STUDY OF ECO AIRCOOLING

Submitted By

Name: - Tanmoy Chakraborty
Md. Aminul Islam
Md. Abul Hasam Molla
Mizanur Rahman Faisal
Md. Abdul Halim

Bachelor of Science in Mechanical Engineering

Department of Mechanical Engineering

Sonargaon University (SU)
Dhaka-1215, Bangladesh

February 2020

Certification of Approval

This is to certify that thesis title of "**Study of Eco Air Cooler System**" Submitted by Tanmoy Chakraborty (ID No: BME1602009413), Md. Aminul Islam (ID No: BME1602009408), Md. Abul Hasam Molla (ID No: BME1602009417), Mizanur Rahman Faisal (ID No: BME1602009404), Md. Abdul Halim (ID No: BME1602009418) has been accepted as satisfactory in partial fulfilment of requirements for the degree of *Bachelor of Science* in the department of Mechanical Engineering on 3rd February 2020, Sonargaon University, Dhaka, Bangladesh is authentic work carried out under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to elsewhere for the award of any degree.

Md. Mostofa Hossain
Associate Professor & Head
Mechanical Engineering Department
Sonargaon University (SU)
Dhaka-1215

Date: 03rd February 2020

DECLARATION OF THE CANDIDATE'S

This is to certify that the work presented in the thesis in an outcome of the investigation carried out by the authors under the supervision of Associate Professor & Head Md. Mostofa Hossain, Department of Mechanical Engineering, Sonargaon University, Dhaka. It is declared that this thesis has been submitted only for the award of graduation it has not been submitted elsewhere for the award of any degree or diploma.

Signature of the candidates

_____
Name: Tanmoy Chakraborty
ID No: BME1602009413

_____
Name: Md. Aminul Islam
ID No: BME1602009408

_____
Name: Md. Abdul Halim
ID No: BME1602009418

_____
Name: Mizanur Rahman Faisal
ID No: BME1602009404

_____
Name: Abul Hasam Molla
ID No: BME1602009417

CONTENTS

ACKNOWLEDGEMENT

At first, we would like to express eternal gratitude Almighty for the successful Completion of the project work. We the author immense pleasure to express our earnest graduate to our honorable supervisor, Md. Mostofa Hossain (Associate Professor and Head of Mechanical Engineering Department), Sonargaon University (SU). For his constant Guidance, Inspiration, suggestion, and support in performing and completing the project study.

We would like to especially thank to our supervisor for the continuous encouragement. Authors are grateful to the all teachers who help us directly or indirectly which was very necessary to complete the project work.

Finally, we are also grateful to the vice-chancellor of Sonargaon University, for his overall support to finish the project works.

"Author"

Tanmoy Chakraborty
Md. Aminul Islam
Md. Abul Hasam Molla
Mizanur Rahman Faisal
Md. Abdul Halim

Dedication

To Our most honorable Parents & well wishers

ABSTRACT

Air conditioning is one of the major consumers of electrical energy in many parts of the world today and already today air conditioning causes energy shortage in for example China. The demand can be expected to increase because of changing working times, increased comfort expectations and global warming. Air conditioning systems in use are most often built around a vapor compression system driven by grid-electricity. However, most ways of generating electricity today, as well as the refrigerants being used in traditional vapor compression systems, have a negative impact on the environment keywords. Energy is the primary and most universal measure of all kinds of work by human beings and nature. Energy is a crucial input in the process of economic, social and industrial development day by day the energy consumption is increasing very rapidly. The rate of energy consumption is increasing. Supply is depleting resulting in inflation and energy shortage.

"Author"

Tanmoy Chakraborty
Md. Aminul Islam
Md. Abul Hasam Molla
Mizanur Rahman Faisal
Md. Abdul Halim

LIST OF FIGURE

LIST OF TABLE

LIST OF NOMENT CLATURE

Cm = Centimeter

℃ = Degree Celsius

LCD = Liquid Crystal Display

L = Length

M = Meter

m3 = Meter Cube

mm = Millimeter

Mpa = Mega pascal

Pa = Pascal

% = Percentage

α = Alpha

± = Plus Minus

V = Volt

A = Ampere

AC = alternating Current

DC = Direct Current

A/C = Air Condition

LED = Light Emitting Diode

CHAPTER 1
INTRODUCTION

1.1 Introduction

In Bangladesh, a team of the Dhaka office of the New York-based Grey Group Company created the eco-friendly air cooler working without electricity. The Eco-Cooler, using recycled plastic bottles to produce cool air, is one of the most cost-effective and environmentally friendly solutions that has the capacity to reduce the temperature by up to 5 degree-celsius as soon as it starts to work. The Eco-cooler is built using re-purposed plastic bottles, which are cut into half and fitted in a grid that is designed in accordance to the size of the window. The change in the pressure that will take place as soon as the air enters the wider part of the bottle and then passing through the bottleneck makes the air cooler. Placing the Eco-Cooler in the window with the wide part of the bottles facing outside, hot air will rush into each bottle, which is pushed to the rim where it starts to expand and this expansion is what cools the air before it enters the room. Approximately 70 percent of the Bangladesh population lives in villages where electricity is not an option and temperatures can reach 42 degrees Celsius in the summer. To address this issue, the Dhaka Office of Grey Group and in particular the creative supervisor Ashis Paul conceived the innovative idea of the Eco cooler that makes the houses livable during the summer season. After initial tests, blueprints of the Eco-Cooler were put up online for everyone to download for free. The Eco-cooler is easy to make by anyone and raw materials are easily available, making Eco-Coolers a cost-effective environment-friendly solution that can be easily implemented in rural areas. Since February 2016, working in collaboration with volunteers of Grameen Intel Social Business Ltd. the cooler has been installed in many villages and teams are teaching people how to make the Eco-coolers. Ideal for other countries and territories facing similar conditions, the Eco-Cooler not only helps people struggling with scorching heat but is an example of up cycling old plastic material and building something constructive with urban waste.

1.2 Aim of the Project

The aim of our project is to build a device that is not only SMART in the sense that it does not consume electricity but in essence, it is a way to recycle wasted raw material for sustainable development of our society by reducing environmental pollution as well as a reduction in power usage.

1.3 Objectives

- To a very simple micro controlling system.
- To find out the problem very short time to troubleshooting.
- To monitoring in short order time all of the refrigeration system as like Compressor temp; RH% temp; Fan status; Compressor Amp; & voltage.
- To the advantage of micro controlling system reducing cost if according to the needed running system.
- This system is simple and convenient. Furthermore, efficiency decreases very little during part-load. It is especially applicable to systems with several cylinder reciprocating compressors.

1.4 Description

This invention relates to the temperature and other climate control of interiors of buildings, and in particular to a system for controlling the temperature of an environment according to predetermined criteria including the presence or absence of people, programmable comfort ranges, and programmable time tolerances to reach those comfort ranges.

