

DIGITAL WIND SPEED DIRECTION AND MONITORING SYSTEM

**A Project and Thesis submitted in partial fulfillment of the requirements
for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering**

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October 2019

Certification

To prove that this project, titled "**Digital Wind Speed Direction and Monitoring System**", was supervised by the following students under my supervision and this work was conducted by laboratories of electrical and electronic engineering departments under the Faculty of Engineering, Bachelor's Degree in Electrical and Electronic Engineering Presentation of the work was held at Daffodil International University on 31 October 2019.

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requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering**
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List of Abbreviations

IC	Integrated Circuit
SW	South West
KPH	Kilo Meter Per Hour
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
GUI	Graphical User Interface
KV	Kilo Watt
AC	Alternating Current
IC	Integrated Circuit
LED	Light Emitting Diode
LCD	Liquid Crystal Display
Ns	Secondary Winding
Np	Primary Winding
Is	Secondary Current
Ip	Primary Current
CT	Current Transformer
KHZ	Kilo Harz
MHZ	Mega Harz
KB	Kilo Byte
PT	Potential Transformer
KWH	Kilo Watt Hour
nF	Nano Farad
IR	Infrared Ray
TR	Turn Ratio
USB	Universal serial bus
pF	Pico Farad
mF	Micro Farad

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ABSTRACT

Weather station in the university, school and backyard can help the students and employees, farmer to be aware of their surroundings and help them be prepared. This research aim to set up and run the weather station, data acquisition and data presentation for wind speed and wind direction. We used an experimental method. For this project we used IR sensors for the anemometer and wind vane which were compatible with Arduino Nano microcontroller for data collection.

Once the data is logged, it will deliver the data to the recipient every hour with the highest peak speed of wind speed. It also sent an alarm, if it reached at the critical level of 61 kilometers per hour for wind speed. The integrated weather station was fully implemented and the results of the maximum wind speed were recorded last September 20, 2019 at 43.22 Kph and for the wind direction at 225° SW.

The developed integrated weather station for wind speed and wind direction historical data can be significant to the disaster risk reduction and management team of the university to plan for the school activities for the safety and security of the employees, students and school properties.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Today, wind and other weather variables are of equal concern and can have a greater impact on our modern and high technology lifestyles. Weather extends human activities, including agriculture, transportation and leisure time. The weather divides the gas's momentum through the atmosphere and adds particle. The conventional weather monitoring system consisted of individual sensors to measure one meteorological variable, and each connected to a data collection device or recorder. Modern technology has allowed the combination of several sensors into one integrated weather station.

This can be permanently located at one site, and transported to a site where localized weather is needed. In this paper, the researcher focused only on the wind speed and wind direction data monitoring in the university. Many typhoons are visited annually in the Philippine Islands, which is why most Filipinos find weather monitoring essential in their daily activities. Most Internet-based weather services get their information from publicly available sites maintained by local and national government weather network.

Some apply forecasting algorithms to adjust data for regional variations but in most cases the data is only accurate in the location of the measurement system. Having this in Dhaka is considered as an advantage. During calamities like typhoon and flood in Dhaka, the school management will wait for the announcement of the local government to declare suspension of classes.

The responsibility of the school is to keep safe and reduce the risk of the students and employees and to keep the students and employees aware about these types of calamities. A weather station in the school backyard can help the students and employees in the awareness of their surroundings and can help them be prepared. Researchers have passed many papers using microcontroller units to gain knowledge of the existing weather station system. After searching various papers, the researcher came to a conclusion that almost all weather stations are quite similar to the design, which is high production cost, so we tried to reduce the cost of production.

1.2 Frame work of the Study

Weather Center The combination of anemometers and wind disappearances for weather forecasts for meteorological analysis weather in this project, the researcher developed an automated weather station and data acquisition system using the microcontroller module Arduino Uno, which periodically stored weather parameters.

The overall system indicated in Figure 1.1 was the system block diagram. The Philippine Atmosphere, Geophysical and Astronomical Services Administration (PAGASA) is the official source of weather information for the country.

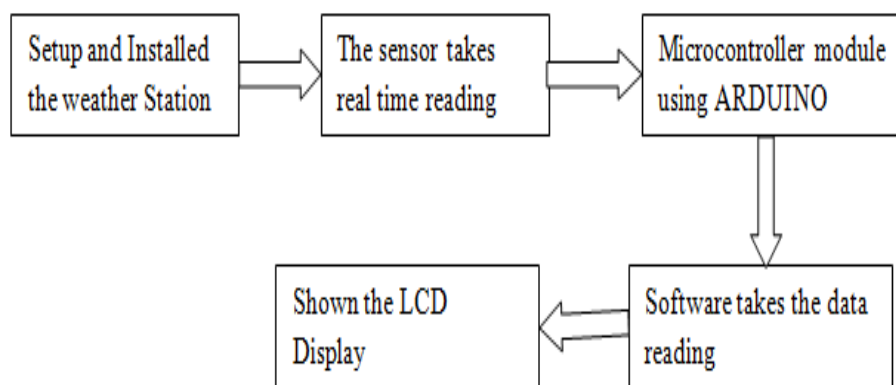


Figure 1.1: System Block Diagram

1.3 Problem Statement

Uncertainty about weather conditions can be catastrophic in planning out human activities. Monitoring the weather requires critical analysis of different climatic conditions, studying the pattern and processing data obtained to produce results. Weather Forecasting is based on analysis of data and the use of meteorology to predict future weather conditions. They require very active human interaction to determine weather conditions and are not necessarily reliable since they are sometimes inaccurate. Weather monitoring station is a solution to this problem, however, the cost of construction is to be considered. They prove to be inefficient if it requires active human interaction to be able to operate and produce results whilst still being able to monitor only a specific weather variable.

1.4 Objectives

The study aimed to accomplish the following:

- a) Design and set-up the weather station system
- b) Gather actual data from the integrated weather station system
- c) Test the acquired sensors for calibration and validation
- d) Design a data logger software that displays and produces warnings if the readings exceed its critical level (61 Kph for wind speed).

1.5 Research Methodology

The research design used in the study is the experimental development method. This method was accomplished by setting-up and installing the weather station system that monitor wind speed and wind direction.

Then software was developed for data monitoring. After that series of testing, debugging and calibrating were done, finally, the data were gathered and analyzed. The researcher conducted the experiments on the weather station data produced using anemometer and wind vane. The data gathered served as the basis for the implementation of the research project.

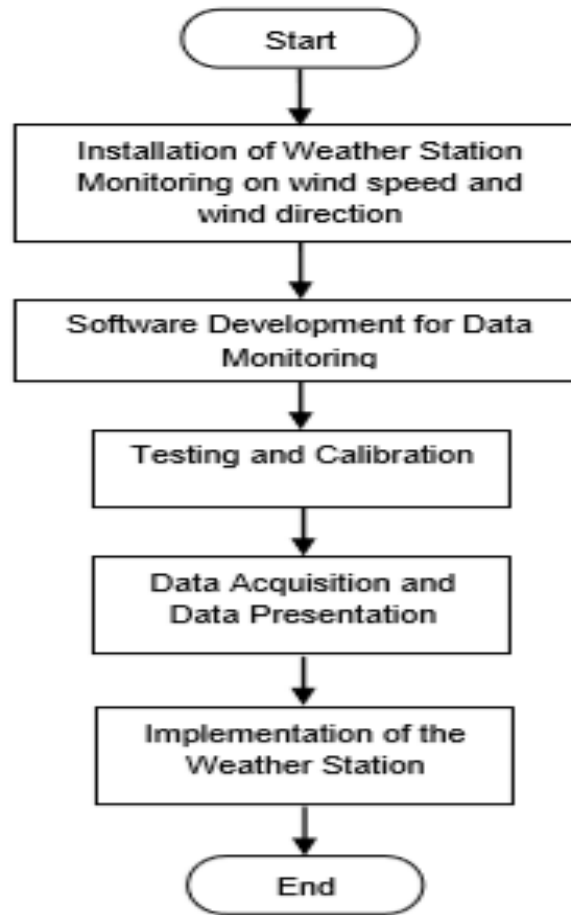


Figure 1.2: Weather Station System Flowchart

The design used was compatible with the Switch Doc Labs Weather Arduino interface board and Arduino Uno microcontroller unit. IR was also used for monitoring the data from the weather station. The data obtained were then transmitted and stored to the computer for data logging and Graphical User Interface (GUI) for further data monitoring and displaying. Every hour the data were e-mailed to the recipient and further if the data exceeded the critical value of 61 Kph for wind speed the device triggered to alarm.

1.6 Project Outline

This Project is organized as follows:

Chapter 1: Introduction

Chapter 2: Literature Reviews

Chapter 3: Hardware Development

Chapter 4: Design and Implementation

Chapter 5: Results and Discussions.

Chapter 6: Conclusion and Recommendations

1.7 Summary

Weather extends human activities, including agriculture, transportation and leisure time. The weather divides the gas's momentum through the atmosphere and adds particles. Then the software for data monitoring was created. After that continuous experiment, debugging and calibrating was done, finally, the data was collected and analyzed.

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

Rac Weather Station Monitoring System was installed in Weather's 6th floor building of Dhaka. Weather sensors (anemometers and wind vans) of the acquired weather rack were designed to determine the speed and direction of the wind.

