

**INFANT INCUBATOR WITH  
TEMPERATURE&HUMIDITY CONTROL  
SYSTEM**

**GRADUATION PROJECT SUBMITTED TO THE  
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**by**

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**THE INFANT INCUBATOR WITH TEMPERATURE SENSOR AND HUMDITIY  
SENSOR SYSTEM**

**Approval of Director of Graduate School of Applied Sciences**

**We certify this thesis is satisfactory for the award of the degree in**

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## ACKNOWLEDGEMENT

We would like to express our gratitude to the people who have helped us in completing our project successfully. We would like to our sincere thanks to them for their support to us at all times.

Firstly, We would like to thank our supervisor Assoc. Prof. Dr Terin ADALI (Head of Department of Biomedical Engineering) for her undue support and guidance given to us during the course of our Project and for providing us with such as class infrastructures.

Then, We would like to thank Dr. Ali I IN for his ideas, suggestions, guidance, and support to come up with this project. Special thanks for his constant motivation throughout this project and this thesis.

And, We are very much owing to our parents for their moral support and encouragement to achieve higher goals. We have no words to express our gratitude and we are very thankful to our parents who have shown us this world and for every support they gave us.

Finally, We would like to thank all our friends for the help and criticism during our project period...

## **ABSTRACT**

Control of the parameters which have close values as the uterus such as temperature, humidity and oxygen is very precious to health of the babies who are born premature or with other problems. Even if this environment is simulated the uterus theoretic it is not possible at all in practical.

In this study, nurse is asked to enter appropriate set values to keep temperature, humidity and oxygen parameters at optimum level for babies. The set values taken from the user are compared to the dates taken from sensors periodically, thus case of alarm is controlled.

In the first and second chapter of the project, the importance of the incubator and what it medically means are expressed. There are some informations about the micro controller which was used in incubator control card in the second chapter. In the third chapter are there technical information about humidity sensor and temperature sensor and also about one-wire which the sensor communicates. The last chapters the trouble that we had while we were working on this project and required alarm cases were mentioned.

**Keywords: Temperature, Humidity, Oxygen**

## ÖZET

Erken veya sorunlu doğan bebeklerin anne rahmindeki ortama benzeyen sıcaklık, nem ve oksijen gibi önemli parametrelerin kontrolü bebeğin sağlığı açısından önem taşıyor. Bu ortam teorikte anne rahmine benzetilse bile pratikte tamamen mümkün olamamaktadır.

Bu çalışmada sıcaklık, nem ve oksijen parametrelerini bebek açısından optimum düzeyde tutabilmek için hem ireden uygun set de erinin girilmesi istenilmektedir. Kullanıcıdan alınan set de eri periyodik olarak sensörlerden alınan bilgiler ile karşılaştırılarak alarm durumları kontrol edilmektedir.

Projenin ilk ve ikinci bölümünde küvözün önemi ve tıbbi açıdan ne anlama geldiği ifade edilmektedir. Üçüncü bölümünde ise küvöz kontrol kartında kullanılan mikrodenetleyici hakkında bilgiler verilmiştir. Dördüncü bölümünde sıcaklık sensörü ve nem sensörüyle ilgili teknik bilgiler bulunmaktadır. Ayrıca sensörün haberleştiği one-wire hakkında bilgiler mevcuttur. Son bölümde projeyi gerçekleştirirken karşılaştığımız zorluklar ve gerekli alarm durumlarından bahsedilmiştir.

**Anahtar Kelimeler : Sıcaklık, Nem, Oksijen**

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In the first and second chapter of the project, the importance of the incubator and what it medically means are expressed. There are some informations about the micro controller which was used in incubator control card in the second chapter. In the third chapter are there technical information about humidity sensor and temperature sensor and also about one-wire which the sensor communicates. The last chapters the trouble that we had while we were working on this project and required alarm cases were mentioned.

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## **ABBREVIATIONS**

**RH: Relative Humidity**

**PWM: Pulse Width Modulation**

**TEWL: Transepidermal Water Loss**

**LCC: Leadless Chip Carrier**

**NV: Nonvolatile**

**CPU: Central Processing Unit**

**CRT: Cathode Ray Tube**

**RAMs: Random-Access Memories**

**ROMS: Read-Only Memories**

**BAN: Body Area Network**

**SFR: Special-Function Registers**

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## INTRODUCTION

Of the four million babies worldwide who die in the first month of life, one million die on their first day. Preterm birth is related, directly or indirectly, to at least 25 percent of neonatal deaths, and low birth weight newborns are at the greatest risk.

Incubators provide prevent heat loss to significantly and warmth improve survival rates. The use of air-heated incubators has been the standard method of providing a stable, thermal environment for the newborn infant at risk.

Humidity and Temperature play an important part in our environment. Changes in temperature and humidity can project is to control relative humidity, the heat of a given environment such as baby incubator.

Temperature regulation is one of the most important factors affecting. Infants typically lose heat to their environment in four different ways: through convection, conduction, evaporation, radiation. Premature infants, as compared to term infants, are at an even greater disadvantage in temperature maintenance, because of the larger skin surface area to body mass ratio, decreased subcutaneous fat. Hence, the normal surge in metabolic rate that occurs after birth is reduced in preterm infants, resulting in limited heat production.

A microcontroller is used to control the temperature in a baby incubator. The temperature had to be kept constant at 36.9 C as in mother's womb. The system will function as stated in the programming code of microcontroller in order to keep the temperature stable. A simple temperature controller which has least complex circuitry has to be designed so that it saves space and be more reliable for an incubator.

Present design which uses microprocessor as main controller in digital signal processing combined with complex combinational logic circuit are redundant and needs to be improved in the sense of functionality. Therefore, the replacement of microcontroller with an Arduino microcontroller is prudent action due to its efficiency, reliability especially in an incubator.

## **CHAPTER 1 : INFANT INCUBATOR**

### **1.1. Definiton Of Infant**

A premature infant is a baby born before 37 completed weeks of gestation so; more than 3 weeks before the due date. Premature infants are at greater risk for short and long term complications, impediments and including disabilities in growth and mental development.



### **1.2. What is The Infant Incubator?**

Infant incubator is a biomedical device which provides humidity, warmth, and oxygen all in a controlled environment as needed by the new born. You can consider as therapy device.

A baby incubator is an infant stimulating systems used for intensive care of the, premature, newborn or sick baby. It provides spacious clean and sterile ambient conditions for the promoters and newborns.

The our incubator environment provides stable and a homogeneous temperature a relative humidity (RH) level and atmospheric gas concentration for intensive care of the premature baby usually the controller used in the baby incubator is a microcontroller.



### 1.3. Importance of Infant Incubator

In baby incubator Humidity control is very important. And therefore we want to control the Humidity according to our requirements. Humidity controller can be done by using an electronic circuit, a microcontroller and a microprocessor.



#### Infant Incubator Device

Temperature regulation is one of the most important factors affecting survival in newborn infants. Infants typically lose heat to their environment in four different ways: through convection, conduction, evaporation radiation. Incubators provide warmth and prevent heat loss to significantly improve survival rates.

## **CHAPTER 2: DESIGN GOAL**

### **2.1. OVERVIEW**

This project is to design a temperature controller and a humidity controller to be used to control the temperature and humidity status. A baby incubator is an infant stimulating system used for intensive care of the newborn, premature or sick baby. It provides a clean and a safe environment, which has fresh air, clean and sterile ambient conditions for the babies. Usually the controller used in the baby incubator is a Microcontroller.

### **2.2 PROBLEM STATEMENT**

Premature or babies are unable to keep themselves sufficiently warm. They are also very weak and recipient to infections. An incubator is a special type of a coat which provides an ideal environment for the baby. It tries to stimulate the conditions as inside the mother's womb.

### **2.3 OBJECTIVE**

The main objective of our graduation project is to design a baby incubator with humidity control and temperature control using a microcontroller (PIC16F877A) or Arduino Microprocessor, while monitoring the incubator temperature and humidity.

### **2.4 STEPS**

- Search for information related to required environment, for example the size of the baby Incubator, function of the incubator and any information related to our project.
- We searched for the equipment and materials required for our project.
- Build an incubator that is suitable and functions that the same as available incubator.
- Designed the PIC16F877A or Arduino Microcontroller programming code according to the specification of temperature and humidity control in C basic language software.
- Program the microprocessor is according to the specifications of the temperature and humidity control system. Administer the circuit and build the model of incubator that is suitable for our environment

## **CHAPTER 3: TEMPERATURE AND HUMIDITY CONTROL SYSTEM**

### **3.1. THE IMPORTANCE OF TEMPERATURE FOR BABIES**

Temperature plays an important part in our environment. Changes in temperature setting can affect the behavior of human beings, plants and even materials such as semiconductors. Our Graduation Project is to control the temperature of a given environment such as baby incubator. Incubators provide warmth and prevent heat loss to significantly improve survival rates. The use of air-heated incubators has been the standard method of providing a stable.

A microcontroller is used to control the temperature in a baby incubator. A simple temperature controller which has least complex circuitry has to be designed so that it saves space and be more reliable for an incubator. Present design which uses microprocessor as main controller in digital signal processing combined with complex combinational logic circuit are redundant and needs to be improved in the sense of functionality. Thus, replacement of microcontroller with an microcontroller is prudent action due to its efficiency and reliability especially in an incubator

Some (25%) of this deaths are caused due to complications of prematurity, most often due to improper heat regulation, water loss and neonatal jaundice. An infant incubator provides stable levels of temperature, relative humidity and oxygen concentration. Temperature control system is the most important part of a baby incubator which has to be maintained around 37oC. In the present work we have designed and developed an enhanced temperature control system incorporating a combination of Pulse Width Modulation (PWM) and simple ON-OFF control system, where thermistors have been used as temperature sensors. The range of variation of temperature against the set temperature (39C) has found to be 1oC which is tolerance. A temperature setting monitor has been designed through a circuit network incorporating a thermistor so that the voltage output is linearly related to the temperature. This allowed the use of a simple milli voltmeter to display the temperature directly through appropriate scaling. To ensure the safety of the premature an alarm circuit was designed which provides sound alarms for personnel attention if the temperature goes beyond a specified safe range, chosen here as 25oC – 39C.

