DIY Group Project Report

Team – I

Acknowledgement

We are really grateful to complete our DIY Group Project within the time given by our professor Vikranth Racherla. The project could not be completed without the effort and cooperation from our group members, Yashraj Singh, Nikhil Saraswat, Gonuguntla Swathi and Siripuram Bhanu Teja.

We are also grateful the online resources which we used during the course of the project. The links to these online resources is provided in the ‘Reference’ section of the report.

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Humidity

Humidity is a quantity representing the amount of water vapour in the atmosphere or in a gas.

The nature and amount of precipitation, the amount of loss of heat through radiation from the earth's surface, surface temperature, latent heat of the atmosphere, stability and instability of air masses etc. depend on the amount of water vapour present in the atmosphere, known as humidity.

Humidity is primarily measured in three systems, namely, 'Absolute', 'Relative' and 'Specific'. Absolute humidity describes the water content of air and is expressed in either grams per cubic metre or grams per kilogram. Relative humidity, expressed as a percentage, indicates a present state of absolute humidity relative to a maximum humidity given the same temperature. Specific humidity is the ratio of water vapour mass to total moist air parcel mass.

The optimum levels of humidity in terms of relative humidity is from 30% to 50%.

Cause of Low Humidity

Due to the increasing rate of climate change, the climate is becoming more and more unpredictable. One effect of this is low humidity during the peak winter and summer months.

The adverse effects of low humidity are very widespread.

Some of the effects of low humidity are listed below:

- Bloody Noses
- Chapped and cracked lips
- Dry and itchy skin known as eczema or winter-itch
- Cold and flu symptoms
- Itchy throat
- Cracking of word and furniture
- Many viruses survive longer in low humidity, further increasing risk of getting sick
- Dry air effects performance and productivity of an individual as well.

Solution to the Problem

“HUMIDIFIER”

Now we have understood the meaning of humidity and also the problems caused because of low humidity in the atmosphere.

Hence to tackle all these problems, our group has arrived on the decision of making an **‘Automatic Room Humidifier’**.

A ‘Humidifier’ is a device, primarily an electrical appliance, used to increase humidity of a room.

There are many kind of humidifiers such as ultrasonic, evaporative and impeller humidifiers.

An ultrasonic humidifier is a very simple device. It includes a reservoir of water and a diaphragm or other type of vibrating element. The diaphragm vibrates at an extremely high frequency, so high that it is above the range of human hearing hence it is called ultrasonic humidifier.

An evaporative humidifier operates much like a cool mist evaporator. It does not heat water to create humidity. It is a wick humidifier that uses a fan to circulate humidity. Evaporative humidifiers create a very fine mist that isn't always visible to the human eye.

Impeller humidifiers produce a cool mist that gets pumped into the air. A rotating disc flings water from the tank through a comb-like diffuser. A fan blowing over the wick lets the air absorb moisture.

Our Project

“Automatic Room Humidifier”

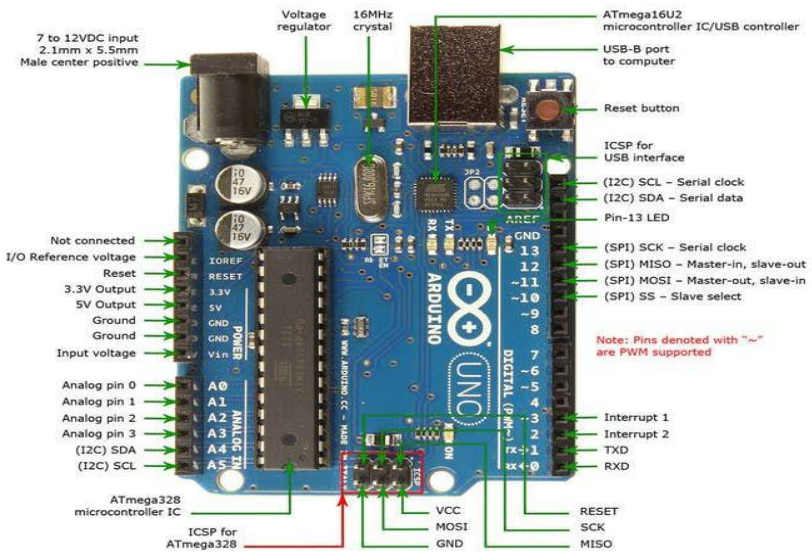
In this project we have made an Ultrasonic Humidifier. The Humidifier as well as the whole circuit is made by us using different components.