2.2 Selection of Sensors

The parameters measure Wind speed and Wind direction. The following sensors were used for each parameter:

1. Anemometer – wind speed
2. Wind vane – wind direction

2.2.1 Cup Anemometer Sensors

The anemometer measures the magnet's speed by passing a switch as well as closing a switch. The second of the contact indicates a second of 1.492 MPH (2.5 km / h). The anemometer must be pulled at 3.3V or above 5V via a 10K ohm pull-up register. The purpose of attaching the barrier input to the host computer was to connect the animator switch to the RJ11 cable shared by the animator and the wind van to two internal conductors (pins 2 and 3).



Figure 2.1: Cup Anemometer Sensors.

2.2.2 Wind Vane

The air van has 8 switches and each is connected to a separate resistor. Weather racks measure the voltage on a register divider (with 10K ohms onboard resistor) to measure the resistance value of the resistor. Usually, the air van will only report a total of 8 parties. Sometimes it is possible to read 16 aspects (when two contacts are closed at the same time), but this is a rare occurrence. In all their experiments at Switch Dock Labs they have never seen it.

Software Development for Data Monitoring The Switch Doc Labs Weather Rack Sensors include Weather Pi Arduino which provide a suit of weather sensors for use by Arduino Uno and Raspberry Pi computer data monitoring of wind speed, its peak value, and wind direction (degrees and cardinal) were also display in Graphical User Interface (GUI).

2.3 Arduino Nano

Arduino Nano is a microcontroller board based on ATMga328. It has everything you need to support microcontrollers. The software was optimized for the ability to monitor weather stations in the direction of wind speed and wind direction.

1. Null Hypothesis

H0 the wind speed reading from the anemometer of the Weather Rack Sensors does not differ from the conventional handheld anemometer. Alternate Hypothesis, H1 the wind speed reading from the anemometer of the Weather Rack Sensors does differ from the conventional handheld anemometer.

2. Null Hypothesis

H0 the wind direction reading from the wind vane of the Weather Rack Sensors does not differ from the conventional digital compass.

Alternate Hypothesis, H1 the wind direction reading from the anemometer of the Weather Rack Sensors does differ from the conventional handheld anemometer.

2.4 Humidity Sensor

The DHT11 humidity and temperature sensor is used only for the monitoring of humidity in this project. It is a reliable, inexpensive and low power consuming device. It acquires digital signal values making it highly reliable and giving it long term stability. The sensor has 4 pins and uses a resistant type of moisture element to continuously moisture data values, including an 8-bit microcontroller. It is able to accurately measure humidity in the range of 20-90% with -1% accuracy.



Figure 2.2: Humidity Sensor

2.4.1 Humidity Sensor Specifications

The specifications of the DHT11 are as follows:

- Operating voltage: 3.5V – 5.5V
- Operating Current: 0.3 mA (measuring) 60 μ A
- Output: serial data
- Temperature range: 0° - 50° C

- Humidity range: 20 – 90%
- Resolution: 16-bit
- Accuracy: $\pm 1\%$ and $\pm 1^\circ\text{C}$

2.5 Temperature Sensor

The temperature sensor is a digital thermometer that outputs a 9 - 12 bit measurement value in Celsius. It connects the microcontroller to a single cable bus and has the power to get power source from this line without the need for external power supply. It also has an alarm function that is user programmable. Multiple DS18B20 sensors can be multiplexed to a single cable bus due to the unique 1-bit serial code, which gives the microcontroller the ability to control all DS18B20 sensors connected to a single cable bus.



Figure 2.3: Temperature sensor

2.5.1 Temperature Sensor Specifications

The specifications of the temperature sensor are

- Programmable digital temperature sensor
- Uses unique 1-wire method
- Operating voltage: 3V – 5V
- Temperature range: -55°C to $+125^\circ\text{C}$
- Accuracy: $\pm 0.5^\circ\text{C}$
- Output resolution: 9-bit to 12-bit
 - Unique 64-bit addressing
 - Conversion Time: 750ms at 12-bit

- Programmable alarm options

2.6 Summary

The anemometer measures the magnet's speed by passing a switch as well as closing a switch. Arduino Nano is a microcontroller board based on ATmega328. It has everything you need to support microcontrollers. The software was optimized for the ability to monitor weather stations in the direction of wind speed and wind direction.

runs at 2KB and 1KB of Epigram, and has gone up to 16 MHz

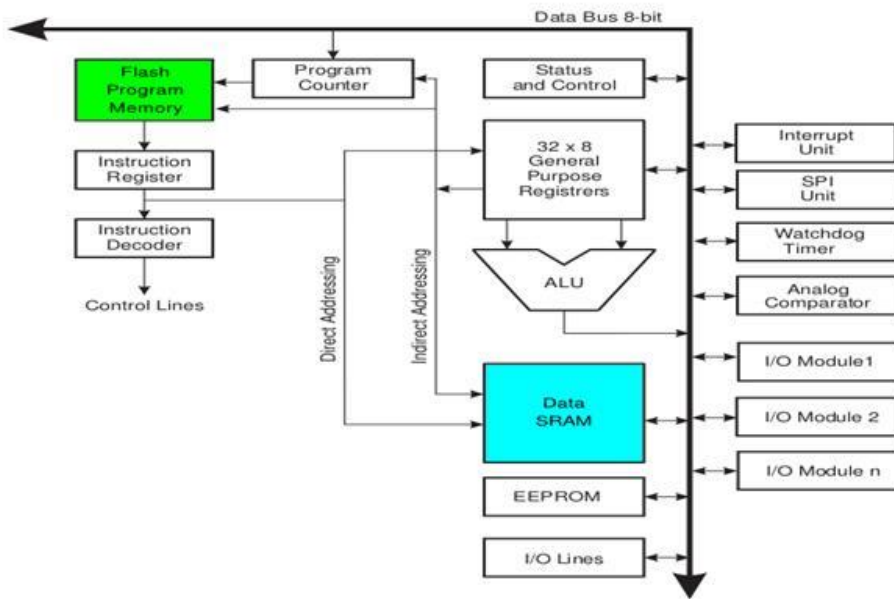


Figure 3.2: Arduino Architecture

3.2.2 Arduino Pin Diagram

A typical example of Arduino board is Arduino Uno. It consists of ATmega328- a 28 pin microcontroller.

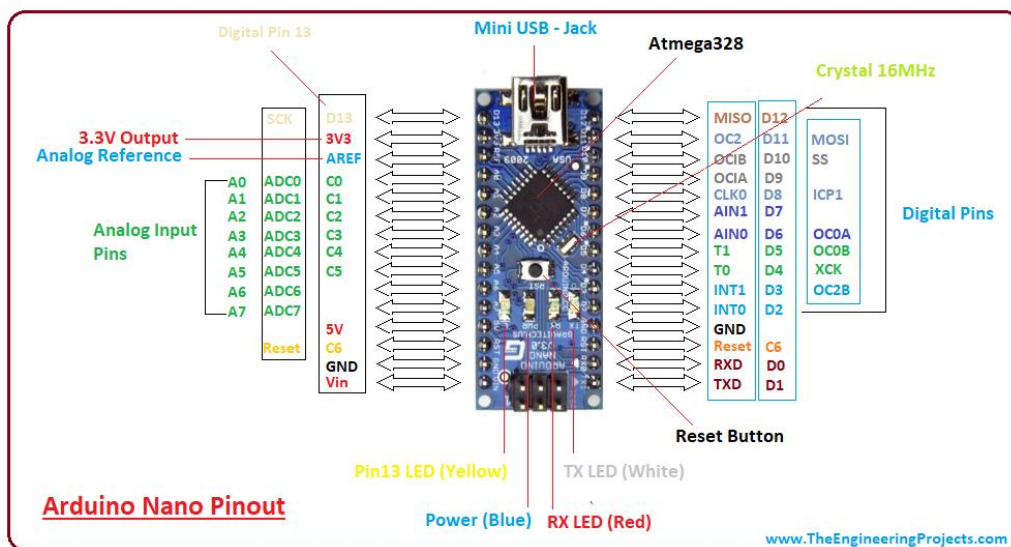


Figure 3.3: Arduino Pin diagram

Power Jack: Arduino can be powered from a PC via a USB or external source such as an adapter or battery. It can operate on an external supply of 7 to 12V. Power can be externally applied via voltage reference via pin VIN or eorif pin.

Digital Inputs: It has 14 digital input / output pins, each of which supplies or receives 40mA current. Some of these have special functions such as pins 0 and 1, which act as RX and TX, respectively, for pins 2 and 3 - which are external obstructions, pins 3, 5, 6,9,11 which are PWM output and pin supply 13 where the LED is connected.

Analog inputs: It has 6 analog input/output pins, each providing a resolution of 10 bits.

ARef: It provides reference to the analog inputs.

Reset: It resets the microcontroller when low.