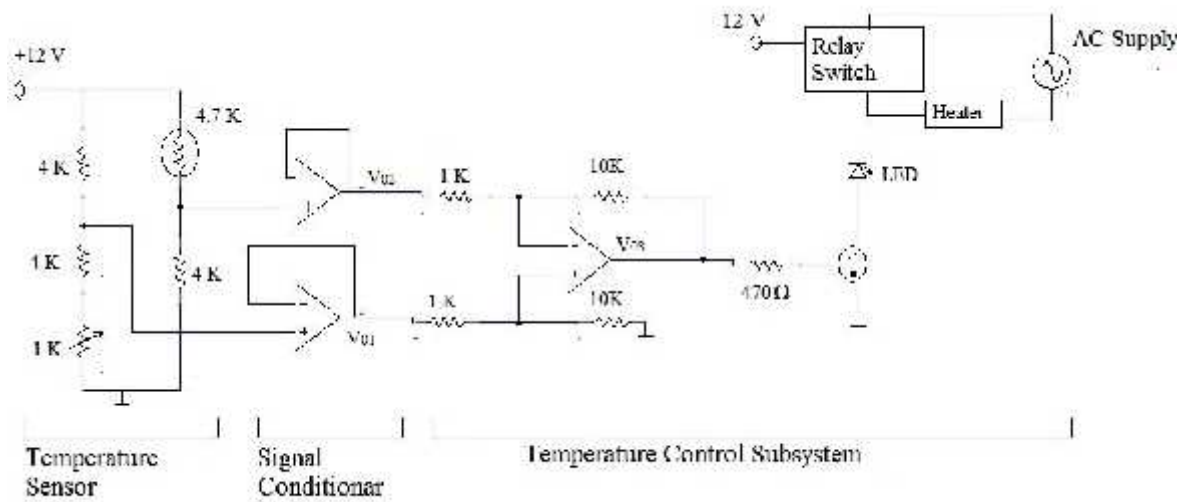
### 3.1.1. DESIGN, DEVELOPMENT AND PERFORMANCE

The temperature of the baby incubator needs to be maintained at a constant level of 39°C. A temperature indicator together with an alarm for accidental failures is also needed. This was the main challenge of the present work. The performance of this combined system was satisfactory. We have also designed a temperature indicator using a simple milli voltmeter by linearizing the performance of thermistor in the range of temperature 25-39°C. This system also incorporates high temperature (39°C) and low temperature (25°C) alarm for medical attention in the case of accidental failure of the temperature regulation system.

Selection of an appropriate temperature sensor is important for effective control of temperature in the incubator. Comparing the sensitivity and response time of available temperature sensors as like thermocouple, thermistor, RTD in the range of temperature 25-39°C along with accuracy, repeatability, term stability, linearity, self heating; thermistor is the best choice in this case .

If the temperature falls below the set value appropriate amount of heat energy needs to be supplied in the incubator to maintain the temperature at that level. This can be done by a simple turn OFF and ON control system which will turn OFF the heater when the temperature is below the set level and turn ON otherwise.,

Wheatstone bridge, as shown in Figure.1, rather than in a voltage divider circuit. Firstly a balance is obtained through adjustments of the resistors in the other arms . The unbalanced output voltage of the bridge in figure 1. was used to give a measure of the temperature change. It is well known that this sensitivity is the greatest when R2 is almost equal to R4 . So, the selection of the value of R1, R2 and R3 depends on the resistance of the thermistor. To select the value of the resistance now we need to know the response of the thermistor that is to be used with the change in temperature. Figure. 1 shows a graph of the resistance of a 4.7k thermistor with temperature. It can be seen that the resistance of the thermistor changes between 4.4K -3.2K in the range of temperature between 31-39°C. The average resistance in that range is 3.85K . A resistor of this value is not practically available so we have used 4K in the bridge circuit for R2.



Wheatstone bridge, as shown in Figure.1

### 3.1.2. Simple ON-OFF Control System

Block diagram of a simple ON-OFF control circuit is showed below in Fig. 2.

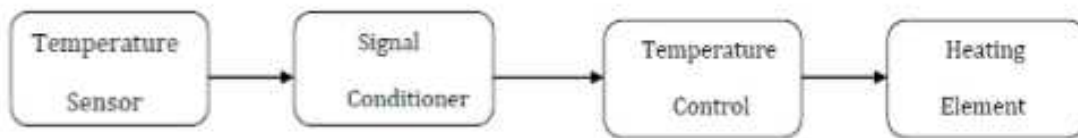


Fig.2

### 3.1.3 Combined Enhanced Temperature Control System

The block diagram of the control system is showned in Fig.3

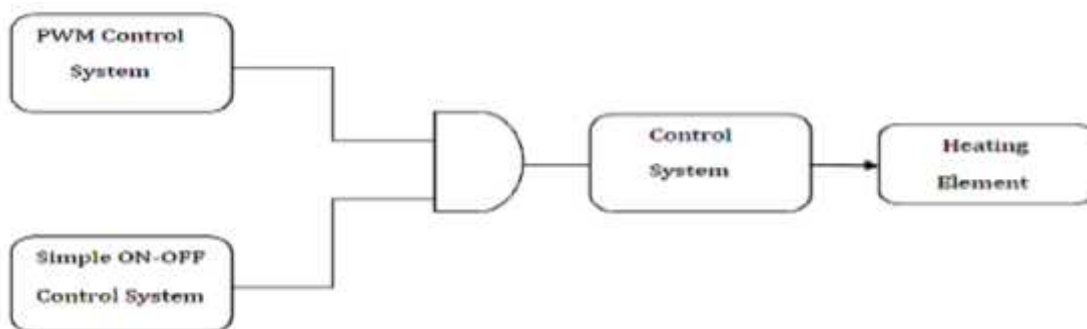


Fig.3.

As long as the output of the Simple OFF-ON circuit is high the output of the AND gate followed the PWM. So, the duty cycle of the heater or the amount of heat energy delivered is controlled by the output of the PWM, that work off to a low value near 39oC. When the temperature reaches the set temperature the output of the simple ON-OFF control circuit becomes zero which forces the output of the AND gate to zero and overrides the PWM. So, it finally shuts down the heater at the set temperature (39oC). However, the temperature overshoots a little due to thermal inertia, but because of the reduced heating before switching off the overshoot is much less than that encountered in a simple ON-OFF system described before. The complete circuit diagram of this combined enhanced temperature control system is shown in Fig.3.

## **3.2. HUMIDITY CONTROL SYSTEM**

### **3.2.1. Overview**

Humidification is the process of adding moisture over and above that which is already naturally present in the environment. Humidity is a measure of the moisture content of the air and can be measured as absolute humidity or relative humidity. It is this value which is of most clinical significance to the preterm infant. Relative humidity is high dependent upon air temperature as the higher the temperature the greater the capacity of the air to hold water vapor.

In this work we were developed a micro controlled system devoted to the newborn incubator, in order to check the conditions of the environment provided to the premature babies a humidity control system and software that carries out the reading of the sensors. With water and humidity control, if it put up inside established band of comfort by standard. Two microprocessed, similar newborn incubator were used, for the realization of the measurements, being that one of the newborn incubator used distilled water and other one was valued without water. The measures were collected to each 3 minutes during 98 hours. The relative humidity inside premature incubator without water and with water but, without humidity control, goes out from the band of comfort established by standard.

### **3.2.2 Background**

NICU are now caring for more and more extremely immature, very low birth weight infants. Evidence shows that when these infants are nursed naked in unhumidified incubators, they are unable to maintain a normal body temperature. It is recommended that additional humidity be used for all infants below 37 weeks gestation, and below 1.30 kg birth weight, during the first week of life. Premature infants lose large amounts of heat due to the thin, poorly developed epidermis and a relatively large surface area in relation to body weight. The greatest source of heat loss is by evaporation. This occurs in the form of insensible water loss and is known as transepidermal water loss. Individual studies have shown the importance of high ambient humidity to prevent this water loss. Reduced significantly reduces electrolyte abnormalities and difficulties with fluid balance.

### **3.2.3. Aims**

- ✓ Water loss reduce transepidermal
- ✓ Improved temperature control

### **3.2.4. PROSS**

Studies have been showed where humidification is used there is reduced transepidermal and water loss improved temperature control reduced epidermal stripping and preservation of skin tolerance reduced infection improved surviving and reduction in morbidity.

## **CHAPTER 4: [SHT11] Humidity Sensor and [DS18B20] Temperature Sensor**

### **4.1 [SHT11] Humidity Sensor**

SHT11 is Sensirion's family of surface mountable relative temperature and humidity sensors. The sensors integrate sensor material signal processing on a fine footprint and provide a fully calibrating digital output. A unique capacitive sensor elements are used to measure the

temperature while relative humidity is measured by a band-gap sensor. SHT11 is support in a surface-mountable LCC which is approved for standard reflow soldering processesing.

**Dimensions**

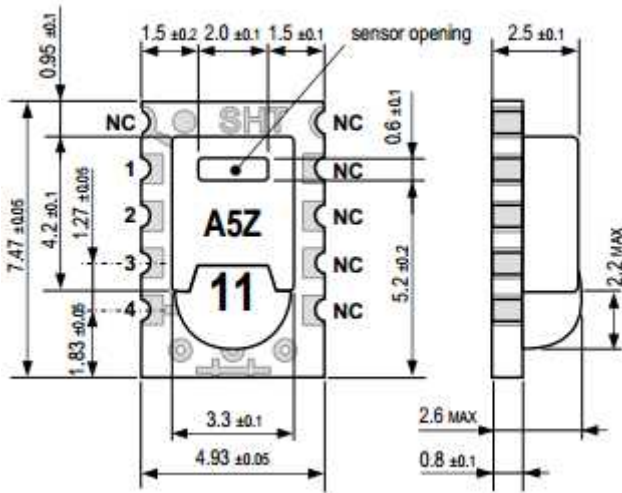


Figure 4: Drawing of SHT11 sensor packaging, dimensions in mm (1mm = 0.039inch). Sensor label gives “11” for SHT11 as an example. Contacts are assigned as follows: 1:GND, 2:DATA, 3:SCK, 4:VDD

**4.1.1. Features**

- Energy of consumption: 80uW (at 12bit, 3V, 1 measurement / s)
- Range of RH operating : 0 - 100% RH
- Range of T operating : -40 - +125°C (-40 - +257°F)
- Time of RH response : 8 sec (tau63%)
- Output: digital (2-wire interface)

**4.1.2.Sensor Chip**

SHT11 V5 – for which this datasheet applies – features a version 4 Silicon sensor chip. Besides the temperature and humidity sensors the chip contains an amplifier, A/D converter, digital and memory interface. V5 sensors can be identified by the alpha-numeric traceability code on the sensor cap – see example “A5Z” .



### 4.1.3. Material Contents

While the sensor is made of a CMOS chip the sensor housing consists of an LCP cap with epoxy glob top on an FR4 substrate. The device is fully RoHS and WEEE compliant, thus it is free of Pb, Cd, Hg, Cr(6+), PBB and PBDE.

### 4.1.4. Connections

The following diagram shows the connections required for the Sensirion SHT11 module.

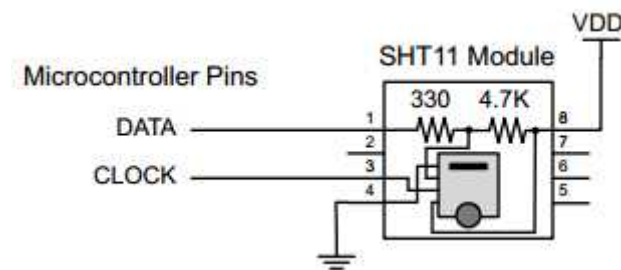


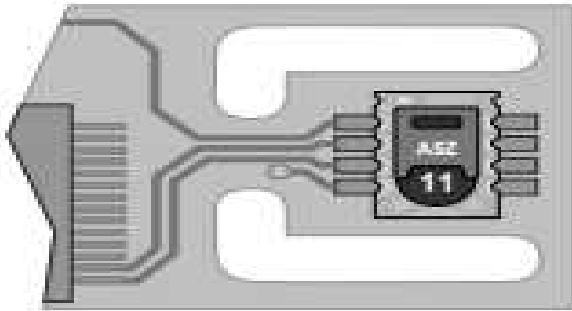
Fig.5

### 4.1.5. Temperature Effects

Relative humidity reading strongly depends on temperature. Thus, it is essential to keep humidity sensors at the same temperature as the air of which the relative humidity is to be measured. In case of testing or qualification the reference sensor and test sensor must showed equal temperature to allow for comparing humidity readings. Measures to reduce heat transfer can be ventilation, reduction of copper layers between the SHT11 and the rest of the PCB or milling a slit into the PCB around the sensor (see Figure 6).

