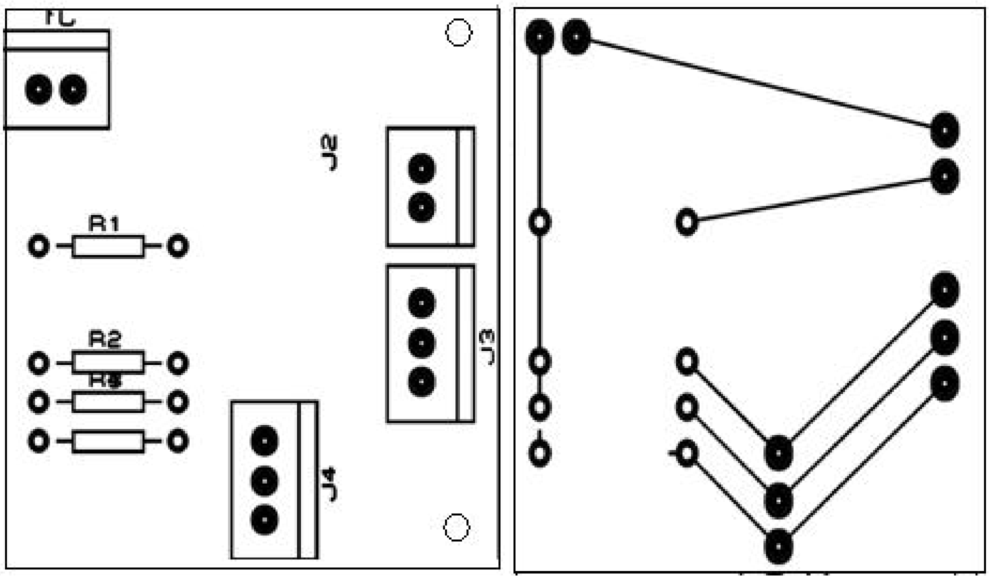


Fig. III 20 Electrical circuit Circuit print components and copper

Table III 5 Components of the head card

Order	Amount	Name
1	3	ENCODER
2	3	R 447
3	1	R 100

3.2.1 ENCODER

Fig. III 21 program Rotary Encoder sensors

A Rotary Encoder is used to provide angular position feedback. They come in "digital" or analog form, and the types of information they offer can be packaged in various ways.

One of the more popular types of encoders is called an optical rotary quadrature encoder. This type of encoder uses two LED emitter and receiver pairs that are slightly staggered in their orientation. Between both pairs of emitters and receivers, is placed a slotted disk that when rotated will either block or allow light to pass between the sensor/emitter pairs. As the slotted disk is rotated, the light sensors respond to fluctuations in light and causes them to output a "pulsed" voltage waveform that corresponds to the slot position on the rotating disk.

It turns out the two sets of the emitter & sensor pairs are offset by one half of the width of the wheels "slot", and thus depending on which sensor detects a change first in the voltage will determine the direction of rotation. Thus by looking at the feedback from the two sensors, we can determine the direction of rotation. Additionally by counting the amount of "pulses" or voltage transitions from high to low - we can also figure out how far the disk has rotated. Translating this into real-world measurements, by knowing how many slots are on the encoder disk (called resolution), we can determine the angle at which the disk has rotated from its original position.

Additionally, with a quadrature encoder having two identical sets of sensor pairs offset by exactly half the slot distance, we can use both sensors in unison to increase the positional accuracy by a factor of two.

Another type of encoder is a magnetic encoder. It works similarly to the optical encoder mentioned above, except that instead of using optical sensors, hall sensors are used to pick up the magnetic signature on a disk. The rotating disk has opposing positively and negatively orientated magnets that the robot can count to determine how much the disk has rotated.

Other types of encoders include linear encoders, which are similar in operation to the rotational type - except they are used to determine the linear position of something such as a robot's extension joint. Absolute encoders return unique strings of serial data based on disk angle. There are also analog encoders that return a voltage based on position. Potentiometers (adjustable resistors) can be used for this purpose and offer a cheap alternative for positional feedback.

Robots rely on encoders to determine Joint position or other feedback that is essential for proper performance.