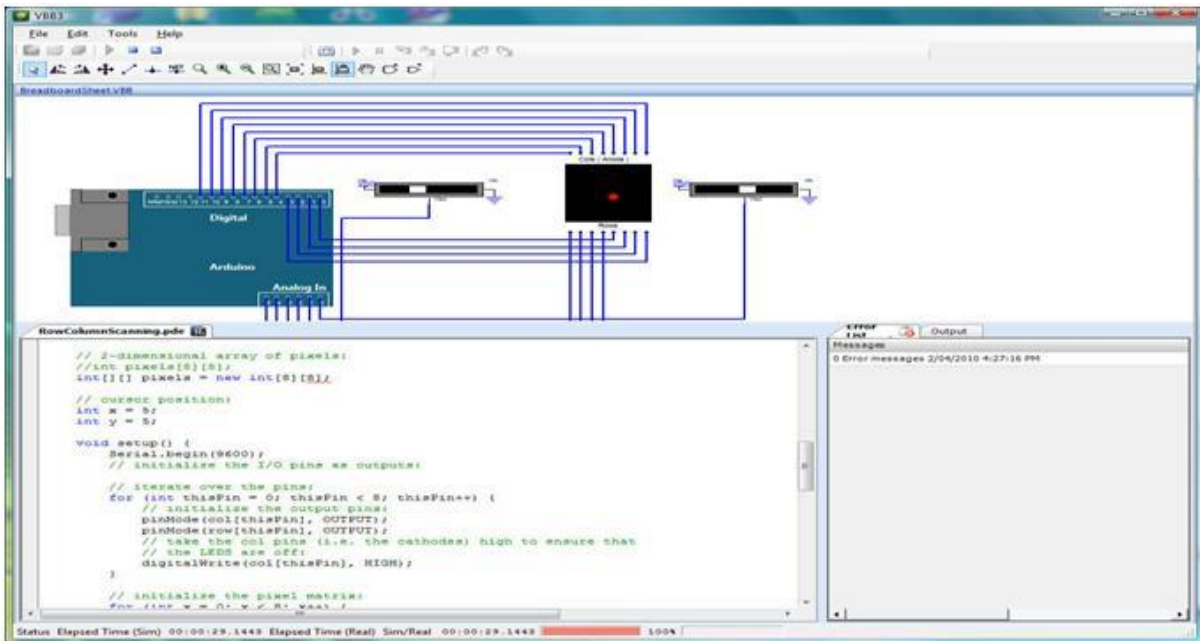
3.2.3 Program an Arduino

The most important advantage of Arduino is that it can be loaded directly into the device without the need for a hardware programmer to burn the programs.

This is due to the presence of a bootloader of 0.5KB that allows the program to ignite within the circuit. All we have to do is download the Arduino software and write the code.

The toolbar of the Arduino Tool window is with buttons like Validate, Upload, New, Open, Save, Serial Monitor. It also has a text editor for writing code, a message field that displays responses like errors, text consoles that output and a series of menus, such as files, edits, and

tools.



5 Steps to program an Arduino

- Programs written in Arduino are known as sketches. A basic sketch consists of 3 parts
 1. Declaration of Variables
 2. Initialization: It is written in the setup () function.
 3. Control code: It is written in the loop () function.
- The sketch is saved with ion extension. Any operations like verifying, opening a sketch, saving a sketch can be done using the buttons on the toolbar or using the tool menu.
- The sketch should be stored in the sketchbook directory.
- Chose the proper board from the tools menu and the serial port numbers.
- Click on the upload button or chose upload from the tools menu. Thus the code is uploaded by the bootloader onto the microcontroller.

Few of basic Arduino functions are:

- **Digital Read** (pin): Reads the digital value at the given pin.
- **Digital Write** (pin, value): Writes the digital value to the given pin.
- **Pin Mode** (pin, mode): Sets the pin to input or output mode.
- **Analog Read** (pin): Reads and returns the value.
- **Analog Write** (pin, value): Writes the value to that pin.
- **Serial Begin** (baud rate): Sets the beginning of serial communication by setting the bit rate.

3.2.4 Technical Specification of Arduino Microcontroller

ARDUINO MICROCONTROLLER	
Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5V
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
Clock Speed	16 MHz
Analog I/O Pins	6
EEPROM	1 KB
DC current per I/O pins	40 mA on I/O pins; 50 mA on 3,3 V Pin

Table No 3.1: Technical Specification

3.4 Technical Specification of General

GENERAL	
Input Voltage	7-12 V
Digital I/O Pins	20 (of which 6 provide PWM output)
PWM Output	6
PCB Size	53.4 × 68.6 mm
Weight	25 Kg

Table No 3.2: Technical Specification (General)

3.5 Power

The power pins are as follows:

- VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source).
- 5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- GND: Ground pins.

3.6 Memory

The Atmega328 has 32 KB of flash memory for storing code. It has also 2 KB of SRAM and 1 KB of EEPROM.

3.7 Inputs and Outputs

- Serial: 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.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- LED: 13 there is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the on the board.

3.8 Summary of the Chapter

- The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

CHAPTER 4

HARDWARE DEVELOPMENT

4.1 Hardware Component

- AC SUPPLY
- VOLTAGE REGULATOR
- RESISTOR
- CAPACITOR
- DIOD
- LED
- LCD
- BUZZER
- RECHARGIBLE BATTERY
- IR SENSOR
- INFRARED TRANSMITTER
- INFRARED RECEIVERS
- TEMPERETURE SENSOR
- OPM AMPLIFIRE

- ARDUINO
- WIND DIRECTION SENSOR
- STEP DOWN TRANSFORM
- WIND SPEED SENSOR
- VARO BOARD
- SWITCH
- SOME WIRE

4. 2 AC Power Supply

Power supply is the reference to the electrical energy source. A device or a system that supplies electrical or other types of power to an output load is called a power supply unit. This term is the most commonly used electric power supply, less for mechanics and sometimes for others. This power supply section is required to convert the AC signal to the DC signal and reduce the amplitude of the signal. The voltage signal received from the mains is 220V / 50Hz which is an AC voltage, but DC voltage (no frequency) with an amplitude of + 5V and + 12V for required applications. In this section we have the transformer, the bridge rectifier, connected to the serial and through a capacitor (1000 μ F) in parallel, the voltage regulators for + 12V (7805 and 7812) as shown in the circuit diagram below. Each voltage controller output is again connected to the capacitors of values (100 μ F, 10 μ F, 1 μ F 0.1 μ F) in parallel with which the corresponding output (+ 5V or + 12V) is taken into account.

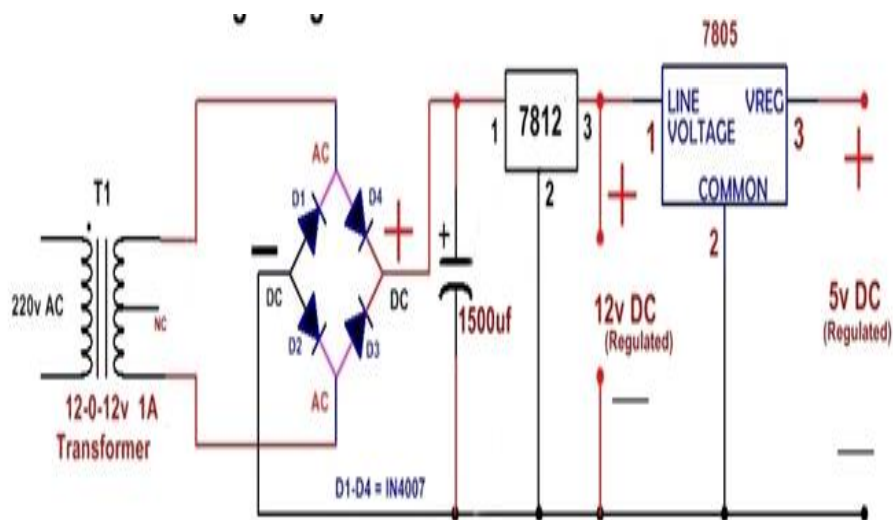


Figure 4.1: AC to DC Converter Power Supply

4.3 Voltage Regulator

Usually, we start with an unregulated power supply ranging from 9volt to 12volt DC. To make a 5volt power supply, IC 7805 voltage regulator as shown in figure has been used.

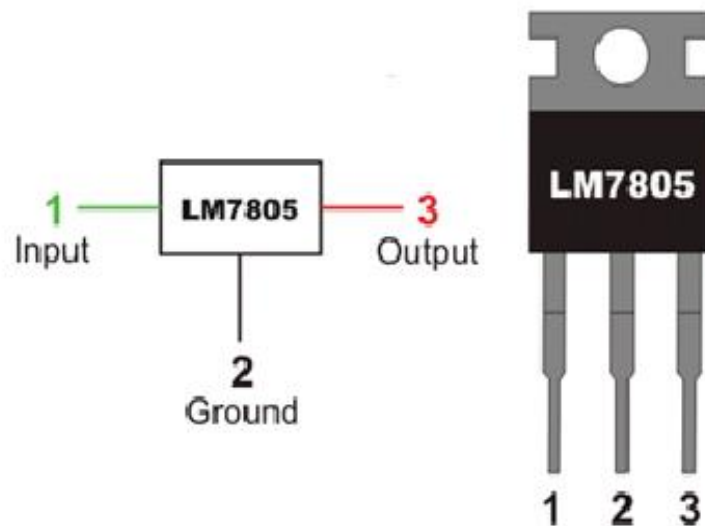


Figure4.2: Pin Diagram of IC 7805

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 7805 indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

4.4 Resistor

A resistor is a passive two-terminal electrical component that applies electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, split voltages, bias active components, and eliminate transmission lines, among other uses.



Figure 4.3: Resistors

High-power resistors that can disperse a lot of electric power as heat, may be used as part of motor control, in a power distribution system or as a test load on a generator. Fixed resistors have resistivity that varies only slightly with temperature, time, or operating voltage. Variable resistors can be used to adjust circuit components (such as a volume control or lamp dimmer) or as sensing devices for heat, light, humidity, force or chemical activity.

The electrical activity of a resistor is specified by its resistance: ordinary commercial resistors are manufactured at widths of nine dimensions. The nominal value of resistance falls within the production tolerance, as indicated in the material.