If the SHT11 shares a PCB with electronic components that produce heat it should be

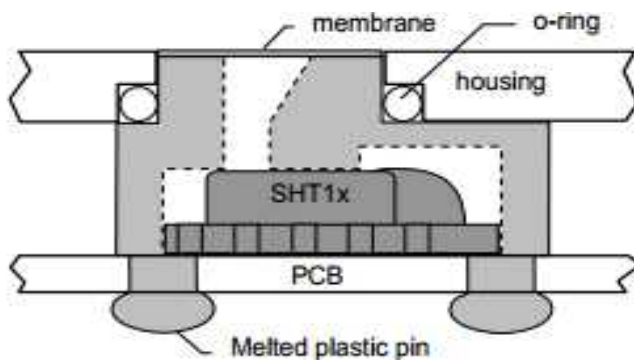
mounted in a way that prevents heat transfer or keeps it as low as possible.



**Figure 6: Top view of example of mounted SHT1x with slits milled into PCB to minimize heat transfer**

#### **4.1.6. Membranes**

SHT11 doesn't contain a membrane at the sensor opening. But, a membrane may be added to prevent dirt and droplets from entering the housing and to protect the sensor. Sensirion recommends and supplies the SF1 filter cap for optimal IP54 protection. Please compare Figure 7. It will also reduce peak concentrations of chemical vapors.



**Figure 7: Side view of SF1 filter cap mounted between PCB and housing wall. Volume below membrane is kept minimal.**

#### **4.1.7. All-Round Relative Humidity Sensor For Any Application**

SHT11 digital humidity and temperature sensor is the all-round version of the reflow solderable humidity sensor series that combines decent accuracy at a competitive price. The capacitive humidity sensor is available up to high volumes and every other sensor type of the SHT11, it is fully calibrated and provides a digital output.

#### 4.1.8.Sensor Performance

##### Relative Humidity

Parameter	Condition	min	typ	max	Units
Resolution <sup>1</sup>		0.4	0.05	0.05	%RH
		8	12	12	bit
Accuracy <sup>2</sup> SHT10	typical		±4.5		%RH
	maximal	see Figure 2			
Accuracy <sup>2</sup> SHT11	typical		±3.0		%RH
	maximal	see Figure 2			
Accuracy <sup>2</sup> SHT15	typical		±2.0		%RH
	maximal	see Figure 2			
Repeatability			±0.1		%RH
Hysteresis			±1		%RH
Non-linearity	linearized		<<1		%RH
Response time <sup>3</sup> $\tau$ (63%)			8		s
Operating Range		0		100	%RH
Long term drift <sup>4</sup>	normal		< 0.5		%RH/yr

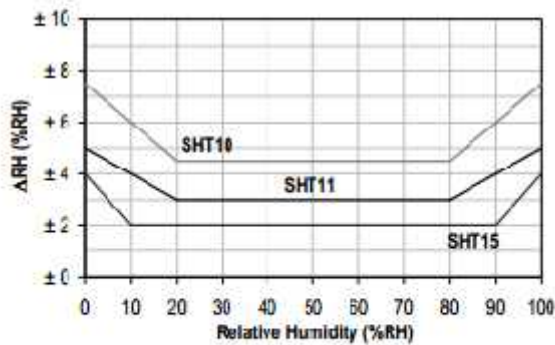


Figure 2: Maximal RH-tolerance at 25°C per sensor type.

##### Temperature

Parameter	Condition	min	typ	max	Units
Resolution <sup>1</sup>		0.04	0.01	0.01	°C
		12	14	14	bit
Accuracy <sup>2</sup> SHT10	typical		±0.5		°C
	maximal	see Figure 3			
Accuracy <sup>2</sup> SHT11	typical		±0.4		°C
	maximal	see Figure 3			
Accuracy <sup>2</sup> SHT15	typical		±0.3		°C
	maximal	see Figure 3			
Repeatability			±0.1		°C
Operating Range		-40		123.8	°C
		-40		254.9	°F
Response Time <sup>4</sup> $\tau$ (63%)		5		30	s
Long term drift			< 0.04		°C/yr

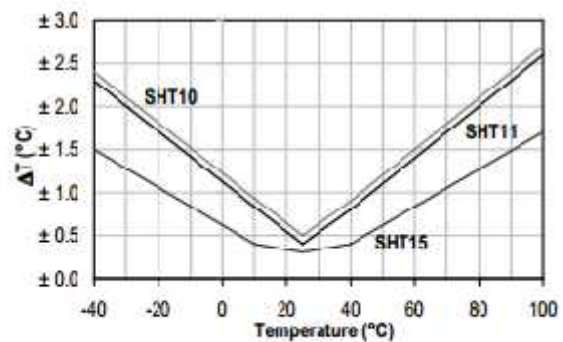


Figure 3: Maximal T-tolerance per sensor type.

Fig.8

#### 4.2. Temperature Sensor [DS18B20 ]

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. It has an operating temperature range of -55°C to +125°C and is accurate to ±0.5°C over the range of -10°C to

+85°C. In addition, the DS18B20 can derive power directly from the data line (“parasite power”), eliminating the need for an external power supply. Each DS18B20 has a unique 64-bit serial code, which allows multiple DS18B20s to function on the same 1-Wire bus. Thus, it is simple to use one microprocessor to control many DS18B20s distributed over a large area. Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

#### **4.2.1. FEATURES**

- Unique 1-Wire® Interface Requires Only One Port Pin for Communication
- Each Device has a Unique 64-Bit Serial Code Stored in an On-Board ROM
- Multidrug Capability Simplifies Distributed Temperature-Sensing Applications
- Requires No External Components
- Can Be Powered from Data Line; Power Supply Range is 2.0V to 5.5V
- Alarm Search Command Identifies and Addresses Devices Whose Temperature is Outside Programmed Limits (Temperature Alarm Condition)
- Available in 8-Pin SO (150 mils), 8-Pin sop, and 3-Pin TO-92 Packages
- Software Compatible with the DS1822
- Applications Include Thermally Sensitive System Industrial Systems, Thermostatic Controls, Consumer Products, and Thermometers,
- Thermometer Resolution is User Selectable from 8 to 12 Bits
- Converts Temperature to 12-Bit Digital Word in 780ms (Max)
- User-Definable Nonvolatile Alarm Settings
- 

#### **4.2.2. PIN CONFIGURATIONS**

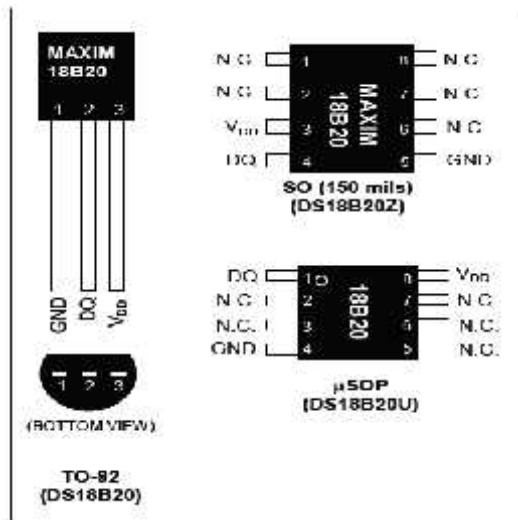


Fig.9

#### 4.2.3 Pin Description

PIN			NAME	FUNCTION
SO	μSOP	TO-92		
1, 2, 6, 7, 8	2, 3, 5, 6, 7	—	N.C.	No Connection
3	8	3	V <sub>DD</sub>	Optional V <sub>DD</sub> . V <sub>DD</sub> must be grounded for operation in parasite power mode.
4	1	2	DQ	Data Input/Output. Open-drain 1-Wire interface pin. Also provides power to the device when used in parasite power mode (see the <i>Powering the DS18B20</i> section.)
5	4	1	GND	Ground

Fig.10

#### 4.2.4 Operation—Alarm Signaling

After the DS18B20 performs a temperature conversion, the temperature value is compared to the user-defined two's complement alarm trigger values stored in the 1-byte TH and TL registers. TH and TL can be accessed through bytes 2 and 3 of the scratchpad as explained in the *Memory* section.

Only bits 11 through 4 of the temperature register are used in the TH and TL comparison since TH and TL are 8-bit registers. If the measured temperature is lower than or equal to TL or higher than or equal to TH, an alarm condition exists and an alarm flag is set inside the

DS18B20. This map is updated after every temperature measurement; therefore, if the alarm condition goes away, the flag will be turned off after the next temperature conversion.

Any DS18B20s with a set alarm flag will respond to the command, so the master can determine exactly which DS18B20s have experienced an alarm condition. If an alarm condition exists and the TH or TL settings have changed, another temperature conversion should be done to validate the alarm condition. The master device can check the alarm flag status of all DS18B20s on the bus by issuing an Alarm Search command.

## **CHEAPTER 5: MICROPROCESSORS AND PIC16F877A**

### **5.1. GENERAL**

A microprocessor is one of the most exciting technological innovations in electronics since the appearance of the transistor. This device hasn't only set in the process of revolutionizing the field of digital electronics, but it is also getting entry into almost human life.

Applications of microprocessors range from the very sophisticated process controllers and supervisory control equipment to simple game machines and even toys. It is, therefore, imperative for every engineering, specially electronics engineer, to know about microprocessors. Every designer of electronic products needs to learn how to use microprocessors. Even if he has no immediate plans to use a microprocessor, he should have knowledge of the subject so that he can intelligently plan his future projects and can make sound engineering judgements when the time comes.

Once he has understood signal of each component and its place in the system, he can go deeper into the working details and design of individual components without difficulty. The subject of microprocessors is overviewed here with the objective that a beginner gets to know what a microprocessor is, what it can do, how it fits in a system and gets an overall idea of the various components of such a system.

### **5.1.1. What Is A Microcomputer?**

The microcomputer is simply a less powerful minicomputer. Microcomputers have smaller instruction sets and are slower than mini computers, but then they are far less expensive and smaller too. To an engineer with a hardware background and no computer experience, a microcomputer will look like a sequential state machine that can functionally replace thousands of random chips, logic , but occupies a much lesser space, costs much lesser and the number of device interconnections being fewer in it, is much more reliable.

A microcomputer is primarily suited, because of its very low cost and very small size, to dedicated applications. On the same grounds, the main computer is as suitable as a general purpose computer. Minicomputer finds applications in both areas.