CHAPTER 2
LITERATURE REVIEWS

2.1 Introduction

The ecosystem is the set of species in a given area that interact among themselves, through processes such as predation, parasitism, competition, and symbiosis, and with their abiotic environment to disintegrate and become part of cycles of energy and nutrients. The species of the ecosystem, including bacteria, fungi, plants and animals, are dependent on each other. The relationships between species and their environment facilitate the flow of matter and energy within the ecosystem. The concept of the ecosystem has evolved since its origin. The term, coined in the 1930s, belongs to British botanists Roy Clapham (1904-1990) and Sir Arthur Tansley (1871-1955). It was originally applied to units of diverse spatial scale; from a weathered piece of the tree trunk to a pond, a region or even the entire biosphere of the planet, the only requirement being that organisms, physical environment and interactions could exist within them. More recently, the ecosystem has had a geographical focus and has become analogous to formations or vegetation types, e.g., scrub, pine forest, grassland, etc. This simplification ignores the fact that the limits of some vegetation types are indistinct, while the boundaries of ecosystems are not. The transition zones between ecosystems are known as ecotones. Refrigeration System Controls are defined as equipment that controls and optimizes the temperatures and pressures in a refrigeration system, and automatically adjusts the refrigeration system's operation to minimize its energy consumption, while maintaining within predefined temperature limits the spaces, processes or equipment being refrigerated, and reflecting changes in load, weather conditions, and operating requirements.

2.2 Development of Control Systems

An ecosystem consists of a biological community, its physical and chemical environment, and the dynamic interactions that link them. Ecosystems can also be thought of as energy transformers and nutrient processors. A diversity of ecosystems exists throughout the world and can be classified according to their functional groups

and physical context. Insights into the structure and function of entire ecosystems can be revealed through whole-ecosystem experiments, management experiments, and natural stable isotope analysis. Increasing threats to global biodiversity and accelerating rates of species extinction have prompted researchers to formally investigate the role of biodiversity in providing, maintaining, and even promoting ecosystem function. Several studies report a positive relationship between biodiversity and ecosystem function, yet, the generality of the results and the mechanisms driving them have provoked considerable debate and several counterexamples exist. Nonetheless, identifying the mechanisms governing ecosystem functioning is an important conservation priority given that ecosystems perform a diversity of services on which human civilization depends. Ecosystem services – such as water purification, pollination, climate regulation, and erosion control to name a few – are typically considered 'free' and thus easily squandered despite their importance and obvious economic value. Although the idea of paying for ecosystem services has been gaining momentum, assigning value to ecosystem services is a tricky task. With the increased recognition that almost all ecosystems have been profoundly altered by humans and those natural and social systems are inextricably linked.

2.3 ECO System Block Diagram

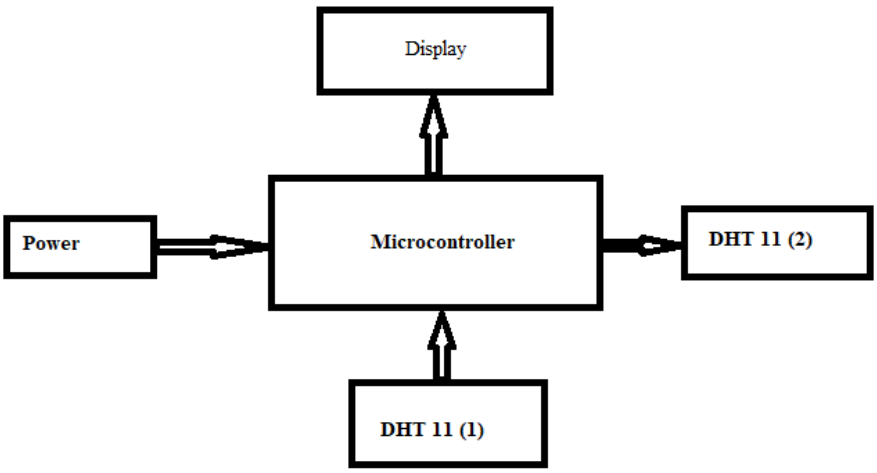

Fig 2.1: ECO System Block Diagram.

2.3.1 Block Diagram Description

Basically, refrigerator cools the things kept in it by absorbing heat contained by them for this purpose a refrigerant is used which is a gas at room temperature we know that evaporation produces cooling because the kinetic energy of gas molecules is more

than that of liquid so converting from liquid to gas kinetic energy of molecules is increased on the expense of heat energy for evaporation heat required may also be taken from the environment as a result of which surrounding will become cooler until now we have come to know that if a liquid will evaporate in the evaporator it will cool the surrounding compressor is used to convert the gas into liquid by applying high pressure when liquid reaches in the evaporator its boiling temperature is same as that of surrounding inside refrigerator so it absorbs the heat from there in order to be converted into gas again this gas is again sent to the compressor for being converted into liquid and cycle continues for continues cooling.

2.4 Circuit Diagram

A circuit diagram is a graphical representation of an electrical circuit. A pictorial circuit diagram uses simple images of components, while a schematic diagram shows the components and interconnections of the circuit using standardized symbolic representations. The presentation of the interconnections between circuit components in the schematic diagram does not necessarily correspond to the physical arrangements in the finished device.

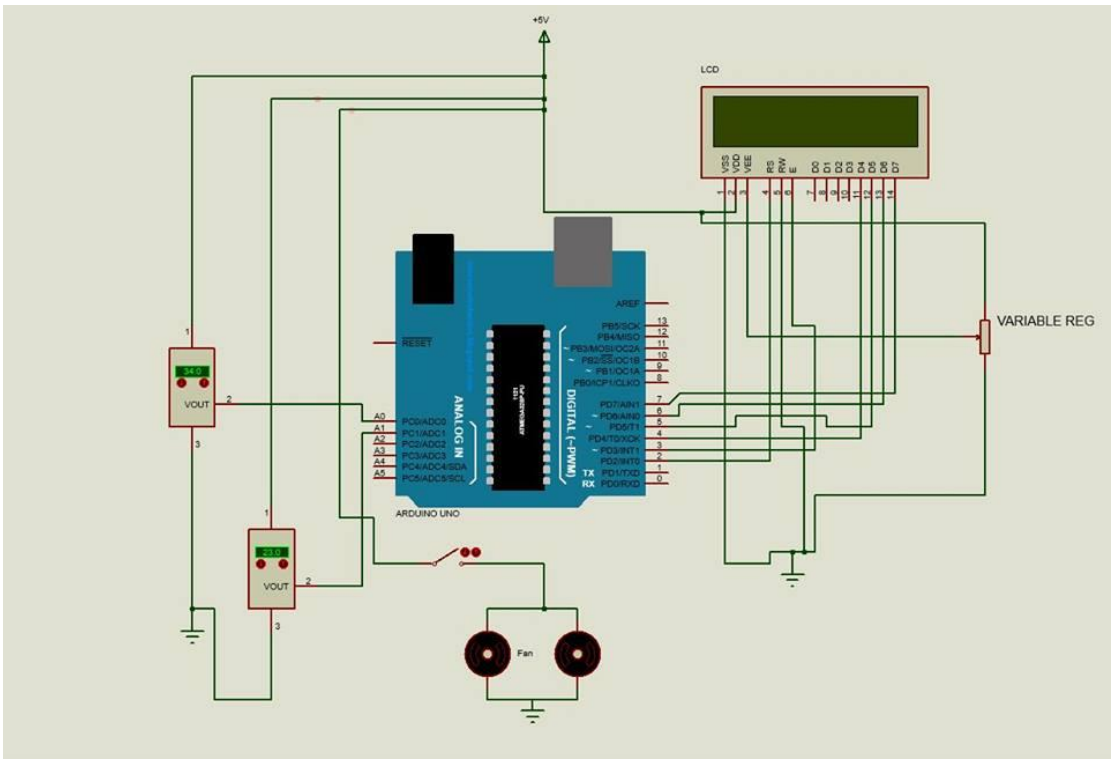

Fig 2.2: Circuit Diagram.