4.4.1 Variable Resistor



Figure 4.4: Variable Resistor

Limits the current flow of an electrical circuit without turning off a resistor current. A variable resistor allows further control of the current flow by changing the amount of resistance. When the resistance of the variable resistor increases, the amount of current to flow in a circuit decreases. The two basic elements make the variable resistive. The resistant material is called the first element and element. The second component, known as a wiper or brush, is used to set resistance and is often controlled with a knob or sliding switch. There are several types of variable resistors. At Future Electronics, we stock many common conventional types classified by type, number of turns, tolerances, rated power, nominal resistance, and packaging types. Parametric filters on our website can help refine your search results, depending on the details required. The most common size for rated power is 250 MW and 500 MW. We also carry variable resistors with rated power up to 37 W V Variable resistors can be pentameter, trimmer or turn counting dial type. Variable Resistors can be found in:

- Audio control
- Television
- Motion control
- Transducers
- Computation
- Home Electrical Appliances
- Oscillators

4.4.2 Tips for Reading Resistor Code

In the sections below examples are given for different numbers of bands, but first some tips are given to read the color code:

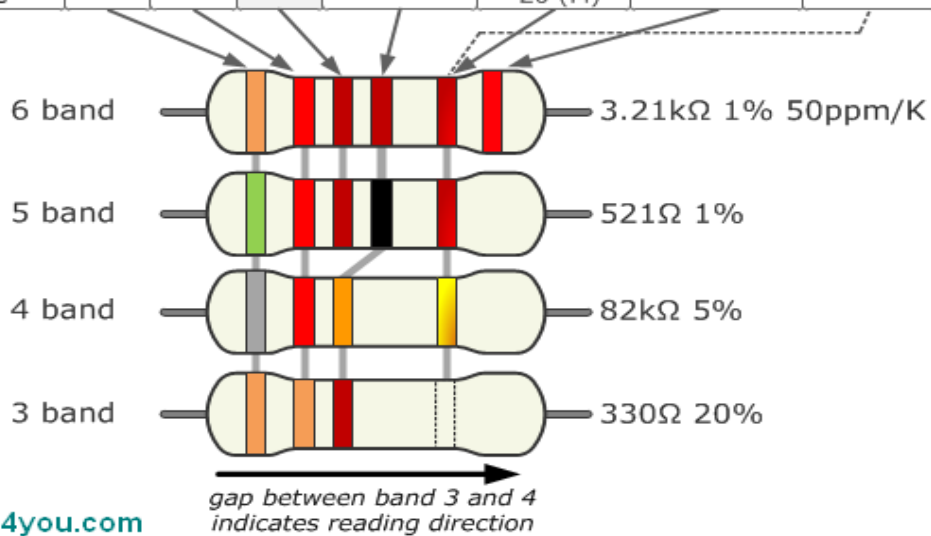
- Reading directions may not always be clear. Sometimes the extra space between bands 3 and 4 gives the direction of reading. Also, the first band is usually the nearest thumb lead. The gold or silver band (tolerance) is always the latest band.
- About it is a good practice to check the manufacturer's documentation to be sure of the user

It may even be the only way to detect resistance; For example, when colored bands are ignited.

4.4.3 Resistor Color Code Chart

The chart below shows how to determine the resistance and tolerance for the resistor. The table can be used to specify the band color if the values are known. The automatic resistor calculator can be used to quickly find the resistor values.

Color	Significant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
	0	1	2				
black	0	0	0	x 1		250 (U)	
brown	1	1	1	x 10	1 (F)	100 (S)	1
red	2	2	2	x 100	2 (G)	50 (R)	0.1
orange	3	3	3	x 1K		15 (P)	0.01
yellow	4	4	4	x 10K		25 (Q)	0.001
green	5	5	5	x 100K	0.5 (D)	20 (Z)	
blue	6	6	6	x 1M	0.25 (C)	10 (Z)	
violet	7	7	7	x 10M	0.1 (B)	5 (M)	
grey	8	8	8	x 100M	0.05 (A)	1(K)	
white	9	9	9	x 1G			
gold			3th digit only for 5 and 6 bands	x 0.1	5 (J)		
silver				x 0.01	10 (K)		
none					20 (M)		



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Figure4.5: Color Code Chart of Resistor

4.4.4 4-Band Resistor

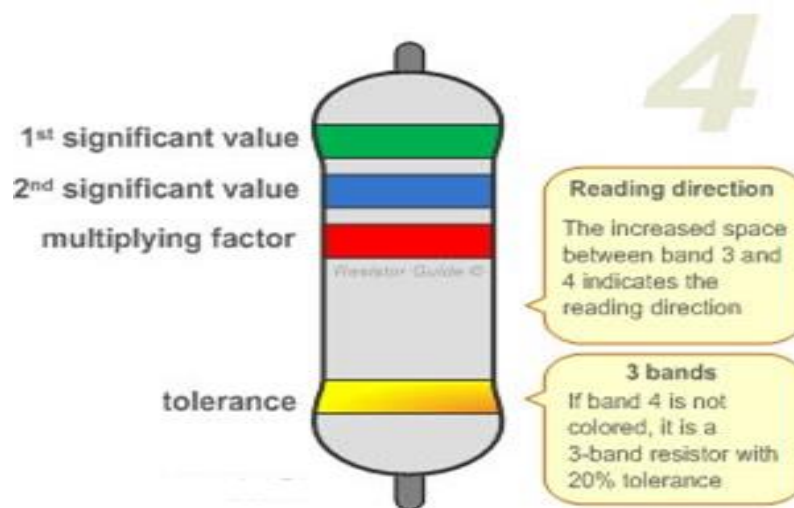


Figure4.6: 4-Band Resistor Color Code

The four band color code is the most common variation. These resistors have two bands for the resistance value, one multiplier and one tolerance band. In the example on the left these bands are green, blue, red and gold. By using the color code chart, one finds that green stands for 5 and blue for 6. The value is thus $56 \cdot 100 = 5600 \Omega$. The golden band means that the resistor has a tolerance of 5%. The resistance value lies therefore between 5320 and 5880 Ω . If the tolerance band would be left blank, the result is a 3 band resistor. This means that the resistance value remains the same, but the tolerance is 20%

4.4.5 5-Band Resistor

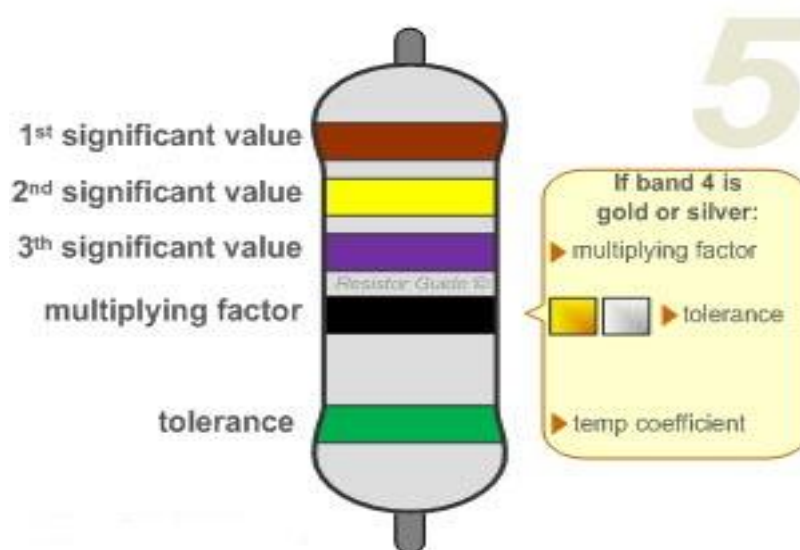


Figure4.7: 5-Band Resistor Color Code

Resistors With High Precision Have An Extra Band To Indicate A Third Significant Digit. Therefore, The First Three Bands Indicate the Significant Digits, The Fourth Band Is the multiply Factor and the Fifth Band Represents the Tolerance. There Are Exceptions To This. For Example, Sometimes the Extra Band Indicates Failure Rate (Military Specification) or Temperature Coefficient (Older or Specialized Resistors). Please Read the Section “Color Code Exceptions” For More Information .Shown Example: Brown (1), Yellow (4), Purple (7), and Black (X1), Green (0.5%): 147Ω 0.5%.

4.5 Capacitor

A capacitor is a material that has the ability or "ability" to store energy in the form of an electric charge, producing a potential difference (static voltage) across its plates, like a small rechargeable battery. Large power factor correction capacitors are used in request circuits. Very small capacitors are available in various types of capacitors, starting from the beads, but they all do the same thing, they save charge. In its original form, a capacitor consists of two or more parallel conductive (metal) plates that do not attach or touch each other, but electronically in the air or in a good insulating material such as waxed paper, mica, electrolytic capacitors, some of ceramic, plastic or liquid gel.

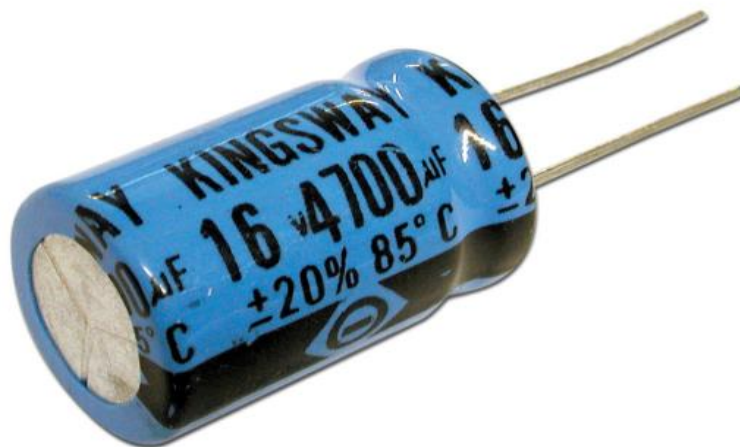


Figure 4.8: Electrolytic Capacitor

4.5.1 The Capacitance of a Capacitor

Capacitance is the electrical property of a capacitor and it is a measure of the capacitor's ability to store electrical charge on its two plates, including units of capacitors.