### **5.1.2. What is a Microprocessor?**

Microprocessors are important devices in our everyday machines called computers. Before we start, we need to understand what microprocessors are and their suitable implementations. Microprocessor is an electronic circuit that functions as the central processing unit (CPU) of a computer, providing computational control. The microprocessor, is the brain of all computers and many household and electronic devices . It comprises of three basic parts:

#### **(a) Central Processing Unit (CPU)**

It performs the necessary arithmetic and logic operations and controls the timing and general operation of the complete system.

#### **(b) Input/Output (I/O) Devices**

Input devices are used for feeding data into the CPU, examples of these devices are switches, analog-to-digital converters, card readers, keyboards, paper tape readers, disk etc. The output devices are used for delivering the results of computations to the outside world;

examples are light emitting diodes, cathode ray tube (CRT) displays, digital-to-analog converters, card and paper-tape punches, character printers, plotters, communication lines etc. The output devices are used for delivering the results of computations to the outside world;

### **(c) Memory**

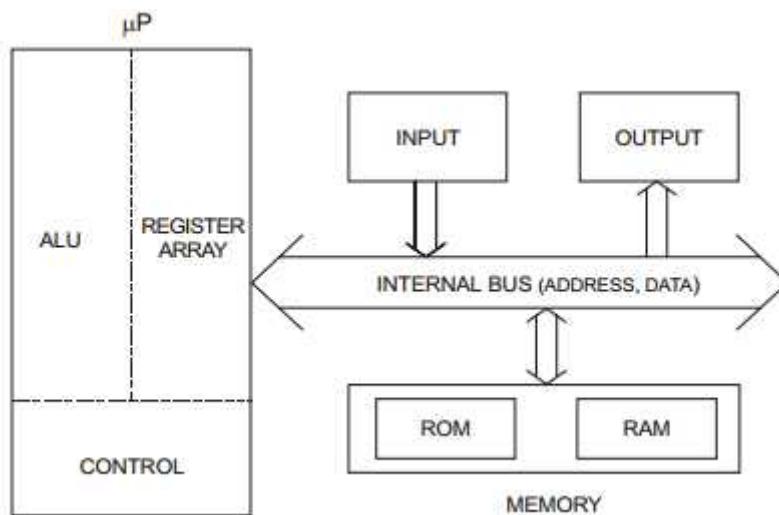
It stores both the instructions to be executed (i.e., the program) and the data involved. It usually consists of both RAMs (random-access memories) and ROMS (read-only memories). A microprocessor is an integrated circuit designed to function as the CPU of a microcomputer.

#### **5.1.3. What Is Inside A Microprocessor?**

The microprocessor or CPU reads each instruction from the memory, decodes it and executes it. It processes the data as required in the instructions. The data is retrieved from memory or taken from an input device and the result of processing is stored in the memory or delivered to an appropriate output device, all as per the instructions. The processing is in the form of arithmetic and logical operations.

A typical microprocessor architecture is shown in fig.11. The various functional units are as follows: To perform all these functions, the  $\mu P$  (microprocessor) incorporates various functional units in an appropriate manner. Such an internal structure or organizational structure of  $\mu P$ , which determines how it operates, is known as its architecture.





**Figure 11.** Architecture of Microprocessor

#### 5.1.4. What Are They Used For?

Like all good things, this powerful component is basically very simple. It is made by mixing tested and high- quality "ingredients" (components) as per following receipt:

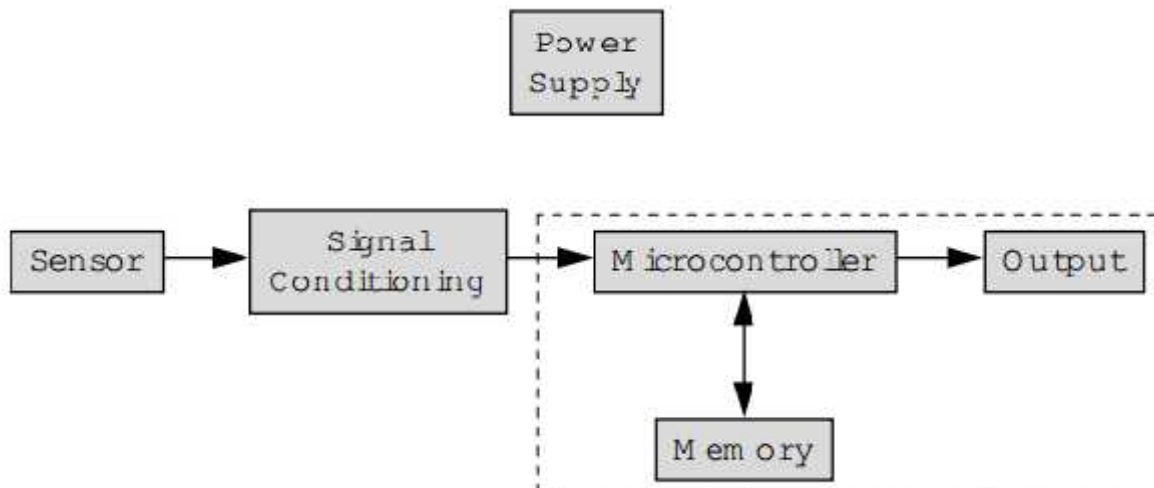
1. The simplest computer processor is used as the "brain" of the future system.
2. Depending on the taste of the manufacturer, a bit of memory, a few A/D converters, timers, input/output lines etc. are added
3. All that is placed in some of the standard packages.
4. A simple software able to control it all and which everyone can easily learn about has been developed.

On the basis of these rules, numerous types of microcontrollers were designed and they quickly became man's invisible companion. Their incredible simplicity and flexibility conquered us a long time ago and if you try to invent something about them, you should know that you are probably late , someone before you has either done it or at least has tried to do it.

### 5.1.5. Microcontroller Based Biomedical Instrument

1. A computer is large in size and limits portability
2. A general purpose computer does a lot of things that are unnecessary for some dedicated biomedical instruments
3. Several applications require the use of a dedicated instrument: portable (home measurement devices) or otherwise (Ultrasound, X-RAY, MRI, CT, etc.)

- Portable systems require the use of a microprocessor
- Larger systems necessitate the design of a dedicated computer system (hard drive, display monitor, elaborate controls)



**Fig.12**

#### **Some Features / Advantages of Microcontrollers:**

They are small and flexible

Data interchange using standard bus systems; -> various peripheral hardware accessible

IDEs and toolchains for firmware programming

Few external components and wires needed

Low and ultra low power designs possible (-> PSoC, ASIC )

Wide range of different uCs available (memory, I/O, speed, busses, A/Ds )

Easy to use ( most of the time .. )

Simulation and high level languages

## Some Examples For Microporocessor Biomed Devices / Applications:

Various sensors or meters: Blood Pressure, Body temperature, Blood Sugar Level, ...

Implants and prosthetics

Pacer makers

Functional Electrostimulation

Artificial Limbs and Orthosis

Biosignal acquisition equipments



**Fig.13**

Portable emergency equipment

Sports medicine

Patient monitoring

Support of Communication for disabled persons

Body Area Network / Wireless sensor networks

Sensors and Actuators medical equipment Life-point defibrillator Spo2 Module

## 5.2. PIC16F877A CONTROLLER

The PIC16F887 is a product of Microchip. It features all the modules that modern microcontrollers normally have. For its low price, wide range of application, high quality and easy availability, it is an ideal solution in applications such as the control of different processes in industry, measurement of different values etc. A list below includes only some of its key features.

Available now exciting range of inexpensive controller boards, ideal for standard embedded applications and incorporating into machinery, control systems and robots. PIC16F877 Controller board features the powerful Microchip PIC16F877 Microcontroller, one of the most popular microcontrollers on the market. Combined into a easy to use and ready to run board complete with all the necessary components for plugging directly into your system.

The PIC16F877 Microcontroller includes 8kb of internal flash Program Memory, together with a large RAM area and an internal EEPROM. An 8-channel 10-bit A/D convertor is also included within the microcontroller, making it ideal for real-time systems and monitoring applications. All port connectors are brought out to standard headers for easy connect and disconnect. In-Circuit program download is also provided, enabling the board to be easily updated with new code and modified as required, without the need to remove the microcontroller.

The PIC16F877 Controller is the ideal solution for use as a standard controller in many applications. The small compact size combined with easy program updates and modifications , make it ideal for use in machinery and control systems, such as alarms, card readers, real-time monitoring applications and much more. This board is ideal as the brains of your robot or at the center of your home-monitoring system. Save time and money, by simply building your ancillary boards and monitoring circuits around this inexpensive and easy to use controller.

All the necessary support components are included, together with a Power and Programming LED for easy status indication. Plus a reset switch for program execution and a RS232 connection for data transfer to and from a standard RS232 port, available on most computers.

In this section, properties of PIC16F877 microcontroller, CCS compiler, ICD-S, the reference book “Embedded C programming and the microchip PIC” are briefly explained to give a general idea; it may seem confusing for a first time reader who is not familiar to

microcontroller's technology or C programming. However, as the functionality of the components such as timers, A/D converters, I/O Ports are explained in detail in Section 3 as they are being used in the experiments, the fundamental concepts would be better understood and, the reader can flashback to this section to view the schematics and the specifications.

PIC16F877 is one of the most commonly used microcontroller especially in automotive, industrial, appliances and consumer applications. In Figure –14, the block diagram of the PIC16F877 is illustrated.

The features of PIC16F877 are:

### **5.2.1. Features**

- Includes Powerful Microchip PIC16F877 Microcontroller with 8kb Internal Flash Program Memory
- Operating Speed at 10MHz
- Direct In-Circuit Programming for Easy Program Updates
- Up to 28 I/O points with easy to connect standard headers
- RS232 Connection with MAX232
- Internal EEPROM
- 8 Channel 10-bit A/D Convertor
- One 16-bit Timer with Two 8-bit Timers
- Power and Programming LED
- Reset Button
- Ideal as an Interchangeable Controller for Real-Time Systems

### **5.2.2. LED Experiment**

The digital I/O and the timers will be discussed with this experiment. The program will count from 0 to 255 and output the binary equivalent of this number to PortD every 2 seconds. The

digital I/O peripherals are discussed in detail in the next experiment “Dipswitch”. In this experiment we will focus on the usage timers. Timers and counters are one of the most commonly used peripheral in a microcontroller. They can be used to measure time periods, speed and provide output signals in a specified rate. The PIC16F877 has 4 timers timer0, timer1, timer2 and watch dog timer. Timer0 and timer2 are 8 bit timers and timer1 is a 16bit timer. The important issue is to know when the counter reaches the maximum value (255 in 8 bit timers and 65,535 in 16bit timers) and rolls over.

The watch dog timer is a safety device. When an unexpected event occurs, the watch dog timer resets the microcontroller. In this experiment we will use the watch dog timer as our timer to time the digital output.