3.3 Structure components

3.3.1 Body dimensions

In this section describe the structure robot Made of plastic

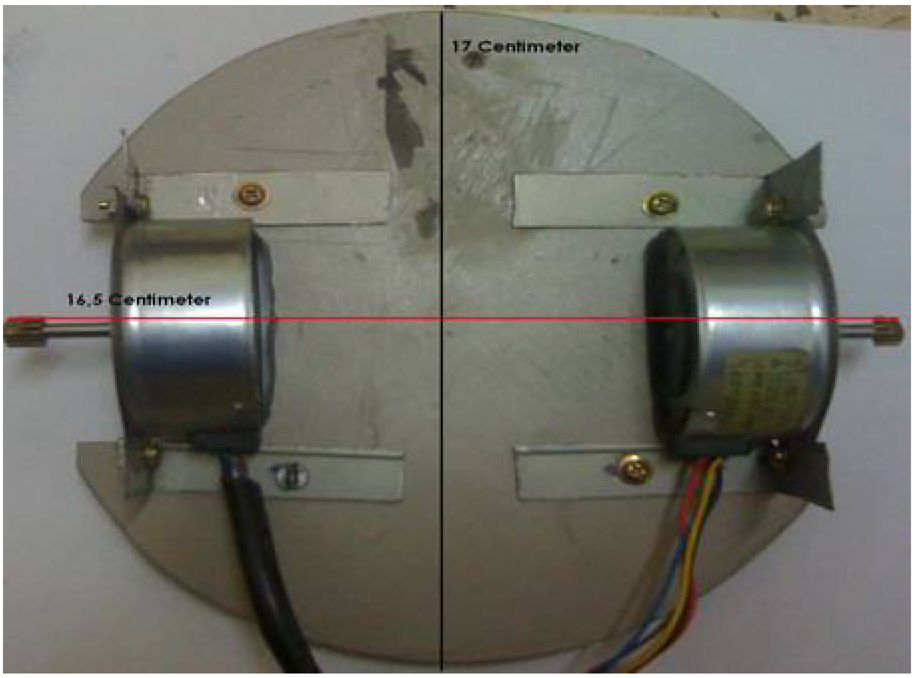


Fig. III 22 Body dimensions

3.3.2 wheels

Made of the same material made from them structure Plastic

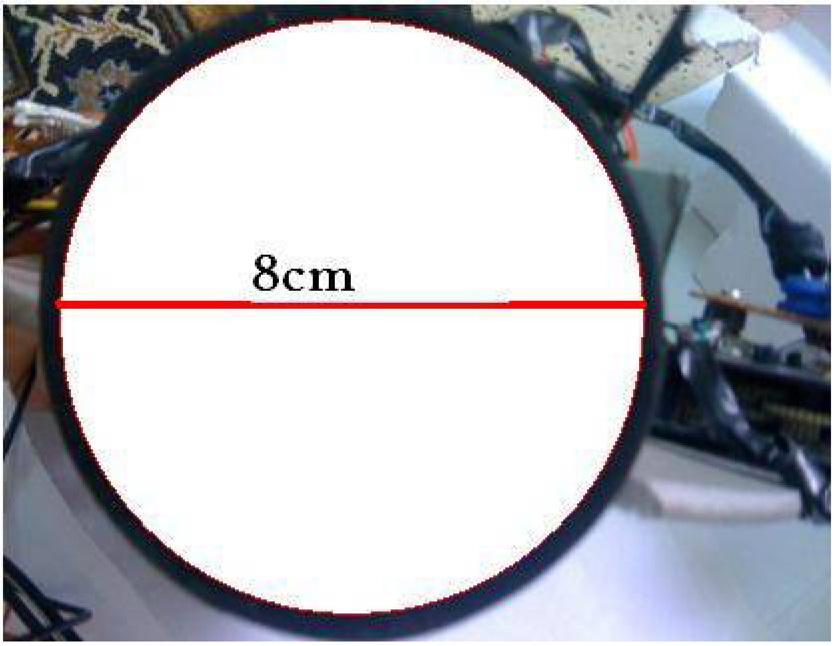


Fig. III 23 wheels dimensions

3.3.3 Information on the extension robot

- The total weight of the robot:

Fig. III 23 Net Weight Robot

- Engine rotation speed is one cycle every 1.5 seconds
- Color mostly on the robot is White
- The form of a circular robot

4 Conclusion

Robots use sensors to sense what is going on in the world around them Sensors can be broadly categorised as proprioceptive or exteroceptive and active or passive Sensor error can be a serious issue that we need to take care of There are many kinds of sensors that offer different levels of performance, error, price, etc

all components of the robot and coordination to give the robot the potential to overcome obstacles And it depends mainly on the program in the pic

In order to work robot must know whether there were any hindrance and this depends on the infrared and is the process of data processing and make the decision The decision comes in the form of an electric current to the engine to give the movement

CHAPTER IV:

Robot work

1. Introduction

Getting feedback through sensors is important when building a robot because without any type of feedback the robot does not know about the world that surrounds it. By adding a proximity sensor our robot can now 'see' things infront of it. In this article we made the robot react to something that moved too close to the robot, alternatively the robot could also react if it moved too close to something else.