Farad (F abbreviation) is named after British physicist Michael Faraday. The capacitance is defined such that a capacitor holds the capacitance of one farad when the charge of one Coulomb is saved on the plate by the voltage of one volt. Note that the capacitance, C is always a value positive and does not have a negative unit. However, the farad is a very large unit of measurement that can be used as its own, so the sub-properties of the farad are commonly used such as micro-farads, Nano-farads and pico-farads.

4.5.2 Standard Units of Capacitance

- Micro-Farad (ft.) $1\mu\text{F} = 1/1,000,000 = 0.000001 = 10^{-6} \text{ F}$
- Nano-Farad (nF) $1\text{nF} = 1/1,000,000,000 = 0.000000001 = 10^{-9} \text{ F}$
- Pico-Farad (pF) $1\text{pF} = 1/1,000,000,000,000 = 0.000000000001 = 10^{-12} \text{ F}$

4.6 Diode

A diode is a specialized electronic component with two electrodes called anode and cathode. Most diodes are made of semiconductor materials such as silicon, germanium or selenium. Some diodes contain metal electrons filled with empty primary gas in a chamber or at low pressure. Diodes can be used as modifiers, signal limiters, voltage regulators, switches, signal modulators, signal mixers, signal demodulators and oscillators.

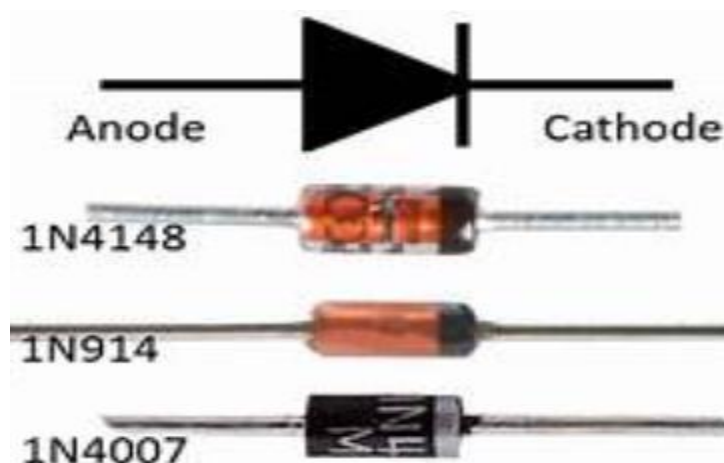


Figure 4.9: Diode

The basic property of a diode is the tendency to conduct electric current in only one direction. When the cathode is negatively charged against anode at a voltage higher than a certain minimum forward break, the diode flows through.

If the cathode is respectfully positive with the anode but at the same voltage as the node, or less negative than the forward break over voltage, the diode does not conduct the discharge. This is a simplistic view, but is true in the case of diodes modifiers, switches, and operators as constraints. Forward break over voltage is about six tenths of a volt (0.6 V) for a silicon device, 0.3 V for a germanium device, and 1 volt for a selenium device. Despite the above general rules, the diode will handle the currents if the bulk cathode voltage is positive compared to the anode voltage. The voltage required to produce this phenomenon, known as the iceberg voltage, depends on the nature of the semiconductor material that the device is coarse. Ice voltage may range from a few volts to several hundred volts. When an analog signal passes through the diode at or near its forward break over point, the signal waveform is distorted. This nonlinearity allows for modulation, demodulation and signal mixing. In addition, signals are generated in integral coefficients of harmonic or input frequency. Some diodes also have a feature that is briefly referred to as negative resistance. These level diodes generate analog signals at microwave radio frequencies with voltage level application and polarization. Semiconductor diodes can be designed to produce direct current (DC) when visible light, infrared transmission (IR) or ultraviolet (UV) energy hits them. These diodes are known as photovoltaic cells and are the basis of solar electric power systems and photo sensors. Yet another form of the diode, which is commonly used in electronic and computer equipment, emits visible light or IR power when the current passes through it. This national device is a known light-emitting diode (LED).

4.7 Light Emitting Diode (LED)

A light-emitting diode (LED) is a semiconductor device that emits visible light when passing through an electric current. The output from an LED can range from red (wavelength of about 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) power (830 nanometers or more); this type of device, known as the infrared-emitting diode (IRED), is the two components that form a region called the PN junction and are in direct contact. In this case, the LED or IRED are similar to most other diodes but there are important differences.

LED or IRED is a transparent package, which can go with visible or IR power. Also, the LED or IRED has a large PN-junction region whose size is suitable for application.

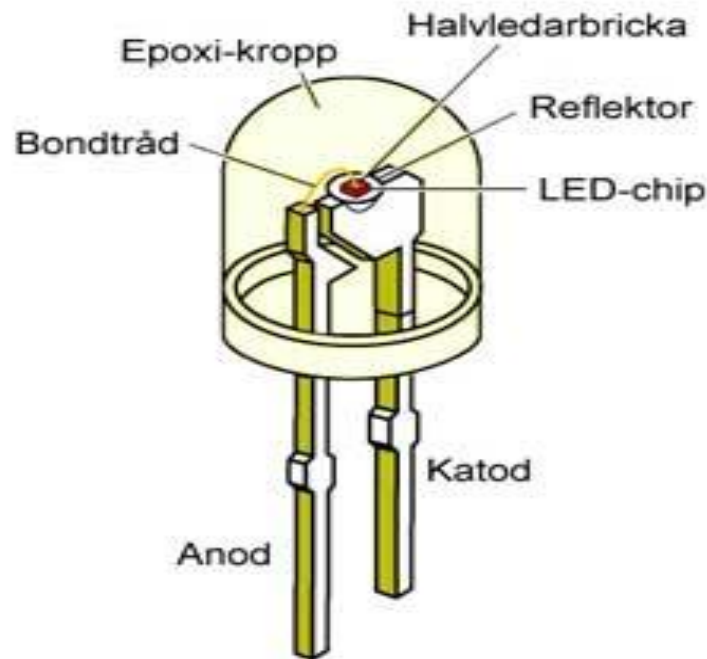


Figure 4.10:LED Function

4.7.1 Types of Light Emitting Diodes

There are different types of light emitting diodes present and some of them are mentioned below.

- Gallium Arsenide (GaAs) – infra-red.
- Gallium Arsenide Phosphide (GaAsP) – red to infra-red, orange
- Gallium Phosphide (GA) – red, yellow and green
- Aluminum Gallium Phosphide (AlGaP) – green
- Gallium Nitride (GaN) – green, emerald green
- Gallium Indium Nitride (GaInN) – near ultraviolet, bluish-green and blue
- Silicon Carbide (SiC) – blue as a substrate
- Zinc Selenide (ZnSe) – blue
- Aluminum Gallium Nitride (AlGaN) – ultraviolet

4.8 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16 x 2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16 x 2 LCD means it can display 16 characters per line and there are 2 such lines.



Figure4.11:LCD Display

4.9 Buzzer

The buzzer or beeper is an audio signaling device, which can be mechanical, electromechanical, or piezoelectric. Common uses for markets and beepers include confirmation of user input such as alarm devices, timers, and mouse clicks or keystrokes.



Figure.4.12: Buzzer

4.10 Introduction of Battery

Batteries are often used on PV systems for the purpose of storing energy produced by PV arrays during the day and for providing electrical loads as needed (during night and cloudy weather). Other reasons for battery use in a PV system are to operate near the maximum power point of the PV array, to power the electrical loads at stable voltages, and to provide a current for electrical loads and inverters. In most cases, a battery charge controller is used in these systems to protect the battery from overcharge and extra discharge.

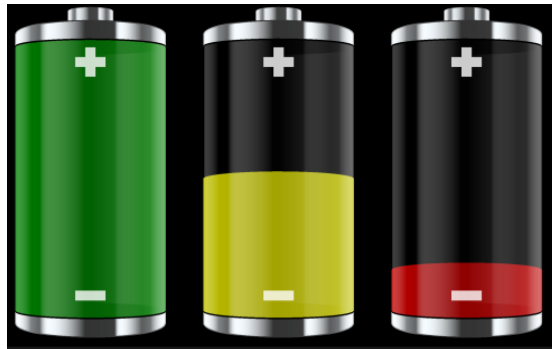


Figure 4.13: Battery

4.11 OP-Amplifier

A voltage converter is an electronic circuit that compares two input voltages and tells you which of the two is more. It is easier to make the voltage comparable to an op amp, because the polarity of the output circuit of the op amp depends on the type of difference between the two input voltages.