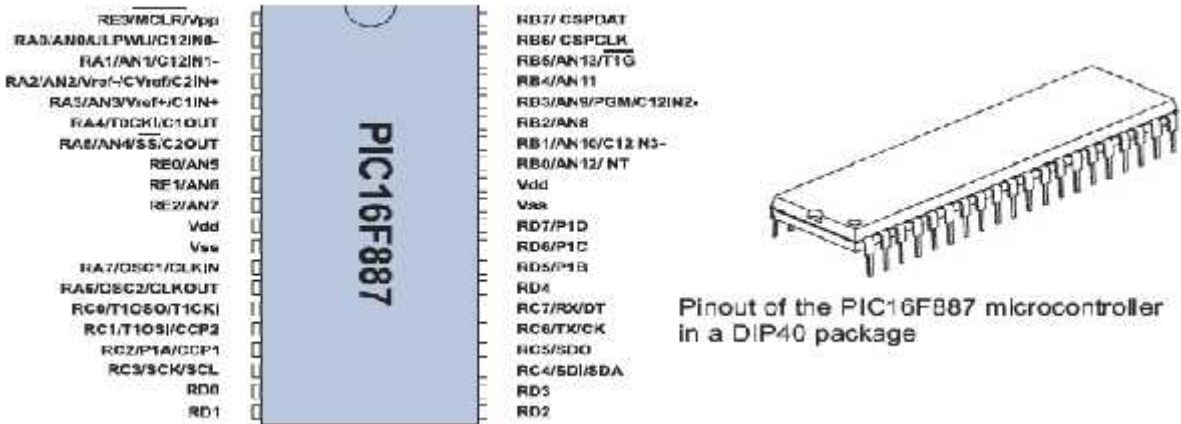


Fig.14

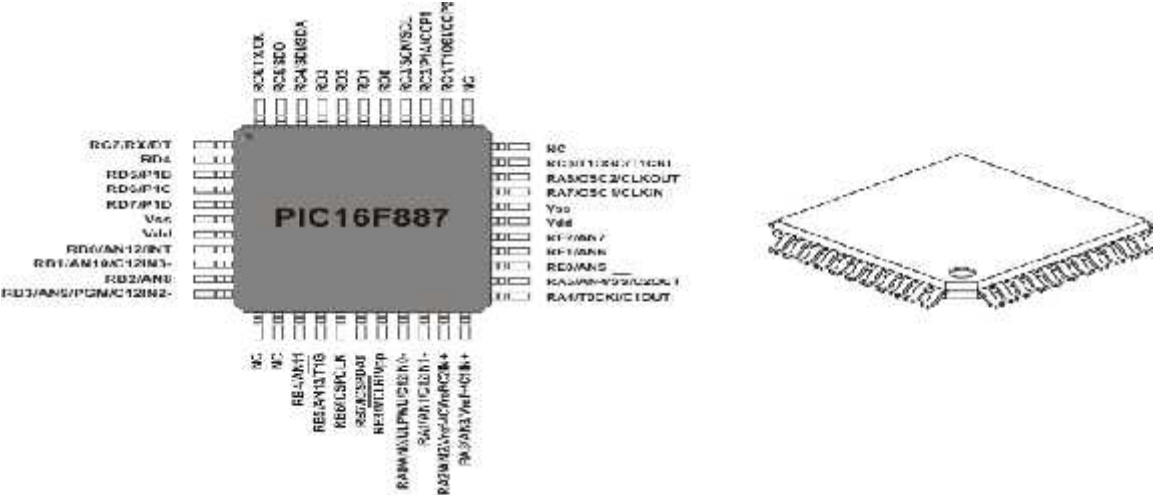


Fig.15

### 5.2.3. Pinout Description

Most pins of the PIC16F887 microcontroller are multi-functional as seen in figure above. For example, designator RA3/AN3/Vref+/C1IN+ for the fifth pin of the microcontroller indicates that it has the following functions:

- RA3 Port A third digital input/output
- AN3 Third analog input
- Vref+ Positive voltage reference
- C1IN+ Comparator C1 positive input

Such pin functionality is very useful as it makes the microcontroller package more compact without affecting its operation. These various pin functions cannot be used simultaneously, but can be changed at any point during operation.

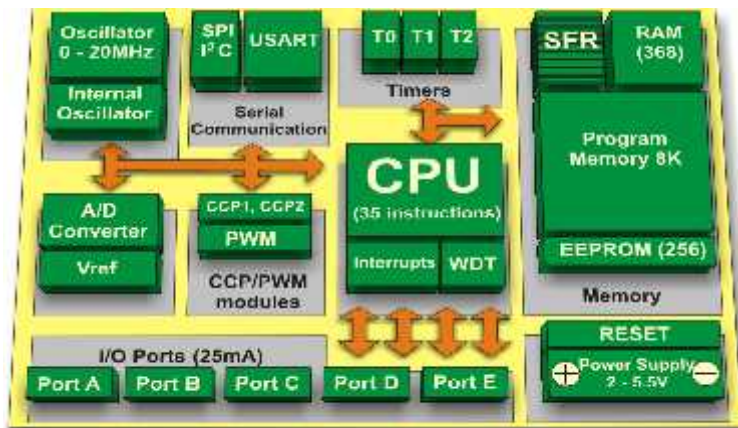


Fig.16

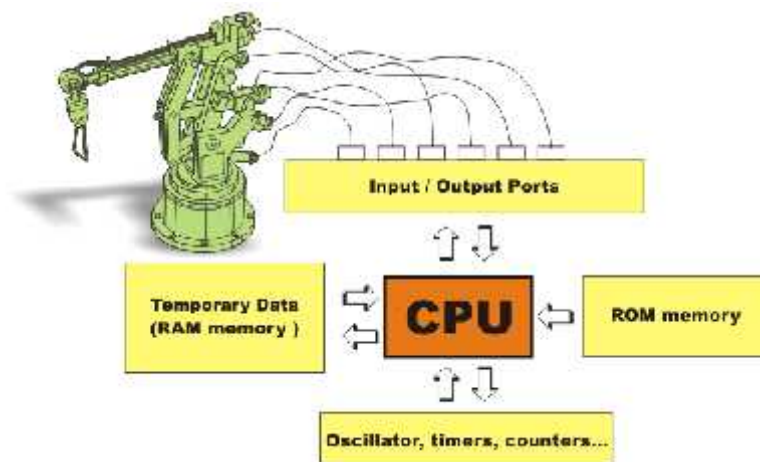
### 5.2.4. Central Processor Unit (CPU)

As any attempt to explain the operation of the CPU in detail would take us too far, we are not going to do it at this stage. Anyway, it is important to point out that the CPU is manufactured in RISC technology as this fact may be crucial when deciding which microcontroller to use. RISC stands for Reduced Instruction Set Computer, which gives the PIC16F877 two great advantages:

- The CPU is capable of recognizing and executing only 35 simple instructions. By the way, to program other microcontrollers in assembly language it is necessary to know more than 200 instructions by heart.
- The execution time is the same for almost all instructions, and lasts 4 clock cycles. The clock frequency is stabilized by a quartz crystal. The exceptions to the rule are jump and branch instructions the execution time of which is 2 clock cycles. It means that if the microcontroller's operating frequency is 20MHz, the execution time of each instruction will be 200nS, i.e. the program will execute 5 million instructions per second!

### 5.2.5. Memory

The PIC16F887 features three types of memory: ROM, RAM and EEPROM. Each deserves to be separately discussed here due to their specific functions, features and organization.



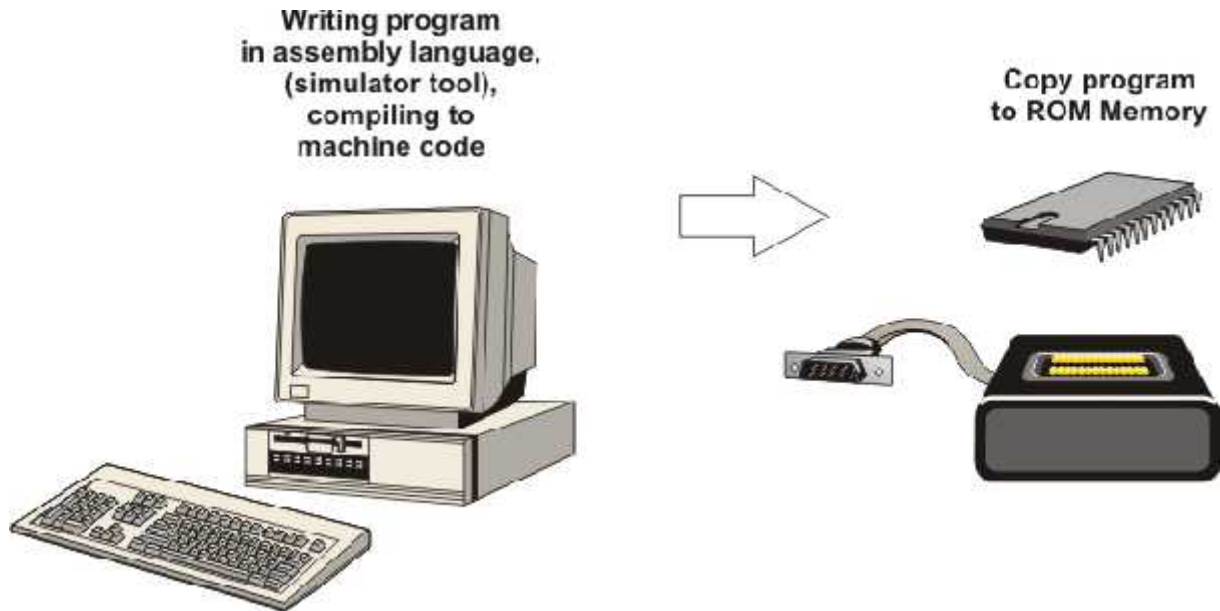
**Fig.17**

### ROM Memory

ROM memory is used to permanently save the program being executed. This is why it is often called 'program memory'. The PIC16F887 has 8Kb of ROM . Since the ROM memory is made with FLASH technology, its contents can be changed by providing a special programming voltage (13V).However, it is not necessary to explain it in detail as being



automatically performed by means of a special program on the PC and a simple electronic device called the programmer.



**Fig.18**

### **EEPROM Memory**

Similar to program memory, the contents of EEPROM is permanently saved, even when the power goes off. However, unlike ROM, the contents of EEPROM can be changed during the operation of the microcontroller. This is why this memory is perfect for permanently saving some of the results created and used during the operation.

### **RAM Memory**

This is the third and the most complex part of microcontroller memory. In this case, it consists of two parts: general-purpose registers and special-function registers (SFR). All these registers are divided in four memory banks to be explained later in the chapter.

Even though both groups of registers are cleared when power goes off and even though they are manufactured in the same manner and act in a similar way, their functions do not have many things in common.

## **CHEAPTER 6: PARTS OF PROJECT**

**Our Project comprises of this elements and equipments:**

- ✓ **7805**
- ✓ **LCD**
- ✓ **Capacitor**
- ✓ **BC547**
- ✓ **Buzzer**
- ✓ **Heat Lamp**
- ✓ **Switches**
- ✓ **RLI (TSC-112D3H)**
- ✓ **Fan**

### **6.1 7805 POSITIVE-VOLTAGE REGULATORS**

#### **6.1.1. Description/Ordering Information**

This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. . The internal current-limiting and thermal-shutdown features of these regulators essentially make them immune to overload. Each of these regulators can deliver up to 1.8 A of output current in addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents, and also can be used as the power-pass element in precision regulators.