2.4.1 Working Principle of Circuit

We use on this project Arduino UNO to control the circuit. At first, we use two DC fans both are connected with an adapter and that fans are controlled by a switch. We use two humidity sensors one of the sensors set up in front of the two DC fans and another one is set up in front of the bottle which is the front side of our project. We use a display which is control by the microcontroller. Our projects all data like humidity and temperature value are shown on this display.

2.5 Electrical Earthing

Earthing is utilized to shield you from an electric stun. It does this by giving away (a defensive conductor) for a shortcoming current to stream to earth. It additionally causes the defensive gadget (either an electrical switch or breaker) to turn off the electric flow to the circuit that has the shortcoming.

There are five shorts of impartial earthing:

- Solid-earthed unbiased.
- Unearthed unbiased.
- Resistance-earthed unbiased. Low-opposition earthing. High-opposition earthing.
- Reactance-earthed unbiased.
- Using earthing transformers, (for example, the Crisscross transformer)

2.6.1 Importance of Earthing

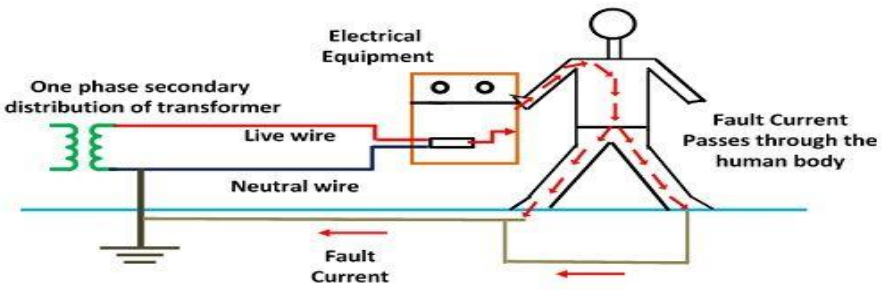

Fig 2.3: Electrical system without Earthing.

Definition: The process of transferring the immediate discharge of the electrical energy directly to the earth by the help of the low resistance wire is known as the Electrical earthing.

When the fault occur the fault current from the equipment flows through the earthing system to the earth and thereby protects the equipment from the fault current. At the time of the fault, the earth mat conductors rise to the voltage which is equal to the resistance of the earth mat multiplied by a ground fault.

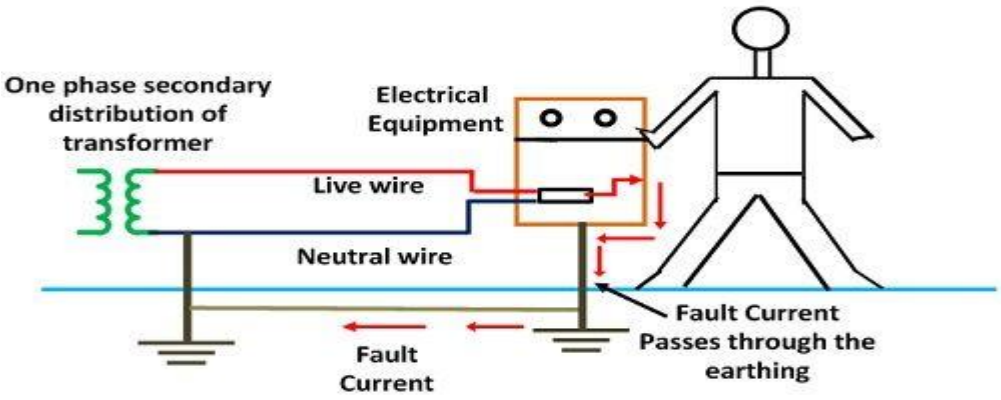

Fig 2.4: Electrical system with earthing.

CHAPTER 3
HARDWARE AND COMPONENT DESCRIPTION

3.1 Introduction

The increasing demand for refrigeration in various fields led to the production of more electricity and consequently more release of harmful gas like CO2 all over the world which is a contributing factor to global warming on climate change. Thermoelectric refrigeration is a new alternative method. The thermoelectric modules are made of semiconductor materials electrically connected in a series configuration and thermally in parallel to create cold and hot surfaces. Although they are less efficient than the vapor compression system, they are very light, low in cost, silent in operation, and are environmentally friendly. The objectives of this project are to design and develop a working thermoelectric refrigerator that utilizes the Peltier effect to refrigerate and maintain a temperature between 5 0C to 25 0C. The design requirements are to cool the volume to a temperature within a short time and heat can be generated to melt ice. The amount of heat absorbed or rejected at the junction is proportional to the electrical current intensity. The constant of proportionality is known as the Peltier coefficient.

3.2 Arduino Uno

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced with various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution-Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. The word "UNO" means "one" in Italian and was chosen to mark the initial release of the Arduino Software. The Uno board is the first

in a series of USB-based Arduino boards, and it and version 1.0 of the Arduino IDE were the reference versions of Arduino, now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

3.2.1 Special pin functions

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5, each of which provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

Serial / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.

External interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM (pulse-width modulation): 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.

SPI (Serial Peripheral Interface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

TWI (two-wire interface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

AREF (analog reference): Reference voltage for the analog inputs.

Fig 3.1: Arduino UNO.

3.3 AC to DC Converter

In electrical engineering, power engineering, and the electric power industry, power conversion is converting electric energy from one form to another such as converting between AC and DC; or changing the voltage or frequency; or some combination of these. A power converter is an electrical or electro-mechanical device for converting electrical energy. This could be as simple as a transformer to change the voltage of AC power but also includes far more complex systems. The term can also refer to a class of electrical machinery that is used to convert one frequency of alternating current into another frequency. Power conversion systems often incorporate redundancy and voltage regulation. One way of classifying power conversion systems is according to whether the input and output are alternating current (AC) or direct current (DC). There are different types of power electronics converters such as rectifier, inverter, voltage regulator, F to V converter, cyclotron more vert, and so on. The power electronics converter which is used for converting AC to DC is called a

rectifier circuit. The maximum number of electronic circuits is using DC power for their operation and let us consider the microcontrollers (8051 microcontrollers are typically used in a maximum number of microcontroller based projects or circuits) which require 5V DC regulated power supply. There are different circuits that can be used for converting the available 230V AC power to 5V DC power using various techniques. Generally, the step-down converters can be defined as converters with output voltage less than the input voltage. Let us discuss AC to DC converter (here considering a frequently used converter in the power supply circuit, 220V AC to 5V DC converter) and its working in detail.