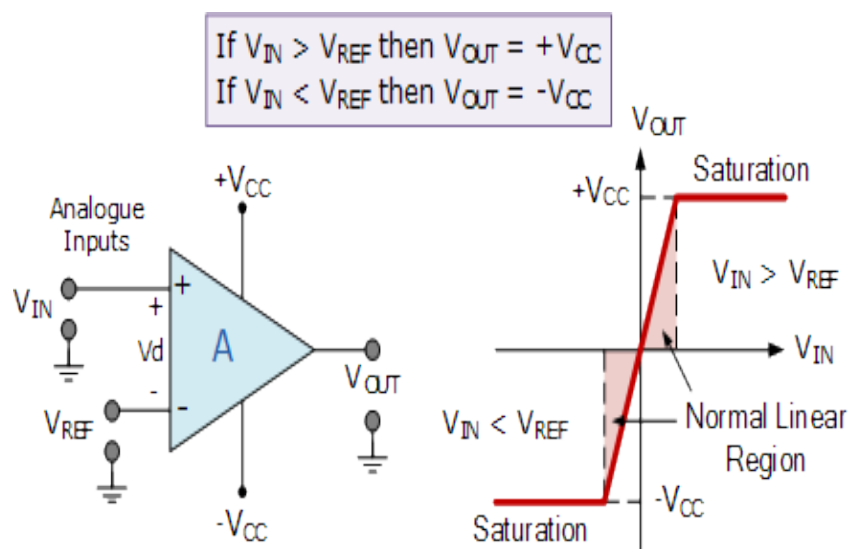


Figure 4.14: OP –Amplifier comparator mode working

4.12 Connecting Wires

A cable is a single, usually cylindrical, flexible strand or metal rod. Cables are used to carry mechanical loads or to carry electrical and telecommunications signals. It is usually made by painting a metal with a hole in a die or a drawing plate. Wiring gauges come in a variety of standard sizes, such as those published in a single gauge number.

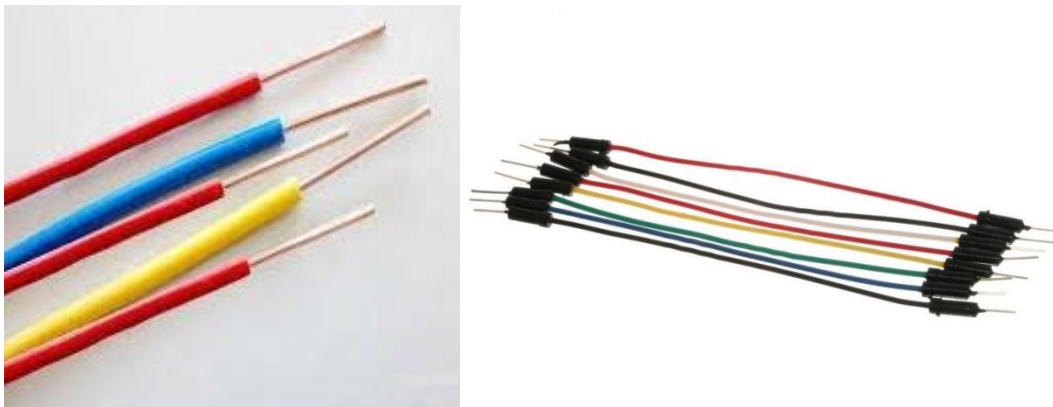


Figure4.15: Connecting wire

The term wire is also used more loosely to refer to a bundle of such strands, as in 'multi stranded wire', which is more correctly termed a wire rope in mechanics or a cable in electricity.

4.13 Vero Board Copper DIL Strip Board

Strip board is the generic name for a widely used type of electronics prototyping board characterized by a 0.1 inch (2.54 mm) regular (rectangular) grid of holes, with wide parallel strips of copper cladding running in one direction all the way across one side of the board. It is commonly also known by the name of the original product Vero board, which is a trademark, in the UK, of British company Vero Technologies Ltd and Canadian company Pixel Print Ltd. In using the board, breaks are made in the tracks, usually around holes, to divide the strips into multiple electrical nodes. With care, it is possible to break between holes to allow for components that have two pin rows only one position apart such as twin row headers for IDCs.

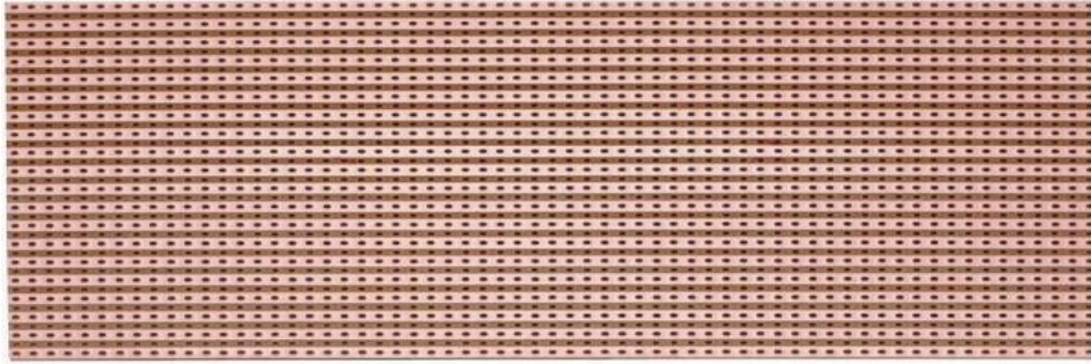


Figure4.16: Vero board copper DIL strip board

Strip board is not designed for surface-mount components, though it is possible to mount many such components on the track side, particularly if tracks are cut/shaped with a knife or small cutting disc in a rotary tool.

4.14 IR Proximity Sensor

Infrared technology addresses a variety of wireless applications. The key areas are sensing and remote controls. In the electromagnetic spectrum, the infrared part is divided into three regions: the near-infrared region, the middle infrared region, and the far infrared region.

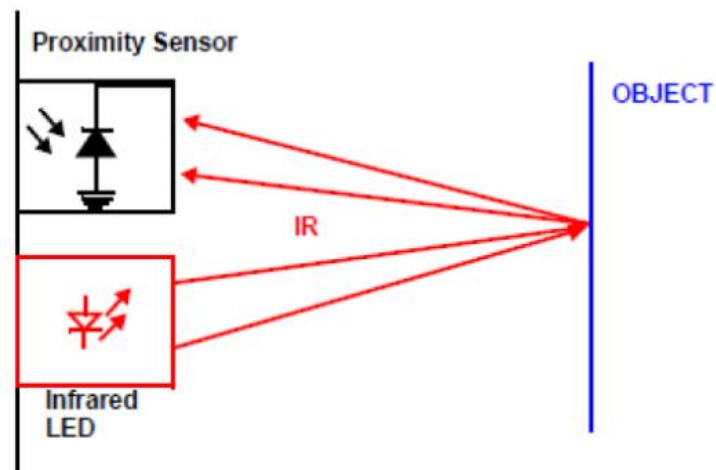


Figure 4.17: IR Proximity Sensors

The wavelengths of these regions and their applications are shown below.

- Near infrared region — 700 nm to 1400 nm — IR sensors, fibre optic
- Mid infrared region — 1400 nm to 3000 nm — Heat sensing
- Far infrared region — 3000 nm to 1 mm — Thermal imaging

The frequency range of infrared is higher than microwave and lesser than visible light. For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications. An infrared sensor emits and/or detects infrared radiation to sense its surroundings. The working of any Infrared sensor is governed by three laws: Planck's Radiation law, Stephen – Boltzmann law and Wien's Displacement law. Planck's law states that "every object emits radiation at a temperature not equal to 0^0K ". Stephen – Boltzmann law states that "at all wavelengths, the total energy emitted by a black body is proportional to the fourth power of the absolute temperature". According to Wien's Displacement law, "the radiation curve of a black body for different temperatures will reach its peak at a wavelength inversely proportional to the temperature". The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.

4.14.1 IR Transmitter & IR Receiver

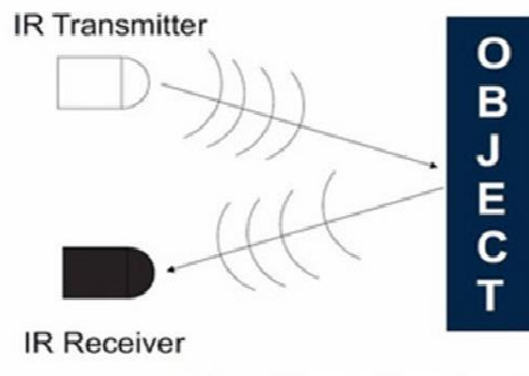


Figure 4.18: IR TX& IR Rx

4.14.2 IR Transmitter

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. The picture of Infrared LED is shown below.

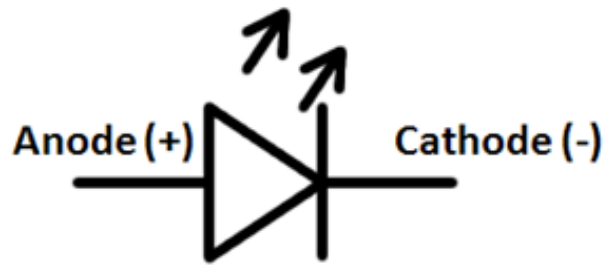


Figure 4.19: IR Transmitter LED

4.14.3 IR Receiver

Infrared receivers are also called infrared sensors as they detect radiation from IR transmitters. IR receivers come in the form of photodiodes and phototransistors. Infrared photodiodes are different from ordinary photo diodes because they only detect infrared radiation. A picture of a typical IR receiver or photodiode is shown below.