So we used in our project this infrared And the head of mobile pregnancy infrared

2. The working principle of robot

To learn how to work robot must know That a robot is available on three cases of Head of

1, when the Head of forward call phase A

2, when the Head of heading to the right call phase B

3. When the Head of heading to the left call Phase C

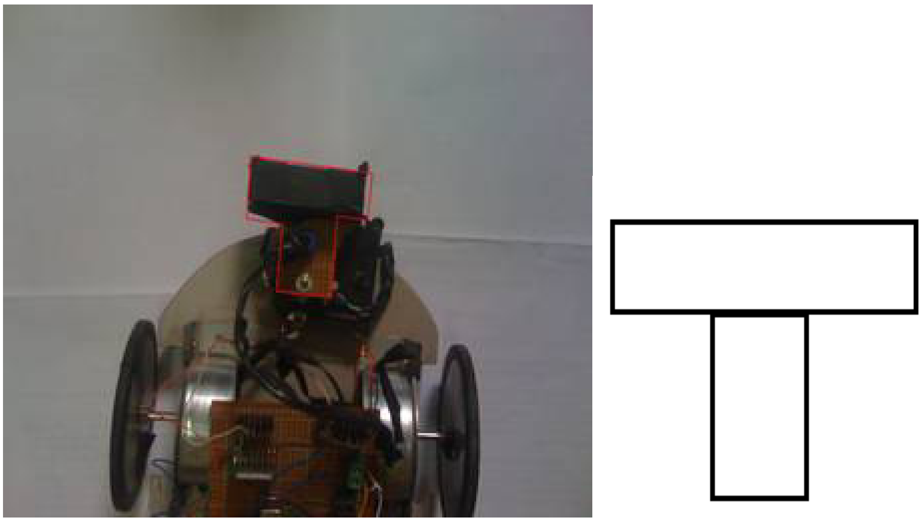


Fig. IV 1 phase "A"

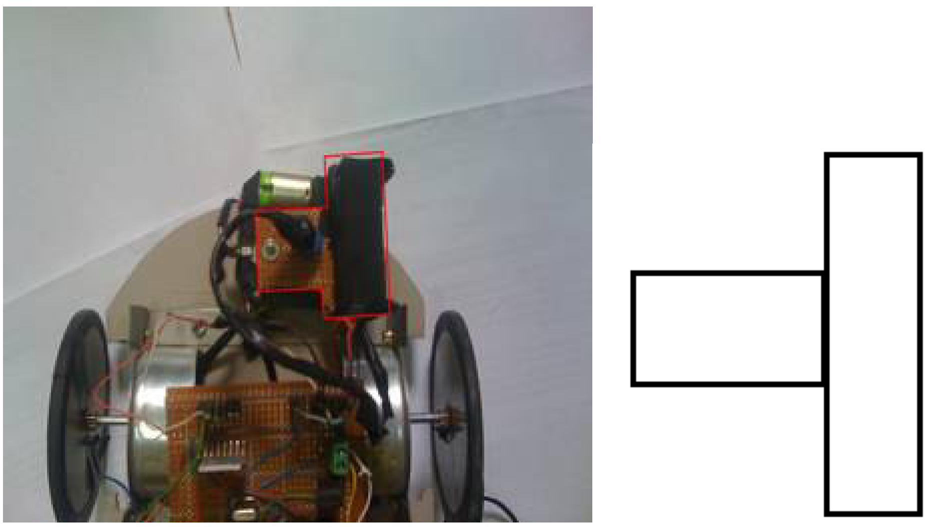


Fig. IV 2 phase "B"