Fig 3.2: AC to DC Converter.

3.4 Buck Converter

A buck converter (step-down converter) is a DC-to-DC power converter that steps down voltage (while stepping up current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) typically containing at least two semiconductors (a diode and a transistor, although modern buck converters frequently replace the diode with a second transistor used for synchronous rectification) and at least one energy storage element, a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with

inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter). Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat but do not step up output current. Buck converters can be highly efficient (often higher than 90%), making them useful for tasks such as converting a computer's main (bulk) supply voltage (often 12 V) down to lower voltages needed by USB, DRAM and the CPU (1.8 V or less). The basic operation of the buck converter has the current in an inductor controlled by two switches (usually a transistor and a diode). In the idealized converter, all the components are considered to be perfect. Specifically, the switch and the diode have zero voltage drop when on and zero current flow when off, and the inductor has zero series resistance. Further, it is assumed that the input and output voltages do not change over the course of a cycle (this would imply the output capacitance as being infinite). The conceptual model of the buck converter is best understood in terms of the relation between the current and voltage of the inductor. Beginning with the switch open (off-state), the current in the circuit is zero. When the switch is first closed (on-state), the current will begin to increase, and the inductor will produce an opposing voltage across its terminals in response to the changing current. This voltage drop counteracts the voltage of the source and therefore reduces the net voltage across the load. Over time, the rate of change of current decreases, and the voltage across the inductor also then decreases, increasing the voltage at the load. During this time, the inductor stores energy in the form of a magnetic field.

Fig 3.3: Buck Converter.

3.5 Liquid-Crystal Display (LCD)

A liquid-crystal display (LCD) is a flat-panel display or another electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead of using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of many small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance. LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to very large television receivers. LCDs are slowly being replaced by OLEDs, which can be easily made into different shapes, and have a slower response time, wider color gamut, virtually infinite color contrast, and viewing angles, lower weight for a given display size and a slimmer profile (because OLEDs use a single glass or plastic panel whereas LCDs use two glass panels; the thickness of the panels increases with size but the increase is more noticeable on LCDs) and potentially lower power consumption (as the display is only "on" where needed and there is no backlight). OLEDs, however, are more expensive for a given display size due to the very expensive electroluminescent materials or phosphors that they use. Also due to the use of phosphors, OLEDs suffer from screen burn-in and there is currently no way

to recycle OLED displays, whereas LCD panels can be recycled, although the technology required recycling LCDs is not yet widespread. Attempts to increase the lifespan of LCDs are quantum dot displays, which offer similar performance as an OLED display, but the Quantum dot sheet that gives these displays their characteristics cannot yet be recycled.

Fig 3.4: Liquid-crystal display.

3.6 Humidity Sensor

A humidity sensor senses, measures and regularly reports the relative humidity in the air. It measures both moisture and air temperature. Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold. The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature. Humidity sensors detect the relative humidity of the immediate environments in which they are placed. They measure both the moisture and temperature in the air and express relative humidity as a percentage of the ratio of moisture in the air to the maximum amount that can be held in the air at the current temperature. As the air becomes hotter, it holds more moisture, so the relative humidity changes with the temperature. Most humidity sensors use capacitive measurements to determine the amount of moisture in the air. This type of measurement relies on two electrical conductors with a non-conductive polymer film laying between them to create an electrical field between them. Moisture from the air collects on the film and causes changes in the voltage levels between the two plates. This change is then converted into a digital measurement of the air's relative humidity after taking the air temperature into account.

Hardware and Software Required

- Arduino Uno
- Humidity Sensor DHT11 Module
- Arduino IDE(1.0.6 version)

Hardware Connections

The Humidity sensor module has 3 pins. The following connections should be made to connect the sensor module with Arduino.

- + to 5V
- - to GNG
- Out to Analog 0 pin of Arduino

3.7 Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load. The relationship between slider position and resistance, known as the "taper" or "law", is controlled by the manufacturer. In principle any relationship is possible, but for most purposes linear or logarithmic (aka "audio taper") potentiometers are sufficient. A letter code may be used to identify which taper is used, but the letter code definitions are not standardized. Potentiometers made in Asia and the USA are usually marked with an "A" for logarithmic taper or a "B" for linear taper; "C" for the rarely seen reverse logarithmic taper. Others, particularly those from Europe, may be marked with an "A" for linear taper, a "C" or "B" for logarithmic taper, or an "F" for reverse logarithmic taper.[2] The code used also varies between different manufacturers.

When a percentage is referenced with a non-linear taper, it relates to the resistance value at the midpoint of the shaft rotation. A 10% log taper would, therefore, measure 10% of the total resistance at the midpoint of the rotation; i.e. 10% log taper on a 10 kOhm potentiometer would yield 1 kOhm at the midpoint. The higher the percentage, the steeper the log curves.

Fig 3.5: Potentiometer.

3.8 Light-Emitting Diode (LED)

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the bandgap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device. Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light. Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet, and infrared wavelengths, with high light output. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays. Recent developments have produced high-output white light LEDs

suitable for room and outdoor area lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology. LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. LEDs are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, plant growing light and medical devices. Unlike a laser, the light emitted from an LED is neither spectrally coherent nor even highly monochromatic. However, its spectrum is sufficiently narrow that it appears to the human eye as a pure (saturated) color. Nor, unlike most lasers, is its radiation spatially coherent, so that it cannot approach the very high brightness characteristic of lasers. In a light-emitting diode, the recombination of electrons and electron holes in a semiconductor produces light (or infrared radiation), a process called "electroluminescence". The wavelength of the light depends on the energy bandgap of the semiconductors used. Since these materials have a high index of refraction, the design features of the devices such as special optical coatings and die shape are required to efficiently emit light.

Fig 3.6: light-emitting diode (LED)

3.9 Cooler Fan

A computer fan is any fan inside, or attached to, a computer case used for active cooling. Fans are used to draw cooler air into the case from the outside, expel warm air from inside and move air across a heat sink to cool a particular component. Both axial and sometimes centrifugal (blower/squirrel-cage) fans are used in computers. Computer fans commonly come in standard sizes and are powered and controlled using 3-pin or 4-pin fan connectors. Fans are used to move air through the computer case. The components inside the case cannot dissipate heat efficiently if the surrounding air is too hot. Case fans may be placed as intake fans, drawing cooler outside air in through the front or bottom of the chassis (where it may also be drawn over the internal hard drive racks), or exhaust fans, expelling warm air through the top or rear. Some ATX tower cases have one or more additional vents and mounting points in the left side panel where one or more fans may be installed to blow cool air directly onto the motherboard components and expansion cards, which are among the largest heat sources. Standard axial case fans are 40, 60, 80, 92, 120, 140, 200 and 220 mm in width and length. As case fans are often the most readily visible form of cooling on a PC, decorative fans are widely available and may be lit with LEDs, made of UV-reactive plastic, and/or covered with decorative grilles. Decorative fans and accessories are popular with case madders.