The Humidifier is automated using a humidity sensor and a relay. These both components are connected to the Arduino circuit to work together.

As the optimum range of humidity is 30% to 50% relatively, we are using 40% as our threshold for the switching On and OFF of the automatic room humidifier.

Components Used

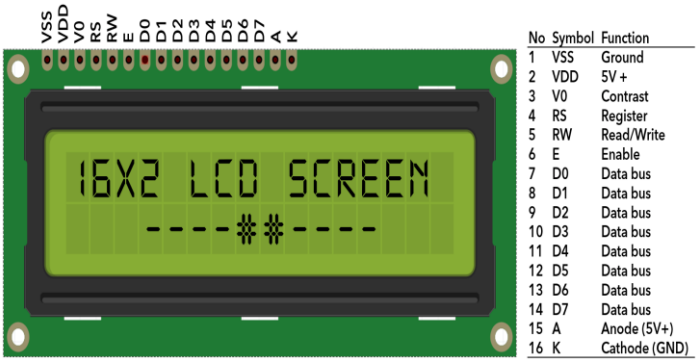
Arduino UNO R3



The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs).

Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

LCD I2C Display



No	Symbol	Function
1	VSS	Ground
2	VDD	5V +
3	V0	Contrast
4	RS	Register
5	RW	Read/Write
6	E	Enable
7	D0	Data bus
8	D1	Data bus
9	D2	Data bus
10	D3	Data bus
11	D4	Data bus
12	D5	Data bus
13	D6	Data bus
14	D7	Data bus
15	A	Anode (5V+)
16	K	Cathode (GND)

The LCD (Liquid Crystal Display) is a type of display that uses the liquid crystals for its operation. Here, we will accept the serial input from the computer and upload the sketch to the Arduino. The characters will be displayed on the LCD.

It has two lines with 16 characters each. Each character is a matrix of 8×5 pixels. Out of its 16 pins, 12 are connected. Out of the 12, 6 are connected to the Arduino Board, 3 are connected to Ground pin, 2 are connected to the 5V pin and the last 1 is connected to the potentiometer.

DHT 22 Temperature and Humidity Sensor

The DHT22 Temperature and Humidity Sensor is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. Hence, no analog input pin is needed. It measures relative humidity along with temperature.

The resolution of temperature measurement is 0.1ºC and the resolution of humidity measurement is 0.1%. The range of temperature measurement is from -40 to 80ºC and range of humidity measurement is from 0-100%. In our project we have attached the sensor at digital pin number 8.

We have used the DHT22 sensor instead of DHT11 Sensor because it is more accurate with an accuracy of 2-5% and it doesn't need calibration as well.

Relay – 5V DC

A relay is a programmable electrical switch, which can be controlled by Arduino or any micro-controller. It is used to programmatically control on/off the devices, which use the high voltage and/or high current. It is a bridge between Arduino and high voltage devices.

In this project, we have operated the relay in Normally Open Mode and connected it to digital pin number 7.

There are two types of relay available, a 12V DC one and a 5V DC one. In this project we are using the 5V DC relay as mentioned earlier.

Ultrasonic Mist-Maker

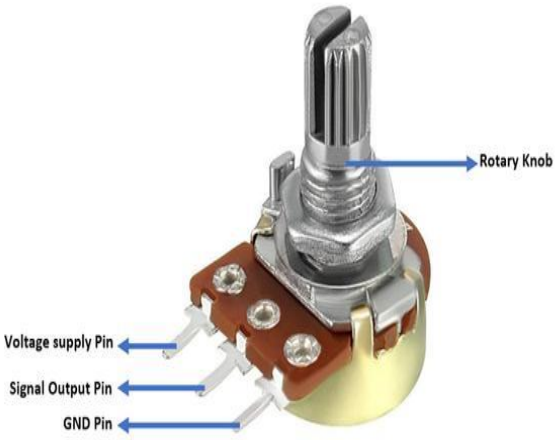
It is a device used to produce very fine mist using piezo-electric transducer.