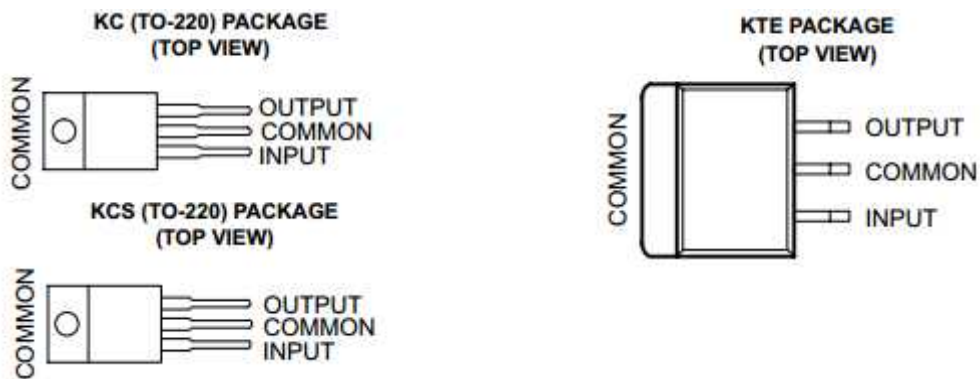


Fig.19

### 6.1.2. Advantages

- The 7805 series don't require additional components to provide a constant, regulated power of source, 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 or to assist in the regulation process. Some other designs may need substantial engineering expertise to implement.
- 7805 series have built-in protection against a circuit drawing too much power. They have protection against heating and short circuits, making them quite in most applications.

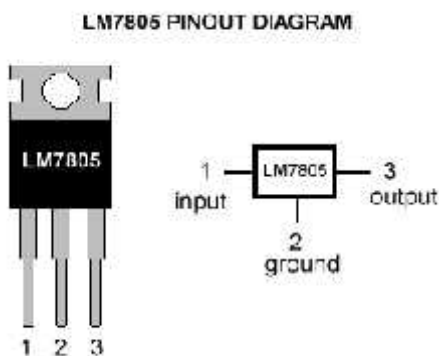


Fig.19

### 6.1.3. Disadvantages

- The input voltage must always be higher than the output voltage by some minimum amount. This can make these devices unsuitable for powering some devices from certain types of power sources
- As they are based on a linear regulator design, the input current required is always the same as the output current. As the input voltage must always be higher than the output voltage, this means that the total power going into the 7805 will be more than the output power provided. The extra input power is dissipated as well as heat.

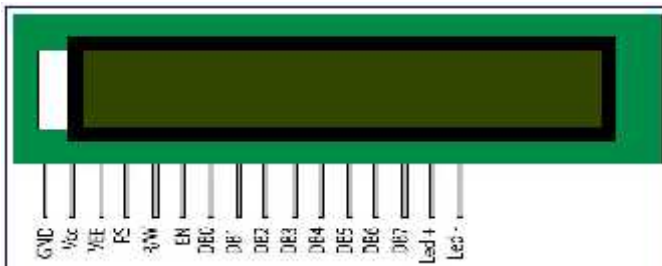
## 6.2. LCD DISPLAY

### 6.2.1. Introduction

LCD is an electronic screen module and range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters, animations.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

**Pin Diagram:**



**Fig.20**

Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 220 different characters and symbols. Booklet provides all the technical specifications for connecting the unit, which requires a single power supply.

**6.2.2.Pin Description:**

Pin No.	Function	Name
1	Ground (0V)	Ground
2	Supply voltage: 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	VEE
4	Selects command register when low, and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7		DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14	DB7	
15	Backlight Vcc (5V)	Led+
16	Backlight Ground (0V)	Led-

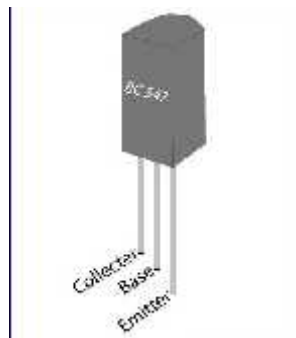
**Fig.21**

**6.3. BC547**

BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current. The current at its base controls a larger current at collector

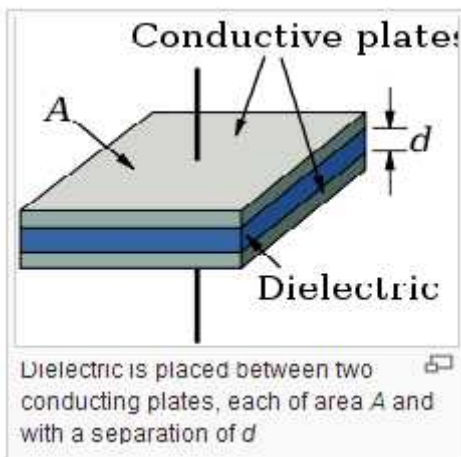
& emitter terminals. BC547 is mainly used for amplification and switching purposes. It has a maximum current gain of 800.

The transistor terminals require a fixed DC voltage to operate in the desired region of its characteristic curves. This is known as the biasing. For amplification applications, the transistor is biased such that it is partly on for all input conditions. The input signal at base is amplified and taken at the emitter. BC547 is used in common emitter configuration for amplifiers. The voltage divider is the commonly used biasing mode. For switching applications, transistor is biased so that it remains fully on if there is a signal at its base. In the absence of base signal, it gets completely off.



## 6.4 CAPACITOR

A **capacitor** (originally known as a **condenser**) is a passive two-terminal electrical component used to store energy electro-statically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric. The conductors can be thin films of metal, aluminum foil or disks, etc. The non-conducting dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, film, air, paper. Capacitors are widely used as parts of electrical circuits in many common electrical devices.



**Fig.22**

A capacitor consists of two conductors separated by a non-conductive region. The non-conductive region is called the dielectric. A capacitor is assumed to be self-contained and isolated, with no net electric charge and no influence from any external electric field. The dielectric is just an electrical insulator. Examples of dielectric media are glass, air and a semiconductor depletion region chemically identical to the conductors.

## **6.5. HEATING ELEMENT (BULB)**

A **heating element** converts electricity into heat through the process of resistive or Joule heating. Electric current passing through the element encounters resistance, resulting in heating of the element. This process is independent of the direction of current flow.

### **6.5.1. Heat Lamp**

Model incandescent lamp, with resistance depending on temperature. The Lamp model is an incandescent lamp, the key characteristic of which is that the resistance increases as the filament warms up.

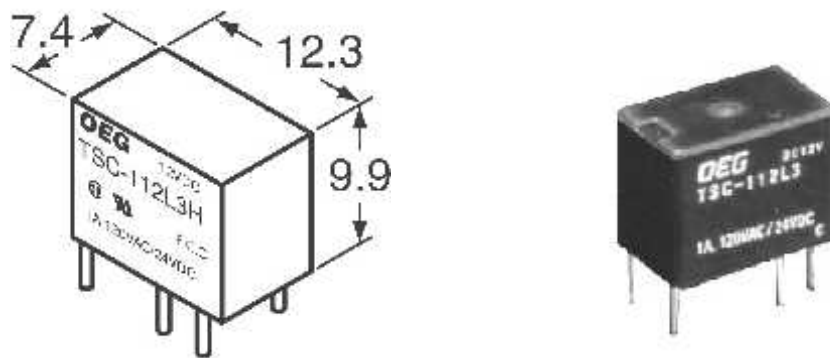
A chrome bulb guard is also provided and easily snaps onto the lamp housing after the bulb is installed. Standard is 220V socket. The heat lamp is table mounted with an adjustable swing arm providing for easy adjustment of radiant heat to specimen. It has a feedback sensor to

prevent overheating when used series of controllers. The bumb is supplied with a 100W heat lamp bulb and a built in reflector.

## 6.6. TSC-112D3H (RLI)

Power Relay; Series:TSC; Relay Type:Miniature; Contacts:SPDT; Relay Mounting:PC Board; Carry Current:1A; Leaded Process Compatible:Yes Coil Voltage VDC Nom:12V; Coil Resistance:480ohm; No. of Poles:1;RoHS Compliant: Yes

**Fig.23**



### 6.6.1.Features

- Low coil power requirement for IC.
- Terminals arrangement on grid pattern.
- 1 Form C contact arrangement.
- Designed for thermostat, modem,video recording and security applications.



## 6.7. BUZZER

A buzzer is an audio device, which may be mechanical, piezoelectric or electromechanical. Typical uses of buzzers and beepers include timers, alarm devices, and confirmation of user input such as a mouse click.

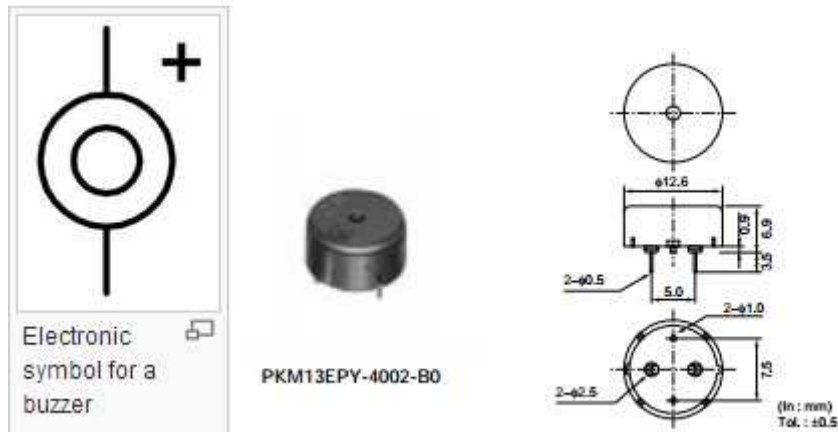


Fig.24

### 6.7.1. Piezoelectric

A piezoelectric element may be driven by an oscillating electronic circuit or other audio source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

### 6.7.2. Features

1. No contacts hence, no noise and highly reliable.
2. Low power consumption.

### **6.7.3. Applications**

- Telephone ringers.
- Various office equipment as like , printers and keyboards.
- Various home applications as like microwave ovens.
- Sound of various audio equipment.

### **6.8.SWITCHES**

THE switch is an electrical component while can break an electrical circuit, the current or diverting it from one conductor to another. Buttons, makes setting of temperature and humidity set value in circuit.

### **6.9. ACRYLIC SHEET**

The Acrylic Sheet is a material with unique physical properties. It weighs half as much as the



finest optical glass, that is equal to it in clarity and is up to 18 times more impact resistant. It sheet is made in over 250 colors. It can transmit ultraviolet light or filter it out as required.

It's light and energy transmission properties architects find it's sheet ideal for skylights, screens, sun, fascia panels and dome structures.

## **6.9.1. Features**

### **Light Transmission**

Colorless Cast acrylic sheet has a light transmittance of 92%. It is clearer than window glass and will not turn yellow. It is also available in a large variety of transparent and translucent colors.

### **UV Light Resistance**

Clear acrylic sheet resists ultraviolet light concentrations. The acrylic sheet has a ten year limited warranty against yellowing and loss of light transmission.

### **Optical Clarity**

Clearer than glass. It isn't yellow after prolonged sun exposure. Acrylic sheets have excellent light transmission..

### **Weather Resistance**

Cold, despite heat, sunlight, and humidity acrylic sheet maintains its original appearance and color.