Figure 4.20: IR Receiver LED

4.15 Circuit Diagram

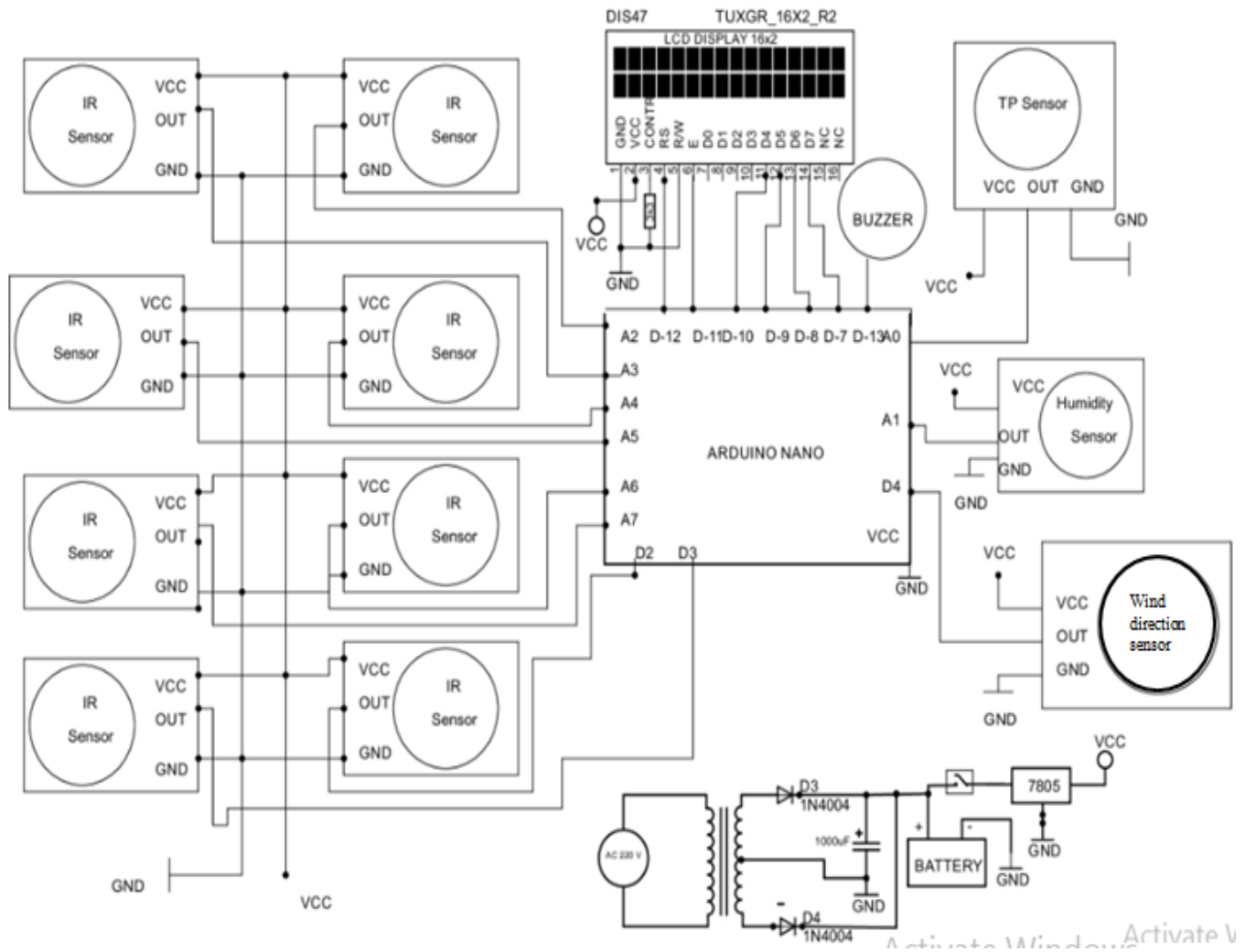


Figure 4.21: Circuit Diagram of Digital Wind Speed Direction and Monitoring System

4.16 Block Diagram

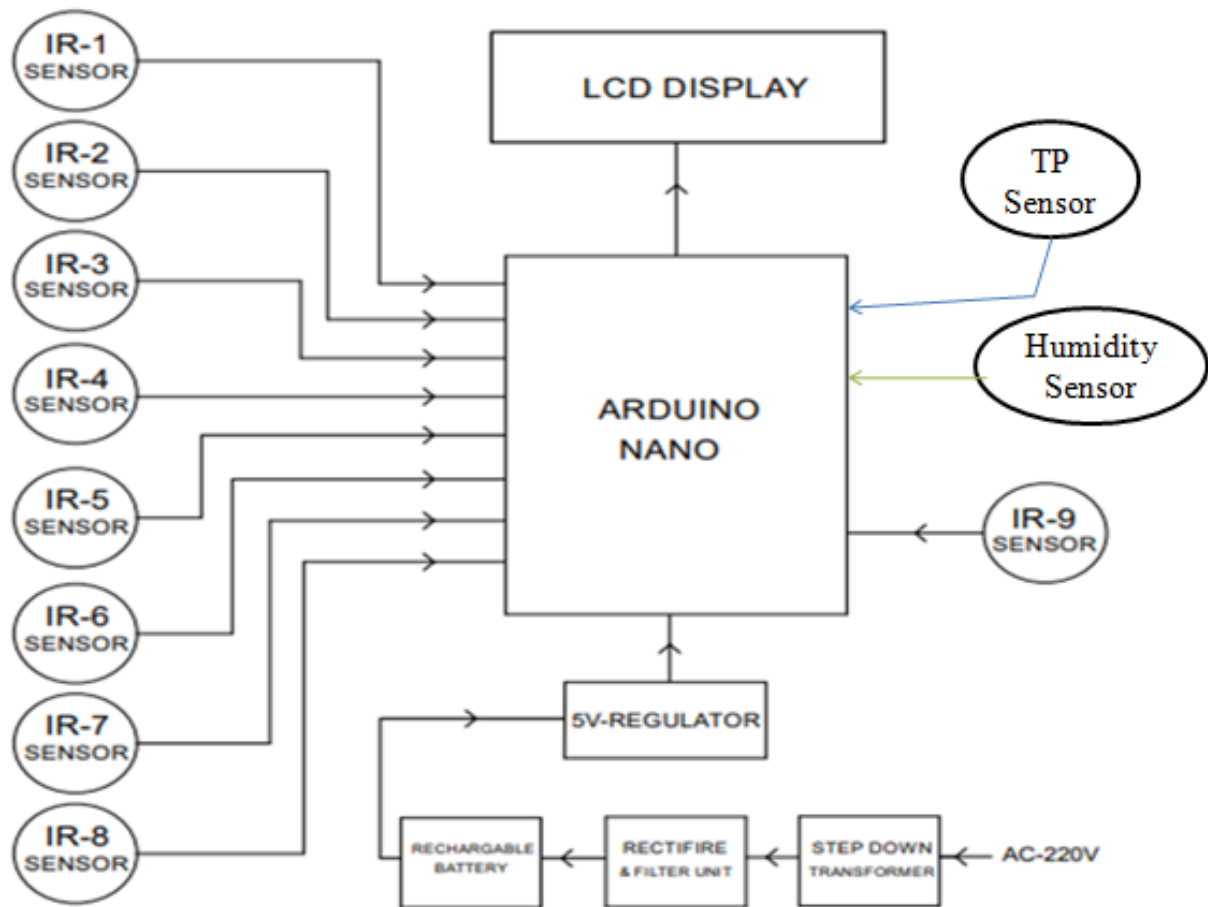


Figure 4.22: Block Diagram of Digital Wind Speed Direction and Monitoring System

4.17 Cost Estimate

Component Name	Quantity	Cost
IR Transmitter	9 Pieces	35
IR Receiver	9 Pieces	35
Arduino Nano	1	420
LCD	1	190
Buzzer	1	20
OPM	1	15
Capacitor	3	15
Resistor	35	10
Variable Resistor	9	5
Voltage Regulator	2	15
BJT	1	10
Diode	2	15
Battery	2	30
Wind Speed Sensor	2	250
switch	1	5
LED	4	10
Humidity& Temperature	1	80
Varo board	4	150
	Total	1295

Table 4.1: Cost Estimate

4.18 Summary

Power supply is the reference to the electrical energy source. A device or a system that supplies electrical or other types of power to an output load is called a power supply unit. A voltage regulator IC maintains a constant value output voltage. A capacitor is a material that has the potential or "ability" to store energy in the form of an electric charge, producing a potential difference (static voltage) across its plates, diode current, voltage controller, variable resistance and some connectors and so on. All output and Ag gal software have been displayed using the circuit design on the LCD display.

CHAPTER 5

DESIGN AND IMPLEMENTATION

5.1 Introduction

The use of smart device in daily activities increase the quality of life and offer high productivity in turn. This has led to the increase called for benefits such as comfort, Centralize control of appliance, cost reduction and energy .Our BSc final project is to build and ARDUIONO Digital weather station monitoring system .Our weather station system use in different place such as lowest area of sea beach, very helpful of the fresher man and low maintain cost.

5.2 Working Principle

In this project we used 8 IR sensors for wind direction in this sensor was used for wind speed direction and one sensor was used for temperature and humidity l all data are shown on an LCD display. We use the buzzer to change the direction of the air direction sensor at 45 degrees. It will give an alarm when the wind speed is above 30kmph. We used a 12V battery as input power. But to reduce the voltage to 5v, we use the 5v operating system and voltage regulator (IC 7805) as if we are not good at signal. We used an Arduino Nano microcontroller consisting of 30 pins. We connect 5V input to VC pins. A1 pin used for temperature and humidity. A2 to D3 pins are used for wind direction.