In an ultrasonic mist maker, piezo-electric transducer works by transposing high-frequency sound waves into mechanical energy that is transferred into a liquid, creating standing waves. As the liquid exits the atomizing surface of the disc, it's broken into a fine mist of uniform micron-sized droplets.

In this project we have used two Mist-maker to create sufficient amount of mist. The Mist-Makers came with their own AC to DC adapter. The Mist-maker work on 24V DC current with 1A input current.

Potentiometer

In this project, a 10 kΩ potentiometer is used to control the brightness of the backlight of the LCD Display. It controls the brightness of the backlight by acting as a variable resistance.



PC Fan

For making the DIY Humidifier we have used a PC fan of rating 12V DC, 1A. It is used to direct the mist out of the container by blowing air into it which in turn exits from the top of the container.

The PC Fan is rated as 12V DC, 1A and it as well comes with its own AC to DC adapter.

Soldering Kit

We have used a soldering kit many times during the project. We have used it to solder pins to the LCD Display and also to solder many wire connections. It is also used to solder pins to the potentiometer.

A soldering kit comprises of several things. The things are as follows.

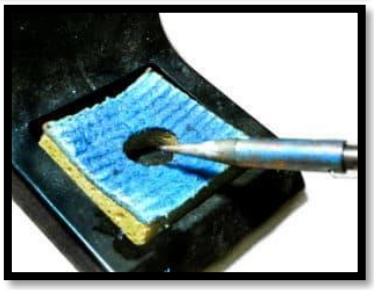
- Soldering Iron- Hand-tool used in soldering which is used to supply heat.

- Solder Wire- Solder wire is a fusible metal alloy wire used to join metal work pieces.

- Soldering Stand- Safe place to put the hot soldering iron.

- Wire Cutter- Very handy little tool used to cut wires.

- Wet Sponge- Inexpensive way of cleaning
  the tip of soldering iron.



9V DC Battery

It is a Zn-C battery. It has 500mAh capacity. It has 0% cadmium and 0% mercury.

Resistor

In this project, we have used a 220 Ω resistor in the setup of the LCD Display.

Jumper wires

These are of three types, namely, male-male, female-female and male-female. In our project we have used all three kinds of jumper wires to connect many components without the use of soldering.

Breadboard

Breadboards come in various sizes such as mini, small and large. We have used a large bradboard for our project and sticked the arduino board on a side of breadboaard using double-sided tape.

Glue Gun and Glue Sticks

We have used the glue gun along with the glue sticks thorughout this project to perform various taskas such as attaching of the PC Fan to the container and also confining the msitmakers in the container.