### **Safety**

Shatter-resistant, earthquake reliable.

### **Light Weight**

Its strength and durability, acrylic sheet is only half the weight of glass. The two compartments compartment A and compartment B are separated.. A detailed description of the two compartments are given following..

### **Expansion and Contraction**

Cast acrylic sheet responds to temperature, humidity changes by expanding or contracting at a far greater rate than glass.

### **Flexibility**

It's much more flexible than glass , many other building materials.

### **Chemical Resistance**

It's excellent resistance to attack by many chemicals. It is affected, varying degrees, by toluene, benzene, carbon tetrachloride, ethyl and methyl alcohol, lacquer thinners, ethers, ketones.

### **Electrical Properties**

It is an excellent insulator. Its surface resistivity is higher than that of most plastics.

## **CHAPTER 7: PROJECT PHASES**

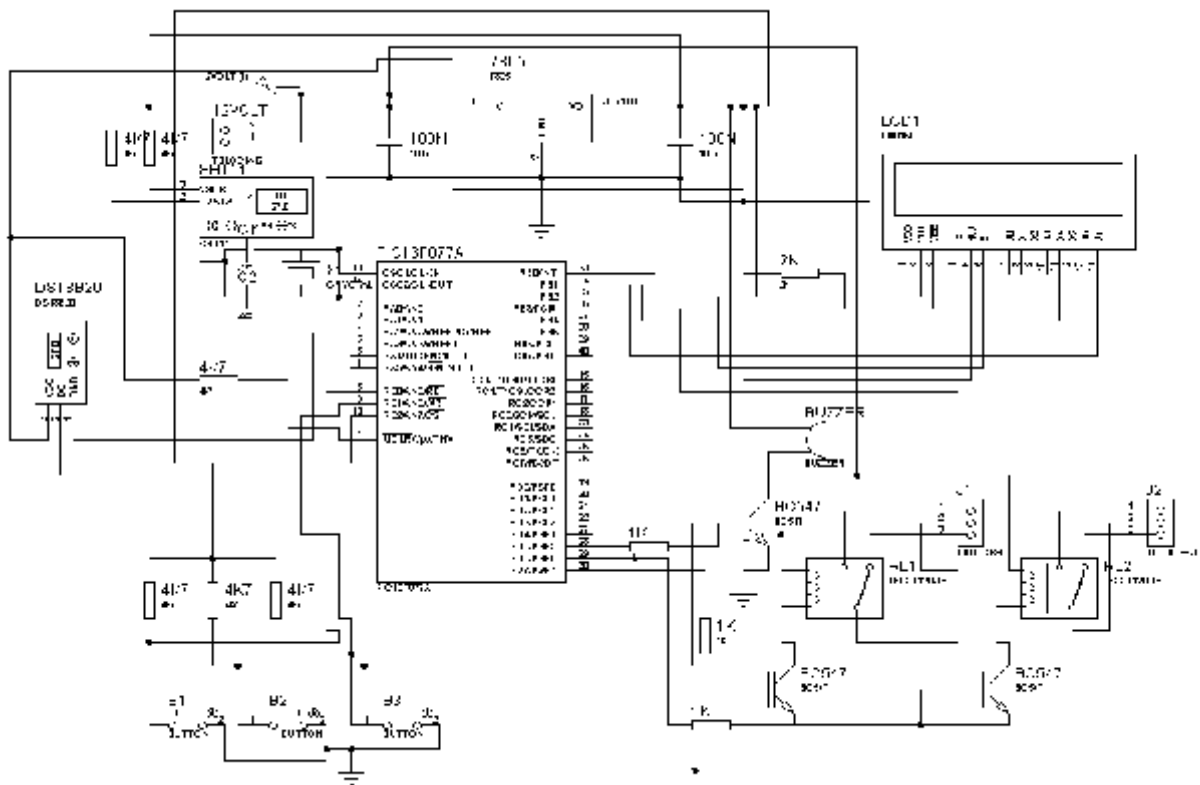
### **7.1.Overview**

We used the PROTEUS (ISIS) program for temperature and humidity circuit. After making the first drawing Proteus, we have observed that our circuit works. After receiving the printing scheme ,were printed on a plaque with ironing method. After completing the wash plate and drilling operations, was fitted circuit elements by the method of soldering. We conclude that the circuit works by connecting 12V.

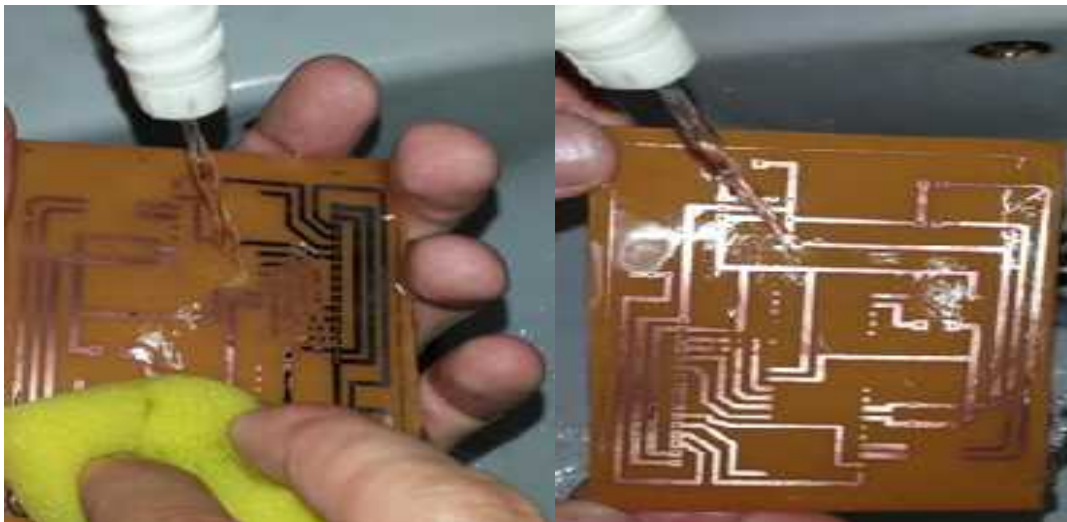
### **7.2.Circuit Operation Principle**

Our circuit is opened by resetting itself. Switches in the circuit can be controlled with the temperature and humidity values. Temperature settings are set between 25 and 39 degrees. humidity between % 90 and % 30 is set. There are (+-3) tolerance values in our environment. 2 bulbs are used as heaters.

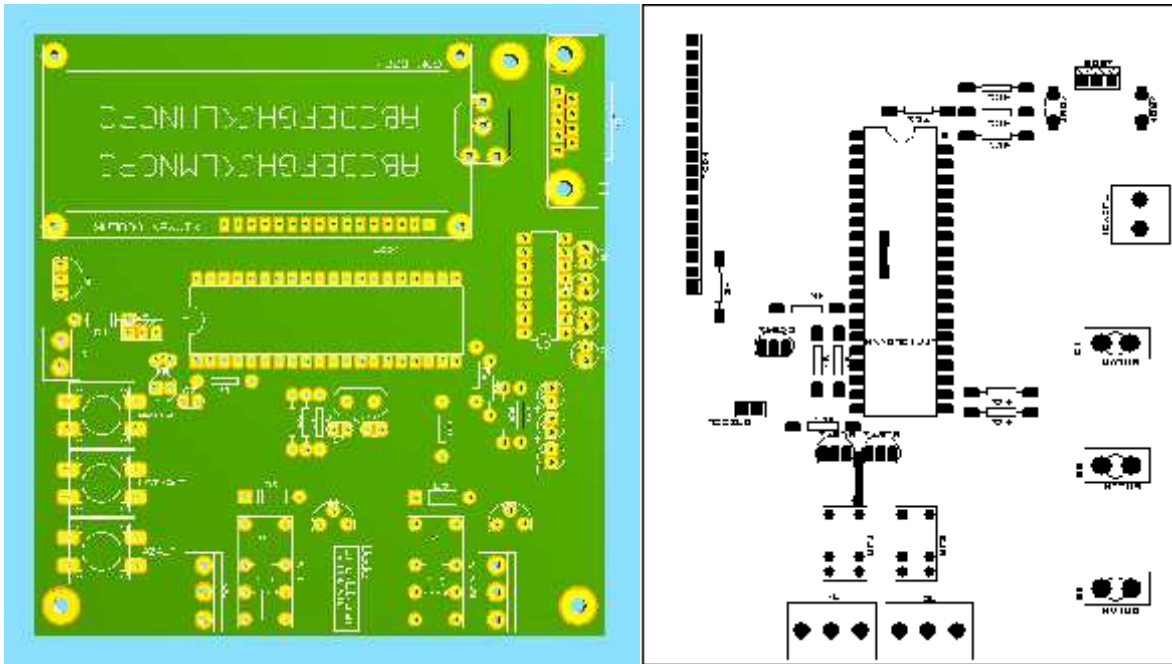
### **Circuit Diagram**



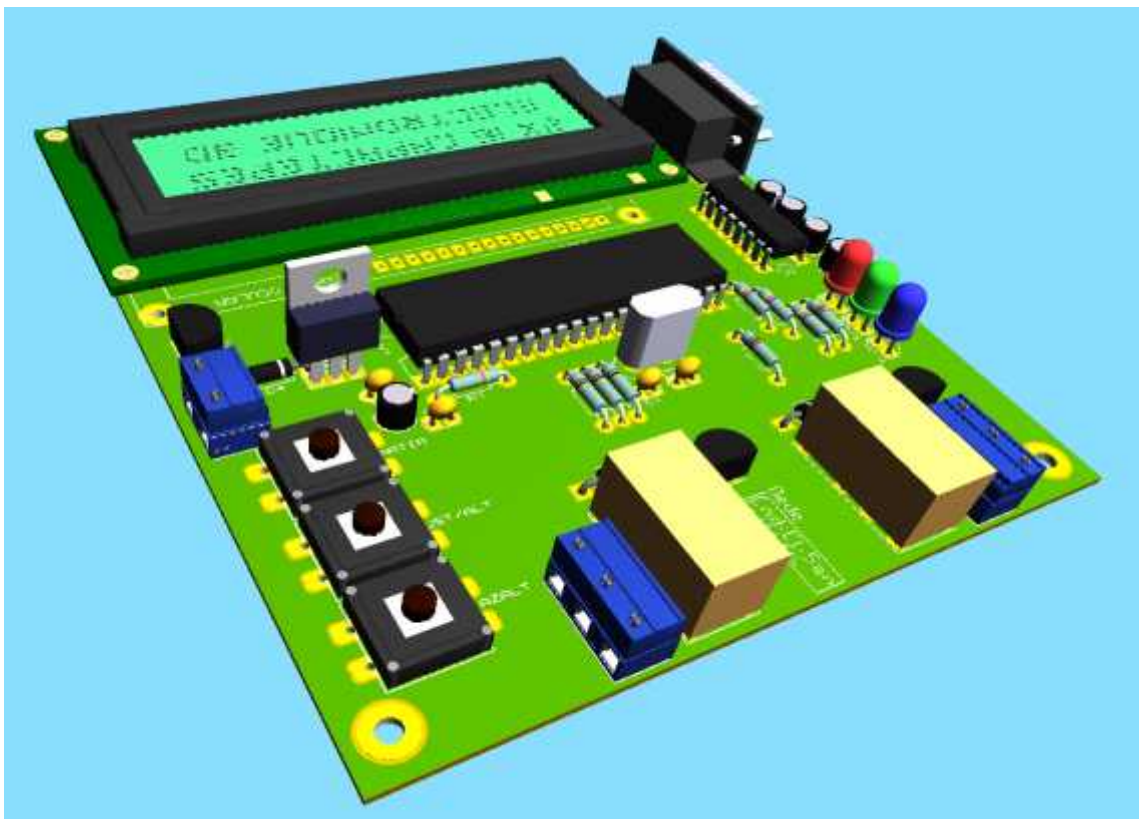
>>>>> In the pictures below ;you can see the stages of our project.<<<<<<



Plaques are washing after removing acidic water.