5.3 Implementation

The circuit diagram was build and the device was successfully complete and accurate output temperature, Humidity, air speed and air direction shown in the LCD display. According to program CODE the device was is sending IR transmitter and IR receiver for taken ARDUINO with weather station monitoring system.

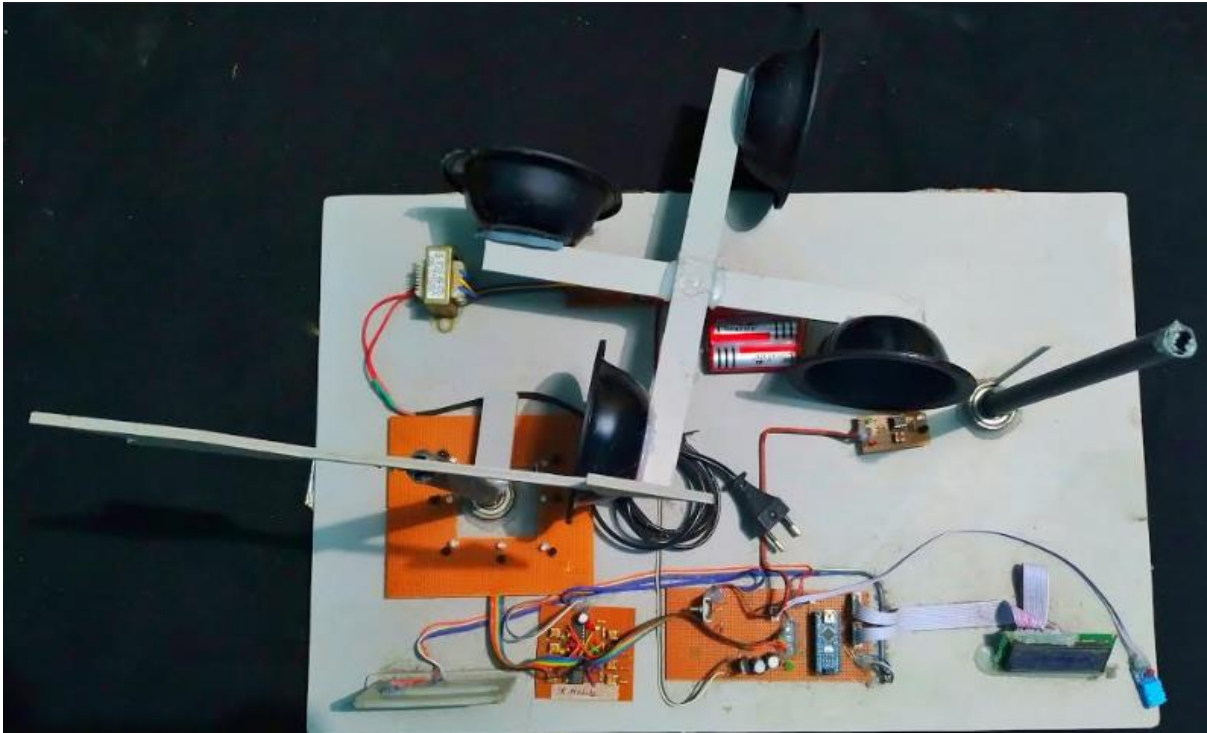


Figure 5.1: Final Project Outlook

CHAPTER 6

RESULTS AND DISCUSSIONS

6.1 Result

We can easily view the LCD display of our data. Establishment of Weather Station monitoring of wind speed and wind direction. The Arduino Nano was tested in conjunction with software embedded in a Nano microcontroller unit to detect and read data from sensors that had a wind van. At the Weather Station. We are connecting this project correctly and in the end we have output temperature, wind speed, wind direction and humidity and when the wind speed crosses compared to the buzzer.

6.2 Advantage

- Main advantage of this project is to help of fresher man and lowest are of sea beach.
- When the air speed limit cross than alarm the buzzer is on and save our life.
- We can easily make this project and costs very low.

6.3 Discussions

The project design on weather station integrated system was used of Weather Rack, Weather sensors interfaced with Weather IR Arduino, Arduino Nano microcontroller unit and Temperature, Humidity and wind speed wind direction automatic measuring system. Weather station in the university, school backyard can help the students and employees, farmer to be aware of their surroundings and help them be prepared.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The weather monitoring system project using Arduino is completely automated. It requires no human attention. You can get earlier alerts about weather conditions. Suppose you are planning to visit a place and you want to know the weather parameters above that place, the weather reporting system is also applicable to the farmers. Weather forecasts play a very important role in agriculture. Weather monitoring projects in places such as volcanoes, rainbows, are proven to be really helpful for weather monitoring. It is difficult for people to stay in this place for a long time. Even areas that are exposed to radioactive leakage.

7.2 Future Scopes

1. As Arduino Uno has 5 Analog inputs, we can add a 5th parameter for weather monitoring
2. GSM based weather monitoring system
3. IOT weather reporting system
4. WIFI Based Weather Station Monitoring System

7.3 Limitations of the Work

The working procedure of this project is very easy but we are facing some limitation for doing this project. Such as coding problem, program writing, connecting to Varo board, commend following etc.

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APPENDIX

```
#include <LiquidCrystal.h>
LiquidCrystallcd(7, 8, 9, 10, 11, 12);

#define dht_apin A1

#define Sensor1 A2
#define Sensor2 A3
#define Sensor3 A4
#define Sensor4 A5
```

```
#define Sensor5 A6
```

```
#define Sensor6 A7
```

```
#define Sensor7 2
```

```
#define Sensor8 3
```

```
#define Sensor9 4
```

```
#define RLED 5
```

```
#define GLED 6
```

```
#define BUZ 13
```

```
float t, t1, t2;
```

```
float windSpeed;
```

```
float rh;
```

```
int tp=0;
```

```
int S1 = 0;
```

```
int S2 = 0;
```

```
int S3 = 0;
```

```
int S4 = 0;
```

```
int S5 = 0;
```

```
int S6 = 0;
```

```
int S7 = 0;
```

```
int S8 = 0;
```

```
int S9 = 0;
```

```
void setup()
```

```
{
```

```
pinMode(Sensor1, INPUT);
```

```
pinMode(Sensor2, INPUT);
```

```
pinMode(Sensor3, INPUT);
```

```
pinMode(Sensor4, INPUT);
```

```
pinMode(Sensor5, INPUT);
```

```
pinMode(Sensor6, INPUT);
```



```

pinMode(Sensor7, INPUT);
pinMode(Sensor8, INPUT);
pinMode(Sensor9, INPUT);

pinMode(BUZ, OUTPUT);
pinMode(RLED, OUTPUT);
pinMode(GLED, OUTPUT);

lcd.setCursor(0, 0);
lcd.print(" WIND DIRECTION ");
lcd.setCursor(0, 1);
lcd.print("SPEED,RH,TP SYS ");
}
void main()
{
DHT.read11(dht_apin);
readSensor2();

if(windSpeed > 30)
{
digitalWrite(RLED, HIGH);digitalWrite(GLED, LOW);
digitalWrite(BUZ, HIGH);delay(40);digitalWrite(BUZ, LOW);delay(40);
}
else
{
digitalWrite(GLED, HIGH);digitalWrite(RLED, LOW);digitalWrite(BUZ, LOW);
}

t2 = millis();
t = t2 - t1;
t = t / 1000;

windSpeed = (2 * 3.1416 * 0.0007 * 3600) / t ;

```

```
humidity = dht11_read();  
temperature = dht11_read();  
}
```

```
displays();
```

```
}
```

```
void readSensor2()
```

```
{
```

```
S1 = digitalRead(Sensor1);
```

```
S2 = digitalRead(Sensor2);
```

```
S3 = digitalRead(Sensor3);
```

```
S4 = digitalRead(Sensor4);
```

```
S5 = analogRead(Sensor5);
```

```
S6 = analogRead(Sensor6);
```

```
S7 = digitalRead(Sensor7);
```

```
S8 = digitalRead(Sensor8);
```

```
S9 = digitalRead(Sensor9);
```

```
}
```

```
void displays()
```

```
{
```

```
lcd.print(temperature);
```

```
lcd.print(humidity);
```

```
lcd.setCursor(0, 0);
```

```
if (S1 == 1)
```

```
{
```

```
lcd.print("0");
```

```
lcd.write(223);
```

```
lcd.print("N ");
```

```
}
```

```
else if (S2 == 1)
```

```
{
```

```
lcd.print("45");  
lcd.write(223);  
lcd.print("NE ");  
}  
else if (S3 == 1)  
{  
lcd.print("90");  
lcd.write(223);  
lcd.print("E ");  
}  
else if (S4 == 1)  
{  
lcd.print("135");  
lcd.write(223);  
lcd.print("SE ");  
}  
else if (S5 > 100)  
{  
lcd.print("180");  
lcd.write(223);  
lcd.print("S ");  
}  
else if (S6 > 100)  
{  
lcd.print("225");  
lcd.write(223);  
lcd.print("SW ");  
}  
else if (S7 == 1)  
{  
lcd.print("270");  
lcd.write(223);  
lcd.print("W ");  
}
```

```
else if (S8 == 1)
{
lcd.print("315");
lcd.write(223);
lcd.print("NW");
}
lcd.setCursor(7, 0);
lcd.print(windSpeed);
lcd.print("km/h ");
////////////////////
lcd.setCursor(0,1);
lcd.print("H:");
lcd.print(DHT.humidity);
lcd.println("% ");

lcd.print("T:");
lcd.print(tp);
lcd.print((char)223);
lcd.println("C ");
}
```