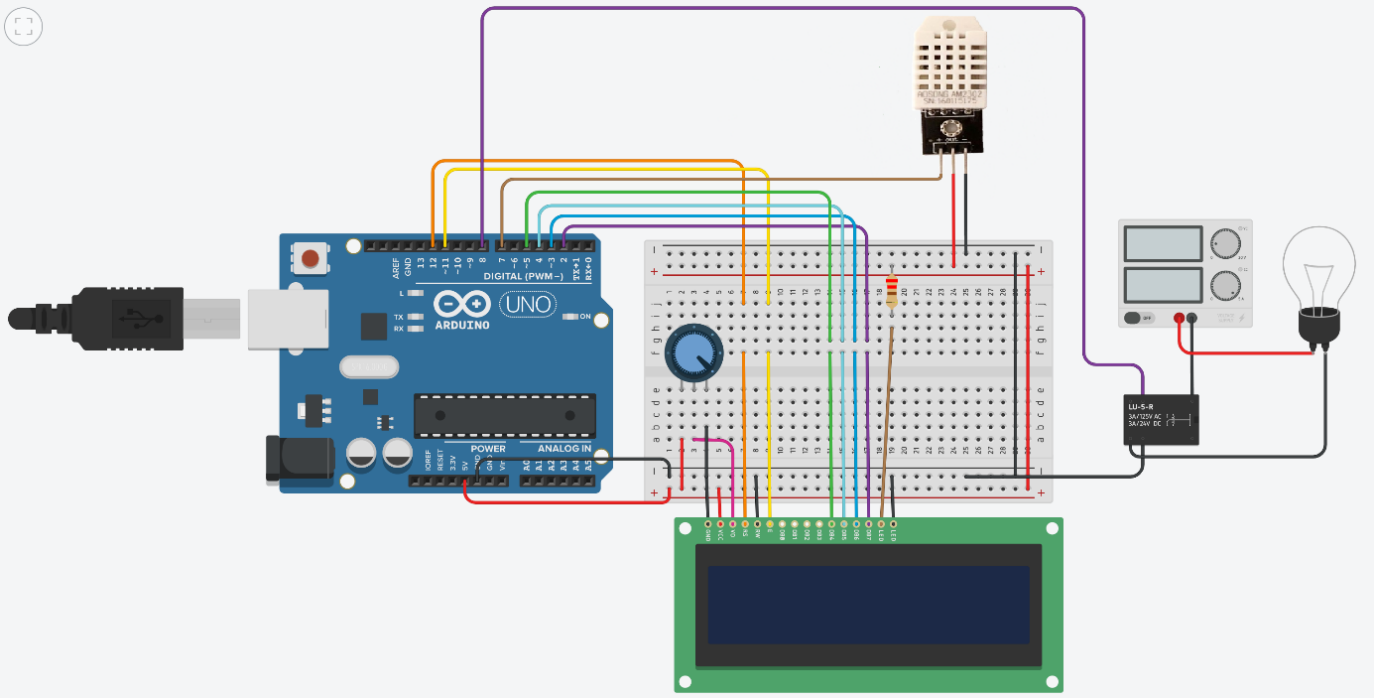
Softwares Used

AUTODESK TINKERCAD

We have used this software to prepare the schematic of our project.

We haven't written our code using the 'Blocks' available in TinkerCAD.

The schmatic is as follows :



Here we have used a light bulb inn the place of our DIY Humidifier Setup.

Arduino IDE

We have used this software to write the code for our arduino. We have used two libraries in the Arduino IDE.

<LiquidCrystal.h> library is used for the I2C LCD Display.

<dht.h> library is used for the DHT22 Humidity and Temperature Sensor.

We have directly written our code in the Arduino IDE.

The code is as follows :

```
#include <LiquidCrystal.h>
#include <dht.h>

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

byte deg[8] = {
  0b00111,
  0b00101,
  0b00111,
  0b00000,
  0b00000,
  0b00000,
  0b00000,
  0b00000
};

dht DHT;

float hum;
float temp;

void setup() {
  lcd.createChar(0,deg);
  lcd.begin(16,2);
  pinMode(7,OUTPUT);
}

void loop() {
    int chk = DHT.read22(8);      //Read data and store it to variables hum and temp
    hum = DHT.humidity;
    temp= DHT.temperature;      //Print temp and humidity values to LCD
    lcd.setCursor(0,0);
    lcd.print("Humidity: ");
    lcd.print(hum);
    lcd.print("%");
    lcd.setCursor(0,1);
    lcd.print("Temp: ");
    lcd.print(temp);
    lcd.write(byte(0));
    lcd.print("C");
    if(hum<=40)
    {
      digitalWrite(7,HIGH);
    }
    delay(2000);
}
```

Making of the Project

For this project first we made a general list of the required components and then selected the desired components from the huge tray of components. Then we moved on to the purchasing of the components by local shops and ordered the components which were not available locally.

Till the arrival of all the components, we started having discussions regarding the working of different components and also made schematic. We divided our project into two phases. One phase was the making of the Arduino circuit and the other part wast the making of the IDY Humidifier.