**Proteus program, view our circuit printed circuit.**



**Top view of our circuit with circuit elements**

**The Final Version Of Our Project**



### 7.3. ALARM CONTROL SYSTEM

The alarm circuit is safety measure to ensure the safety of the premature , by calling the attention of medical staff, however the system fails, or crossed the set control. We have been designed an alarm control circuit which will provide high temperature indication when the temperature of the incubator exceeds 39<sup>0</sup>C. It also provides low temperature indication when temperature of incubator is below 25<sup>0</sup>C and in both case it will produce loud sound from the speaker for medical attention.

### Chapter 8: SOFTWARE

```
*****
```

```
* Name   : SICAKLIK NEM KONTROL.LCD.BAS      *
* Author :                                     *
* Notice : Copyright (c) 2014 [select VIEW...EDITOR OPTIONS] *
* All Rights Reserved :                       *
* Date   : 22.02.2014                         *
* Version : 1.0                               *
* Notes  :                                     *
*                                               *
```

```
*****
```

```
'This program wrote for PIC 16F877A
```

```
*****
```

```
    include "modedefs.bas"
,-----
' Define LCD registers and bits
,-----
Define LCD_DREG  PORTB
Define LCD_DBIT  2
Define LCD_RSREG PORTB
Define LCD_RSBIT 0
```



Define LCD\_RWREG PORTB

Define LCD\_RWBIT 1

Define LCD\_EREG PORTB

Define LCD\_EBIT 2

Define LCD\_BITS 0

Define LCD\_LINES 2

X VAR WORD

KONTROL VAR BYTE

ISI1 VAR BYTE

ISI2 VAR BYTE

U1 VAR BYTE

U2 VAR BYTE

ISI VAR byte

P1 VAR WORD

P2 VAR WORD

P3 VAR WORD

W VAR WORD

CLK VAR PORTA.0

DTA VAR PORTA.1

ISARET VAR BIT 'sensor de eri 0 ise artı, 1 ise eksi

HATA VAR BIT

Sabit var byte 'set ba langıç degerinin tutulacağı ve ayarın sayıldığı register

sabit2 var byte

sabit3 var byte

sabit4 var byte

nem var byte

nemalt var byte

nemust var byte

verici var byte

verici1 var byte

a var word 'Count per degree C

SET VAR BYTE 'ayarlanan de eri tutan register

```

DQ   Var   PORTA.2           ' One-wire data pin
isialt var byte
isiust var byte
' -----
'Makama geçi burada yapılır..
' -----

clear
trisa=%00000000
trisb=%11111111
trisc=%11111111
trisd=%00000000
trise=%00000000
Low PORTB.1                 ' LCD R/W line low (W)
nap 6
sabit =0
sabit2=25
sabit3=0
sabit4=30
' goto Start
Pause 500   ' Wait for LCD to startup
Lcdout $fe, 1 ' Clear LCD screen
Lcdout $fe, 1," ISI VE NEM "
lcdout $fe,$c0," KONTROL  "

Pause 500   ' Wait .5 second
' portd.5=1
' pause 1000
' portd.5=0
' pause 100

```

BASLA:

```
GOSUB isiX
KONTROL=%00000101:HAM=0 RUTUBET ÖLÇME
GOSUB OLCUMAL
HAM=3710 bu de er %100 rutubete e de erdir.
GOSUB RUTHESAP
```

```
Lcdout $fe,1,"t:", DEC temperature ".", DEC2 temperature, " C", " ",dec sabit2,".",dec
sabit
```

```
LCDOut $fe,$c0, "h:",DEC U1,".",DEC1 U2,"%", " ",dec sabit4,".",dec sabit3
nem=sabit4/10
nemust=sabit4+nem
nemalt=sabit4-nem
if portd.0=0 then setx
if u1<nemalt or u1>nemust then portd.7=1 : goto alarm
if temperature>39 then portd.6=1 : goto alarm
isialt=3
isiust=1
if temperature<sabit2-isialt or temperature>sabit2+isiust then portd.6=1 : goto alarm
pause 100
goto basla
```

T\_START:

```
Low CLK
Pause 1
High CLK
Low DTA
Pause 1
Low CLK
Pause 1
High CLK
Pause 1
High DTA
```

Low CLK

Return

?-----R E S E T -----?

RESET: Output DTA:Output CLK?:TRISA.0=0:TRISA.1=0'

High DTA=1

Pause 1

Low CLK

Next W

Return

?-----SENSORE KOMUT GÖNDER -----?

OLCUMAL: GoSub T\_Start

ShiftOut DTA,CLK,1,[KONTROL]

Input DTA

PulsOut CLK,10

HATA=0

For W=0 TO 65500

IF DTA=0 Then EXIT

Next W

HATA=1

EXIT: IF HATA=1 Then

GoSub SENSORYOK

EndIF

ShiftIn DTA,CLK,0,[H1]

Output DTA

Low DTA

PulsOut CLK,10

Input DTA

ShiftIn DTA,CLK,0,[H0]

PulsOut CLK,10

Return

?-----ISI HESAP ALT PROGRAMI-----?

ISIHESAP:

```
IF ham<4000 Then
ISARET=1 'sıcaklık eksi de erde demek
ISI1=(4000-HAM)/100
ISI2=((4000-ham)//100)/10
GoTo ISISON
EndIF
ISI1=(HAM-4000)/100
ISI2=((HAM-4000)//100)/10
```

ISISON: IF HAM>16384 Then

```
ISI1=0:ISI2=0
EndIF
Return
```

'-----RUTUBET HESAP ALT PROGRAMI-----

-----

RUTHEESAP:

```
ISI=ISI1*10+ISI2
p1=(26542-(54722**ham+ham))**ham-40
P2=655+(HAM*5)+(HAM**15917)
P3=(P2**(ISI+2480))-(P2**2730)+P1 'kompanse edilmi de er
U1=p3/10:U2=p3//10
IF ham>3710 Then
u1=0:U2=0
GoTo SENSORYOK
EndIF
Return
```

'-----

SENSORYOK: LCDOut \$FE,\$02," SENSOR YOK "

LCDOut \$FE,\$C0," LUTFEN TAKINIZ "

Pause 1000 ; Return

isiX:

waitloop:

OWIn DQ, 4, [count\_remain] ' Check for still busy converting

If count\_remain = 0 Then waitloop

OWOut DQ, 1, [\$CC, \$BE] ' Read the temperature

OWIn DQ, 0, [temperature.LOWBYTE, temperature.HIGHBYTE, Skip 4,

count\_remain,count\_per\_c]

Temperature =(((temperature >> 1) \* 100) - 25) + (((count\_per\_c - count\_remain) \* 100) /  
count\_per\_c)

temperature =(temperature / 100)

Pause 100 ' Display about once a second

Lcdout \$fe,1,DEC (temperature / 10), ".", DEC2 temperature, " C"

' Calculate temperature in degrees F to 2 decimal places (not valid for negative  
temperature)

'temperature = (temperature \* / 461) + 3200

Lcdout \$fe, \$c0, DEC (temperature / 100), ".", DEC2 temperature, " F"

' Pause 1000 ' Display about once a second

' lcdout \$fe,\$c0,"SET=",dec set, " C"

' IF (TEMPERATURE/10) > SET THEN PORTB.3=0 'reel ısı ayarlanandan yüksekse  
çıkı ı kapat

' IF (TEMPERATURE/10) < SET THEN PORTB.3=1 'reel ısı ayarlanandan dü ükse  
çıkı ı aç

return ' Do it forever

setx:

lcdout \$fe,1,"< KATEGORI SEC >"

pause 500

if portd.1=0 then ISIQ

if portd.2=0 then NEMQ

```
if portd.0=0 then basla
pause 150
goto setx
```

ISIQ:

```
lcdout $fe,1,"ISI AYAR"
pause 500
if portd.1=0 then ISIQ
if portd.2=0 then NEMQ
if portd.0=0 then isiayar
GOTO ISIQ
```

nemq:

```
lcdout $fe,1,"NEM AYAR"
pause 500
if portd.1=0 then ISIQ
if portd.2=0 then NEMQ
if portd.0=0 then nemayar
GOTO NEMQ
```

ISIAYAR:

```
lcdout $fe,1,"ISI AYAR"
LCDOut $FE,$c0,dec sabit2,".",dec sabit," C"
Pause 500
if portd.1=0 then isiarti
if portd.2=0 then isieksi
if portd.0=0 then basla
goto isiayar
```

NEMAYAR:

```
lcdout $fe,1,"NEM AYAR"
LCDOut $FE,$c0,dec sabit4,".",dec sabit3," %"
Pause 500
if portd.1=0 then nemarti
if portd.2=0 then nemeksi
```

```

if portd.0=0 then basla
  goto nemayar
'-----
'set degerinin artırma rutini.....
'-----

isiarti:
  sabit=sabit+1
  if sabit=10 then sabit=0 : sabit2=sabit2+1
  pause 250
  goto isiayar
'-----
'set degerinin eksiltme rutini.....
'-----

isieksi:
  sabit=sabit-1
  if sabit=255 then sabit=9 : sabit2=sabit2-1
  pause 250
  goto isiayar
'-----
'set degerinin artırma rutini.....
'-----

nemarti:
  sabit3=sabit3+1
  if sabit3=10 then sabit3=0 : sabit4=sabit4+1
  pause 250
  goto nemayar
'-----

'set degerinin eksiltme rutini.....

```



'-----

nemeksi:

sabit3=sabit3-1

if sabit3=255 then sabit3=9 : sabit4=sabit4-1

pause 250

goto nemayar

alarm:

portd.5=1

pause 1000

portd.5=0

pause 100

portd.6=0

portd.7=0

goto basla

end

## **CONCLUSIONS**

When the temperature and humidity in the chamber the set humidity and temperature values the bulb is turned off automatically and when the temperature falls below the set temperature value control to the bulb. The temperature and humidity in the chamber are observed to be at a constant value.

Another result of this wireless work can be used in implementation of wireless communication in branch of medical technique. The infant baby's oxygen levels, heating and humidity in the chamber and touch-up as the number of heartbeats can be retrieved with Bluetooth or Internet. Network and communication of devices can be used in many applications of telemedicine, mainly as the system of monitoring base life functions.

This network can be used in the field of telemedicine for inpatients and infants. ARDUINO is a very good example for this practice.

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