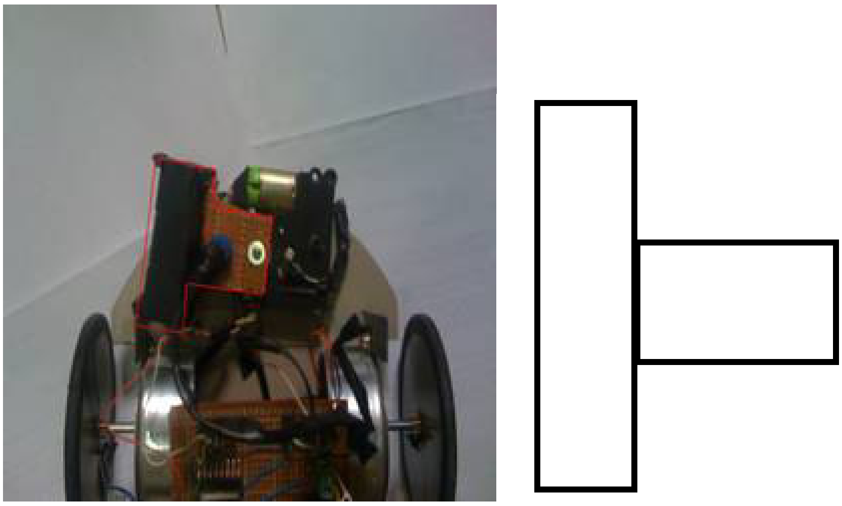


Fig. IV 3 phase "C"

The infrared object detection system we'll build on the Boe-Bot is like a car's headlights in several respects. When the light from a car's headlights reflects off obstacles, your eyes detect the obstacles and your brain processes them and makes your body guide the car accordingly.

The Boe-Bot uses infrared LEDs for headlights as shown in Fig. IV 4 They emit infrared, and in some cases, the infrared reflects off objects and bounces back in the direction of the Boe-Bot. The eyes of the Boe-Bot are the infrared detectors.

The infrared detectors send signals indicating whether or not they detect infrared reflected off an object.

The brain of the Boe-Bot, the BASIC Stamp, makes decisions and operates the servo motors based on this sensor input.

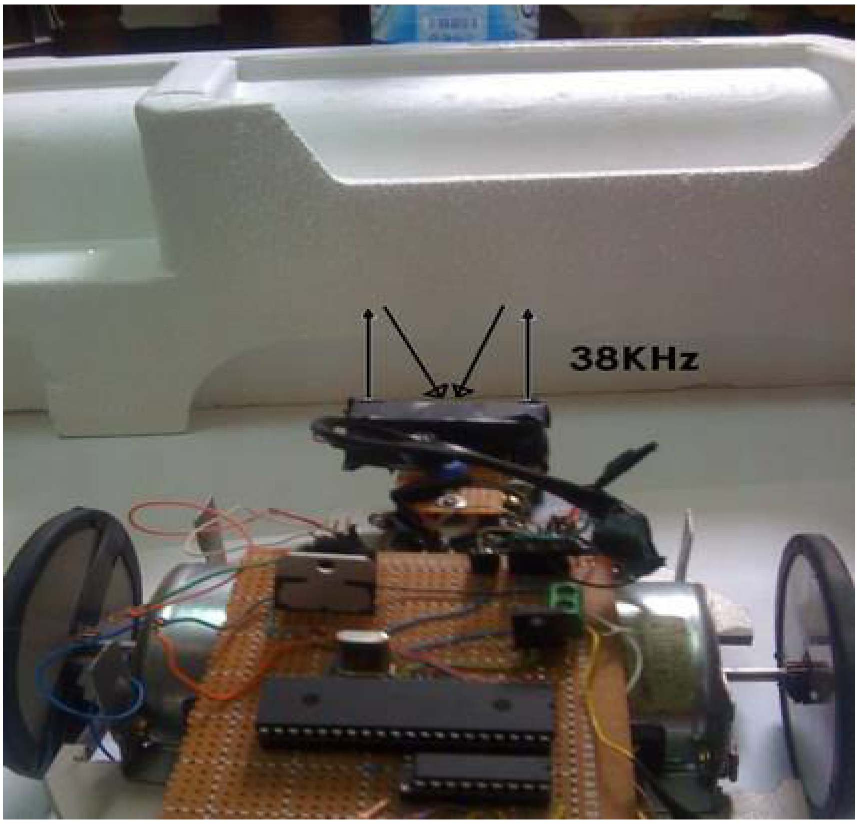


Fig. IV 4 How find obstacle

The IR detectors have built-in optical filters that allow very little light except the 980 nm infrared that we want to detect with its internal photodiode sensor. The infrared detector also has an electronic filter that only allows signals around 38.5 kHz to pass through. In other words, the detector is only looking for infrared that's flashing on and off 38,500 times per second. This prevents IR interference from common sources such as sunlight and indoor lighting.