Fig 3.7: Cooler Fan.

3.10 Plastic Bottle

A plastic bottle is a bottle constructed from high-density plastic. Plastic bottles are typically used to store liquids such as water, soft drinks, motor oil, cooking oil, medicine, shampoo, milk, and ink. The size ranges from very small sample bottles to large carboys. Consumer blow-molded containers often have integral handles or are shaped to facilitate grasping. Plastic was invented in the 19th century and was originally used to replace common materials such as ivory, rubber, and shellac. In the 21st century, this once-celebrated invention has become almost like a disease that has spread to a significant amount of commodities sold today, including plastic beverage bottles. They were first used commercially in 1947 but remained relatively expensive until the early 1950s when high-density polyethylene was introduced. They quickly became popular with both manufacturers and customers because of their lightweight nature and relatively low production and transportation costs compared to glass bottles. However, the biggest advantage plastic bottles have over their glass counterparts is their superior resistance to breakage, in both production and transportation. Except for wine and beer, the food industry has almost completely replaced glass bottles with plastic bottles. This project we use it .the diameter of the bottle is 4 cm.

Fig 3.8: Plastic Bottle.

3.11 Bread Board

A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal breadboard, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plug board, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education. Older breadboard types did not have this property. A stripboard (Vero board) and similar prototyping printed circuit boards, which are used to build semi-permanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs). A bus strip usually contains two rows: one for ground and one for a supply voltage. However, some breadboards only provide a single-row power distributions bus strip on each long side. Typically the row intended for a supply voltage is marked in red, while the row for the ground is marked in blue or black. Some manufacturers connect all terminals in a column. Others just connect groups of, for example, 25 consecutive terminals in a column. The latter design provides a circuit designer with some more control over crosstalk (inductively coupled noise) on the power supply bus. Often the groups in a bus strip are indicated by gaps in the color marking. Bus strips typically run down one or both sides of a terminal strip or between terminal strips. On large breadboards, additional bus strips can often be found on the top and bottom of terminal strips. Note there are two different common alignments for the power bus strips. On small boards, with about 30 rows, the holes for the power bus are often aligned between the signal holes. On larger boards, about 63 rows, the power bus strip holes are often in alignment with the signal holes. This makes some accessories designed for one board type incompatible with the other. For example, some Raspberry Pi GPIO to breadboard adapter’s uses offset aligned power pins, making them not fit breadboards with aligned power bus rows. There are no official standards, so the users need to pay extra attention to the compatibility between a specific model of the breadboard and a specific accessory. Vendors of accessories and breadboards

are not always clear in their specifications of which alignment they use. Seeing a close-up photograph of the pin/hole arrangement can help determine compatibility.

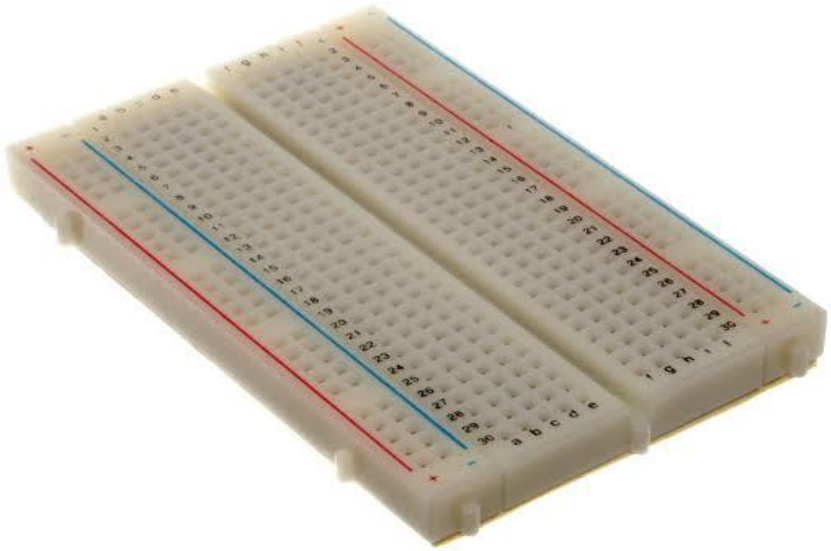

Fig 3.9: Bread Board.

3.12 PVC Board

Closed-cell PVC foam board is a lightweight rigid material used primarily in the manufacture of signs and displays. It is considered robust for outdoor use, being immune to rain and resistant to wind and sunlight. PVC foam board is distinct from the extra-lightweight foam core board, laminated of foam and card surfaces, used for indoor signage and modeling. Like PVC, closed-cell PVC foam board is solid and has a very rigid structure. Where it differs is in its closed-cell foam structure, which makes it very light (as little as half the weight of solid PVC), highly resistant to moisture and some chemicals, and very easy to cut and shape. It also has thermoplastic properties and begins to soften at around 65 °C (149 °F). Typically, closed-cell PVC foam board can be cut as easily as wood, softened and shaped by immersing in boiling water or with a standard heat gun, and painted with standard automobile paints. In addition, Closed-cell PVC foam board is made up of polarized molecules otherwise known as dipoles. It has very low moisture absorption. The mixture of polyvinyl chloride and polyuria has a good bond strength. Closed-cell PVC foam takes solid shape due to its linear structure. However, due to this structure, it is

more brittle than open-celled PVC foam. It is available in densities varying from 3 to 25 (pounds per cubic foot). It has a low flammability rate. A universal cross-linked closed-cell PVC that was used in a comparison with three heat-resistant cross-linked had a glass temperature of 83.2 °C. However, there are issues using PVC that can affect one's health and safety when in use.

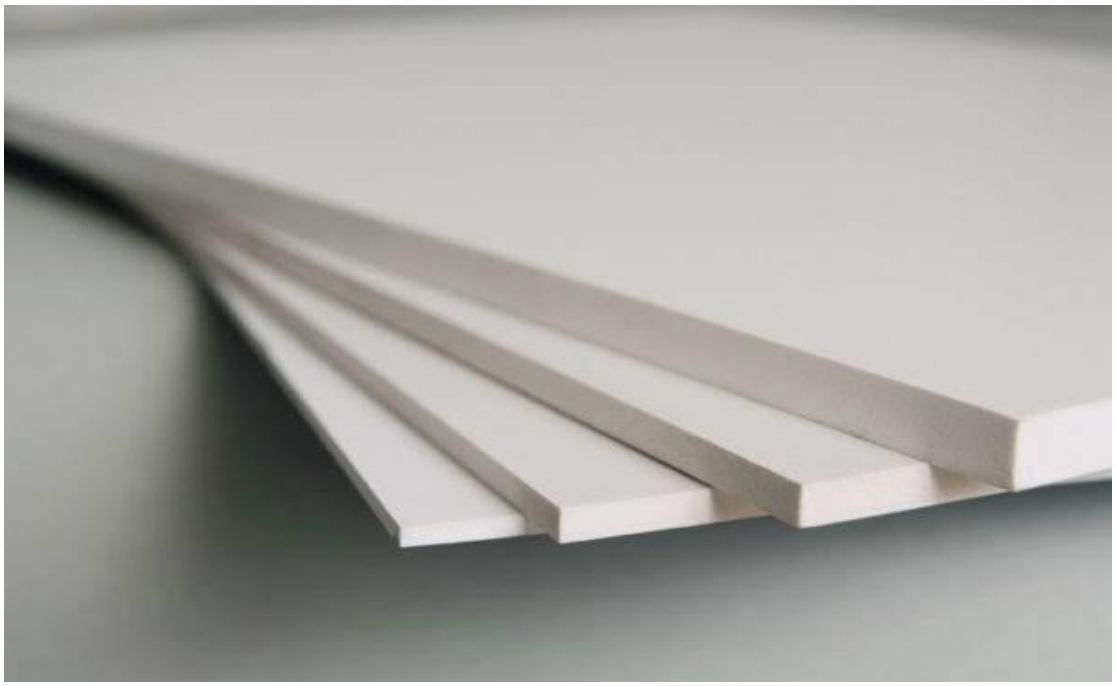

Fig 3.10: PVC Board.

3.13 Jumper wire

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

There are different types of jumper wires. Some have the same type of electrical connector at both ends, while others have different connectors. Some common connectors are:

Solid tips – are used to connect on/with a breadboard or female header connector. The arrangement of the elements and ease of insertion on a breadboard allows increasing the mounting density of both components and jump wires without fear of short-circuits. The jump wires vary in size and color to distinguish the different working signals.

Crocodile clips – are used, among other applications, to temporarily bridge sensors, buttons and other elements of prototypes with components or equipment that have arbitrary connectors, wires, screw terminals, etc.

Banana connectors – are commonly used on test equipment for DC and low-frequency AC signals.

A registered jack (RJnn) – are commonly used in telephone (RJ11) and computer networking (RJ45).

RCA connectors – are often used for audio, low-resolution composite video signals, or other low-frequency applications requiring a shielded cable.

RF connectors – are used to carry radio frequency signals between circuits, test equipment, and antennas.

RF jumper cables - Jumper cables are a smaller and more bendable corrugated cable that is used to connect antennas and other components to network cabling. Jumpers are also used in base stations to connect antennas to radio units. Usually the most bendable jumper cable diameter is 1/2".

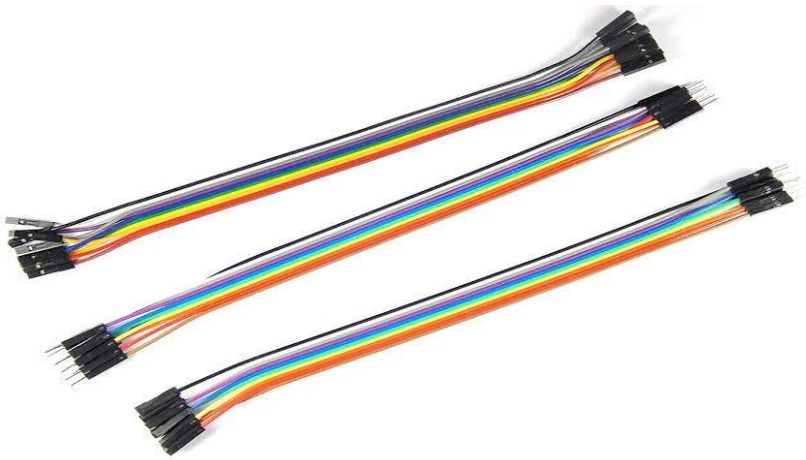

Fig 3.11: Jumper Wire.

3.14 AC Wire

An electrical cable is an assembly of one or more wires running side by side or bundled, which is used to carry electric current. A cable assembly is the composition of one or more electrical cables and their corresponding connectors. A cable assembly is not necessarily suitable for connecting two devices but can be a partial product (e.g. to be soldered onto a printed circuit board with a connector mounted to the housing). Cable assemblies can also take the form of a cable tree or cable harness, used to connect many terminals together. Electrical cables are used to connect two or more devices, enabling the transfer of electrical signals or power from one device to the other. Cables are used for a wide range of purposes, and each must be tailored for that purpose. Cables are used extensively in electronic devices for power and signal circuits. Long-distance communication takes place over undersea cables. Power cables are used for bulk transmission of alternating and direct current power, especially using high-voltage cables. Electrical cables are extensively used in building wiring for lighting, power and control circuits permanently installed in buildings. Since all the circuit conductors required can be installed in a cable at one time, installation labor is saved compared to certain other wiring methods. Physically, an electrical cable is an assembly consisting of one or more conductors with their own insulations and optional screens, individual covering(s), assembly protection and protective covering(s).

Fig 3.12: AC wire.

CHAPTER 4

SOFTWARE ANALYSIS

4.1 Introduction

In this part, the product utilized and the language in which the program code is characterized is referenced and the program code dumping devices are clarified. The section likewise reports the advancement of the program for the application.

4.2 Description of our Software

The open-source Arduino condition makes it simple to compose code and transfer it to the I/O board. It keeps running on Windows, Macintosh operating system X, and Linux. Nature is written in Java and dependent on Preparing, AVR-GCC, and another open-source programming. The screenshot of Arduino 1.6.8 is demonstrated as follows…

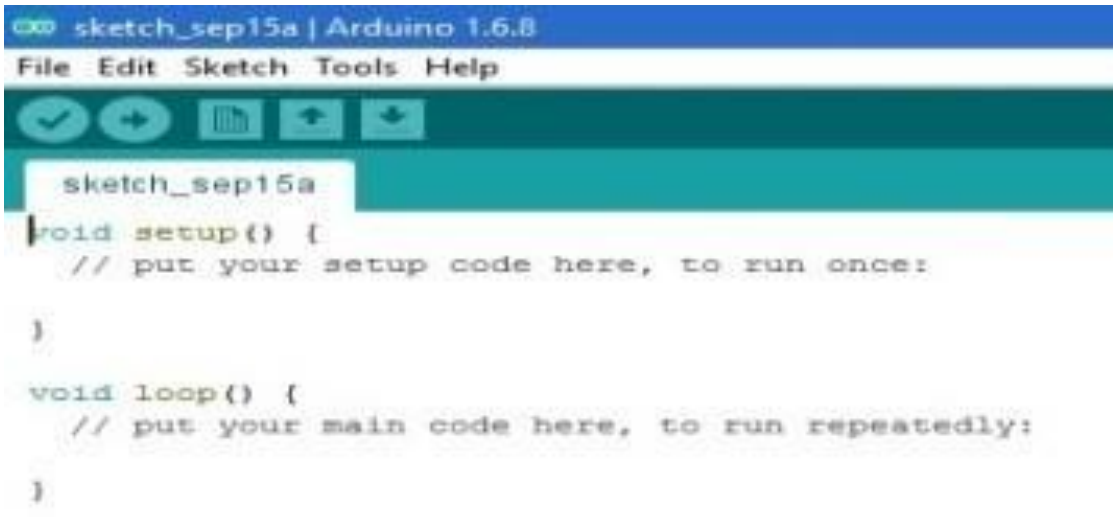

Fig. 4.1: Software Platform

It is likewise fit for arranging and transferring projects to the board with a solitary snap. There is commonly no compelling reason to alter make documents or run programs on a direct line interface. In spite of the fact that expanding on direction line is conceivable whenever required with some outsider apparatuses, for example, UNO.