Sunlight is DC interference (0 Hz), and indoor lighting tends to flash on and off at either 100 or 120 Hz, depending on the main power source in the region.

Since 120 Hz is outside the electronic filter's 38.5 kHz band pass frequency, it is completely ignored by the IR detectors.

3 Dynamic programming side

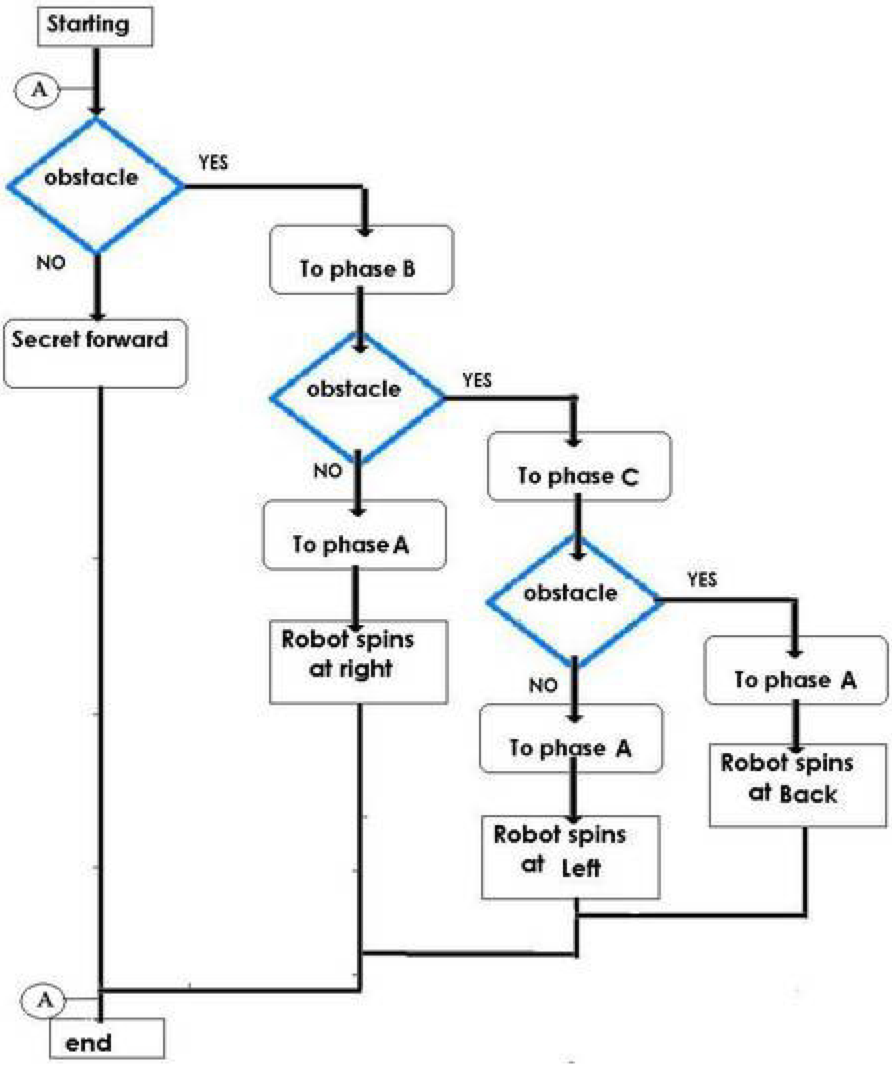


Fig. IV 4 Action plan robot programmed method

4 Conclusion

For the dynamic interaction of the robot must take into account some of the controls Taking into account the shape and size of the robot to make it match with the programming

Because the same programming is not suitable for some shapes

CHAPTER V:

General Conclusion

General Conclusion

oday we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.

In the following important points in the work done :

- In this project has been implemented robot avoid obstacles with the head of a moving relied on infrared (transmitter - receiver) in the frequency of 38 kHz and this to avoid vulnerability to external light and the sun ...... etc..

- We also saw the possibility of project 16f877A pic basic to run the program, which works on the functioning robot At the same time, the program works Supplement to give lighting fast 38 kHz and this by timer0 property and interrupt

- Robot was given a circular shape because he streamlined rotation

- And we used the step motors for being accurate in determining the angle of rotation and a great determination to move the gravity

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