The Arduino IDE accompanies a C/C++ library called "Wiring" (from the task of a similar name), which makes numerous regular info/yield activities a lot simpler. Arduino projects are written in C/C++, in spite of the fact that clients just need to characterize two capacities to make a runnable program:

4.3 The compiled window of my code is shown below

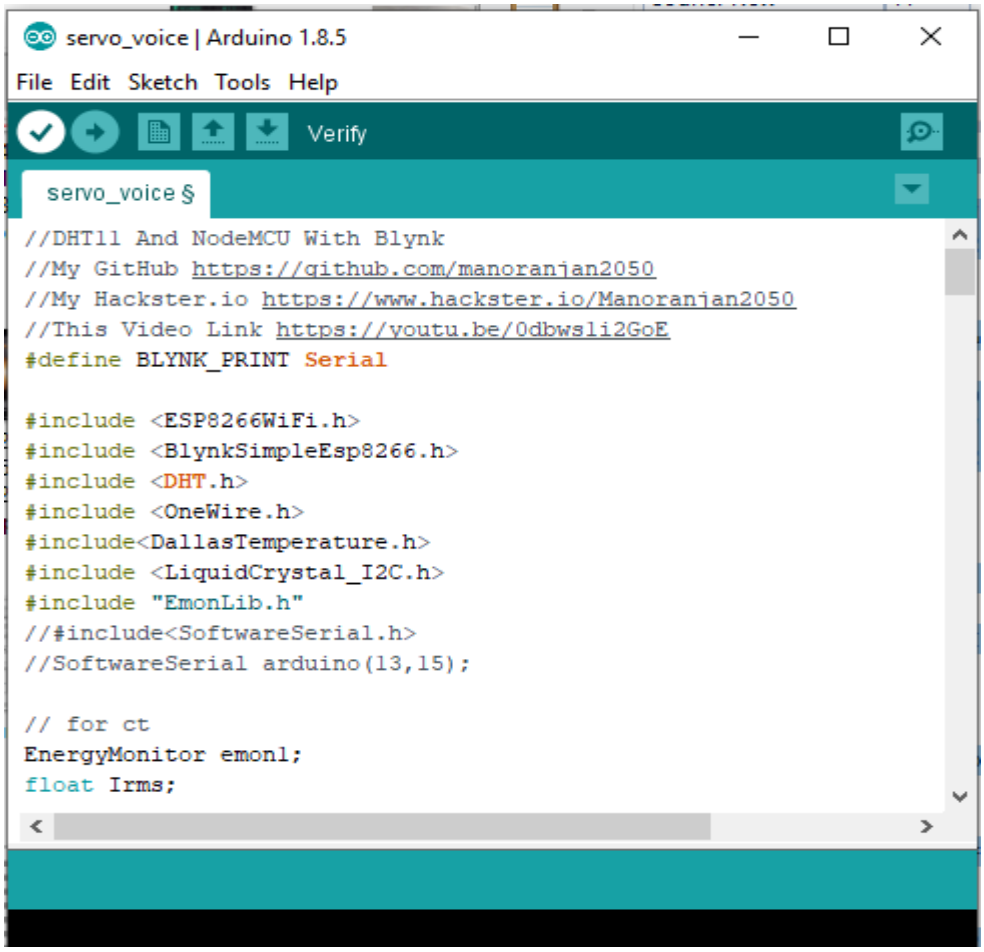

Fig 4.2: Code compiler.

CHAPTER 5

RESULT AND DISCUSSIONS

5.1 AC and Ecosystem some difference

The most efficient and eco-friendly manner is:

- Keep your room closed i.e. wherever you have installed the ac.
- Try having fewer and fewer items in the room where there is ac. One people stuff their rooms so much that the cooling is absorbed by those things and the AC needs to be operated for larger durations.
- Use the energy-efficient model in your AC (almost every AC has it these days).
- Use inverter AC technology that is eco-friendly.
- Or if you have a normal AC, search for 4 or 5 stars rated AC.
- Don't overhaul your AC by keeping its temperature at a minimum always. That way the compressor is in ON state always and draws larger power and more backside heat.

5.2 Air Pressure and Humidity

- Air pressure is the weight of the atmosphere pressing down on the earth. It is measured by a barometer in units called millibars. Most barometers use mercury in a glass column, like a thermometer, to measure the change in air pressure.
- When the weather is calm the mercury in the barometer seldom moves more than half-an-inch below the 30-inch mark.
- If a high-pressure system is on its way, often you can expect cooler temperatures and clear skies. If a low-pressure system is coming, then look for warmer weather, storms and rain.
- The weight pressing down on one square-inch sample of air at sea level is 14.7 pounds, which is equivalent to a column of mercury 29.92 inches in height (1,000 millibars).

- Air pressure changes with altitude. When you move to a higher place, say a tall mountain, air pressure decreases because there are fewer air molecules as you move higher in the sky.
- The relative humidity is the amount of moisture the air can hold before it rains. The most it can hold is 100 percent. Humidity is measured by a psychrometer, which indicates the amount of water in the air at any one temperature.

5.3 Humidity and temperature value Day one and day Two:

Time	Normal Temperature in air ℃	Normal Humidity in air ٪	System Temperature In air ℃	System Humidity in air ٪
8:00 am	23	57	22	73
8:30 am	23	56	22	74
9:30 am	24	57	20	77
11:00 am	24	55	21	76
12:30 am	26	57	19	76
1:30 pm	26	57	19	78
3:30 pm	26	56	20	76
5:00pm	26	56	19	78

Table 5.1: Temperature and Humidity value.

Time	Normal Temperature in air ℃	Normal Humidity in air ٪	System Temperature In air ℃	System Humidity in air ٪
8:00 am	25	58	23	71
8:30 am	25	56	20	75
9:30 am	27	59	21	75
11:00 am	26	54	23	72
12:30 am	26	58	20	79
1:30 pm	27	52	20	74
3:30 pm	27	50	23	73
5:00pm	25	51	22	77

Table 5.2: Temperature and Humidity value.

5.4 Proposed Assembly of Our Projects backside

Fig 5.1: Backside of our project.

5.5 Proposed Assembly of Our Projects front side

Fig 5.2: Frontside of our project

5.6 Proposed Assembly of Our Projects result

Fig 5.3: Our project output result.

5.7 Advantages

- It’s very simple and easy to make.
- This project is very energy safe and low cost to make it.
-
- Micro controlling is the importance of controlling automatic than manual control.
- The refrigerant 404a is the environment-friendly refrigerant to CFC free to save Global potential warming (GPW).
- The project Assembly is very simple and cheeps all of the equipment.
- The micro controlling cheaper than PLC control and maintenance cost is very low.

5.8 Disadvantages

- The micro control is very difficult for a computer programming language.
- The APN net control is a very problem of a server error or network problem to connection fault.

CHAPTER 6

CONCLUSION

6.1 Conclusions

400a is HFC blend to on Environment-friendly refrigerant gas the remove global warming to the main component of carbon dioxide (CO) remove to save the greenhouse and great high-security global warming potential the powerless compressor used to save energy to the energy to regulate the future generation to stop fossil fuel. Food storage the importance of refrigeration storing food at cold temperatures relates humidity slows is the growth of microorganism's thereby limited food poisoning while preserving food's nutritional qualities and a good test. One of the most important regions for grounding electrical current is that protects our applications, our home and everyone in, it from surges in electricity of lighting was to strike or the power was to surge at our place for whatever reasons, this produces a dangerously high voltage of electricity in our system. In addition to the high degree of efficiency and lower energy consumptions, the other benefits of optimized compressor drives are low operating temperatures and therefore a longer life. Whereas the compressor with the IE3 motor would have a performance efficiency of around 92% and only a 200 kW power loss. Microcontrollers as used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, applications, power tools, toys and another embedded system. By reducing the size and cost compared to a design the uses a separate. Microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed-signal microcontrollers are common integrating analog components needed to control the nondigital electronic systems. In the context of the internet of things, microcontrollers are an economical and popular means of data collection. Sensing and actuating the physical world as edge devices.

6.2 Literature Review

A review of a number of patented thermoelectric refrigerator designs, a photovoltaic-direct/indirect thermoelectric cooling system, and research studies from the literature are described in the following section. A simple design was proposed by Beitner in 1978 consisting of thermoelectric modules directly powered by an external DC source and an external thermal sink to dissipate heat to ambient by using natural convection cooling. Reed and Hatcher in 1982 proposed an effective way to increase the heat-dissipating capability at the hot end of thermoelectric modules by using the cooling fan. Park et al. in 1996 introduced the new design of thermoelectric refrigerator by combining the benefits of super insulation materials with thermoelectric system and phase change materials to provide an environmentally benign system that was energy efficient and could maintain a relatively uniform temperature for the extended periods of time with relatively low electrical power requirements.

6.3 Future Scope

- The future development of the controlling at the server to a web page is sketch drawing controlling computer programming.
- We are used Refrigerant 404a. Then the next generation is used then refrigerant 600a at then better on the refrigerant 404a.
- The Apps and modification the other option to buy the change to international master card $. Then added others to the extra calculation
- Our project is controlling the micro control used on the Node MCU and Aruindo UNO circuit then two circuits are adjustment on very short. At a future used to the simple circuit of micro controlling.

REFERENCE

1. Y. J. Kim, S. Kim, Y. K. Joshi, A. G. Fedorovc, and P. A. Kohl, "Thermodynamic analysis of an absorption refrigeration system with ionic liquid/refrigerant mixture as a working fluid," Energy, vol. 44, no. 1, pp. 1005–1016, 2012
2. Basic Refrigeration and Air Conditioning
   -PN. Ananthanarayanan.
3. Principal of Refrigeration,
   -Roy J. Dossat
4. A text book of Refrigeration and Air-conditioning
   -R.S Khurmi
   -J.K Gupta
5. A course in Refrigeration and air-conditioning
   -S.C Arora
6. Modern refrigeration and air conditioning for engineers
   Prof PS Desai
7. Refrigeration and air conditioning
   -CP Arora
8. Two-Phase Flow in Refrigeration Systems by
   Junjie Gu and Shujun Wang
9. Refrigeration Systems and Applications by
   Ibrahim Dincer
10. Troubleshooting and Servicing Modern Air Conditioning and Refrigeration Systems by John Tomczyk
11. Introduction to Electrical and Electronics Circuits
12. Electronic Devices and Circuits
13. Discrete Data and Digital Control

APPENDIX A

```
#include <dht.h>
dht DHT;

float  humidity_data;
int temp_data1;
int temp_data;
float  humidity_data1;
#define DHT11_PIN A1
#define DHT11_PIN1 A2
#include<LiquidCrystal.h>
LiquidCrystal lcd (2, 4, 8, 9, 10, 11);
int led1 = 13; //yellow
int led2 = 12; //green
int chk;
int chk1;
void setup() {
// put your setup code here, to run once:
Serial.begin(9600);
lcd.begin(16, 2);
lcd.clear();
lcd.setCursor(0, 1);
lcd.print("Project Solution ");
delay(2000);
lcd.clear();
lcd.setCursor(0, 2);
lcd.print("Eco air cooler");
delay(1000);
pinMode(led1, OUTPUT);
pinMode(led2, OUTPUT);
chk = DHT.read11(DHT11_PIN);
chk1 = DHT.read11(DHT11_PIN1);
int temp = constrain(DHT.temperature, 0, 100);
int temp1 = constrain(DHT.temperature, 0, 100);
delay(500);
}

void loop() {
dht_sensor();
delay(100);
}
void dht_sensor()
{
chk = DHT.read11(DHT11_PIN);
temp_data = constrain(DHT.temperature, 0, 100);
humidity_data = constrain(DHT.humidity, 20, 67);
chk1 = DHT.read11(DHT11_PIN1);
temp_data1 = constrain(DHT.temperature, 0, 100);
humidity_data1 = constrain(DHT.humidity, 20,100);
Serial.print(temp_data);
Serial.print(" ");
Serial.print(humidity_data);
Serial.print("\t");
Serial.print(temp_data1);
```

```
Serial.print(" ");
Serial.print(humidity_data1);
delay(2000);

lcd.clear();
lcd.setCursor(0, 0);
lcd.print(constrain(humidity_data, 0, 100));
lcd.setCursor(3, 0);
lcd.print("%");
lcd.setCursor(4, 0);
lcd.print("T:");
lcd.setCursor(5, 0);
lcd.print(constrain(temp_data, 0, 100));
lcd.setCursor(7, 0);
lcd.print("C");
lcd.setCursor(8, 0);
lcd.print(" ");
lcd.setCursor(0, 1);
lcd.print(constrain(humidity_data1, 0, 100));
lcd.setCursor(3, 1);
lcd.print("%");
lcd.setCursor(3, 1);
lcd.print("T:");
lcd.setCursor(5, 1);
lcd.print(constrain(temp_data1, 0, 100));
lcd.setCursor(7, 1);
lcd.print("C");
lcd.setCursor(8, 1);
lcd.print(" ");
delay(500);

digitalWrite (led1,HIGH);
digitalWrite (led2,HIGH);
delay (1000);
digitalWrite (led1,LOW);
digitalWrite (led2,LOW);
delay (1000);




}
```