After arrival of the parts, we first made the Arduino circuit, set up the LCD Display and the DHT22 Humidity and Temperature Sensor and then did the programming. For the setup of the LCD display we performed soldering of pins to the LCD Display.

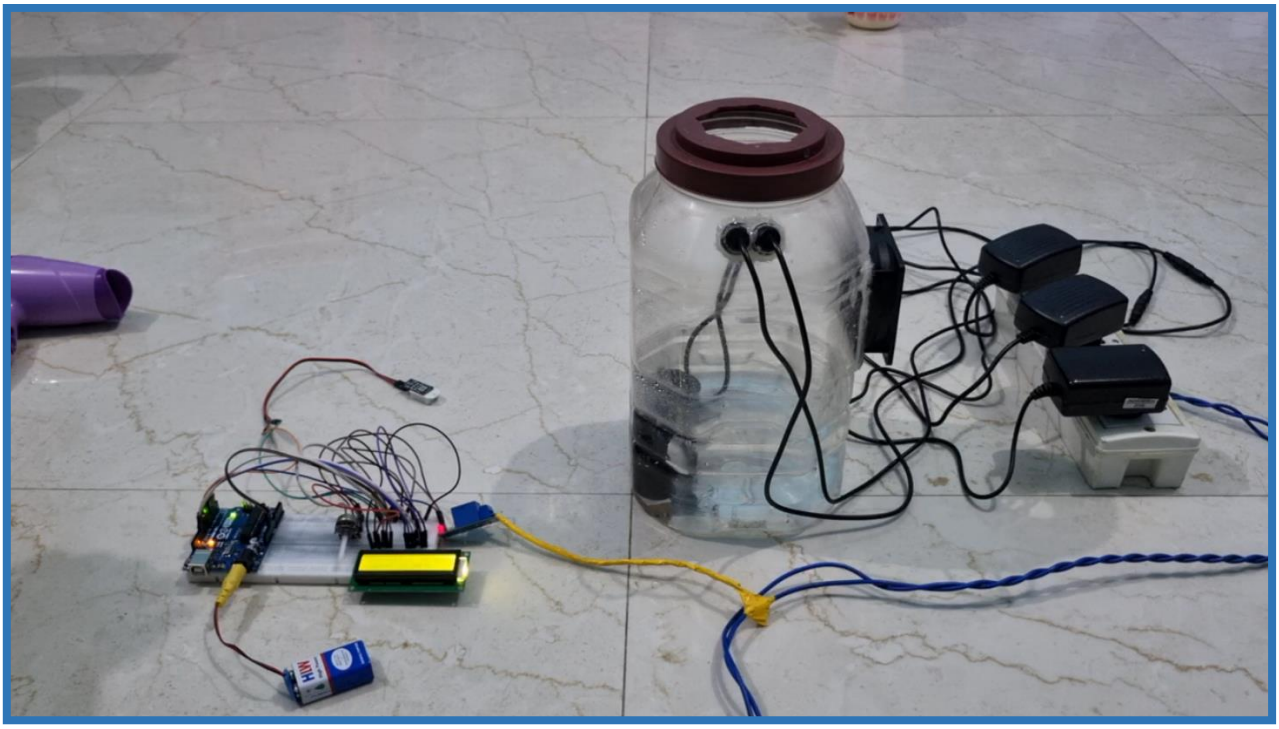
Then we moved to the next phase of making of the DIY Humidifier using the fan and Mist-maker. First we tested the humidifiers in a flat based tub. Then when we tried transferring the DIY Humidifdier in a container we came across the problem that the Mist-Makers have to be placed horizontally insider the container and as the base of container was not flat, we provided support to the humidifiers.

After the completion of two discrete phases of the project, we merged them using a relay. Here, we encountered the problem that the relay which we purchase was a 12V DC relay and as the Arduino can only provide output of 5V, it needed an NPN transistor and other things to start working. Then we decided to shift from the 12V DC relay to the 5V DC relay as it didn’t need any extra components.

We now moved on to make the project aesthetically pleasing and to do this we purchased a case and made slots in it for the LCD Display, DHT22 Sensor, battery and the relay wires. This case is shown the video whose link will be attached further.

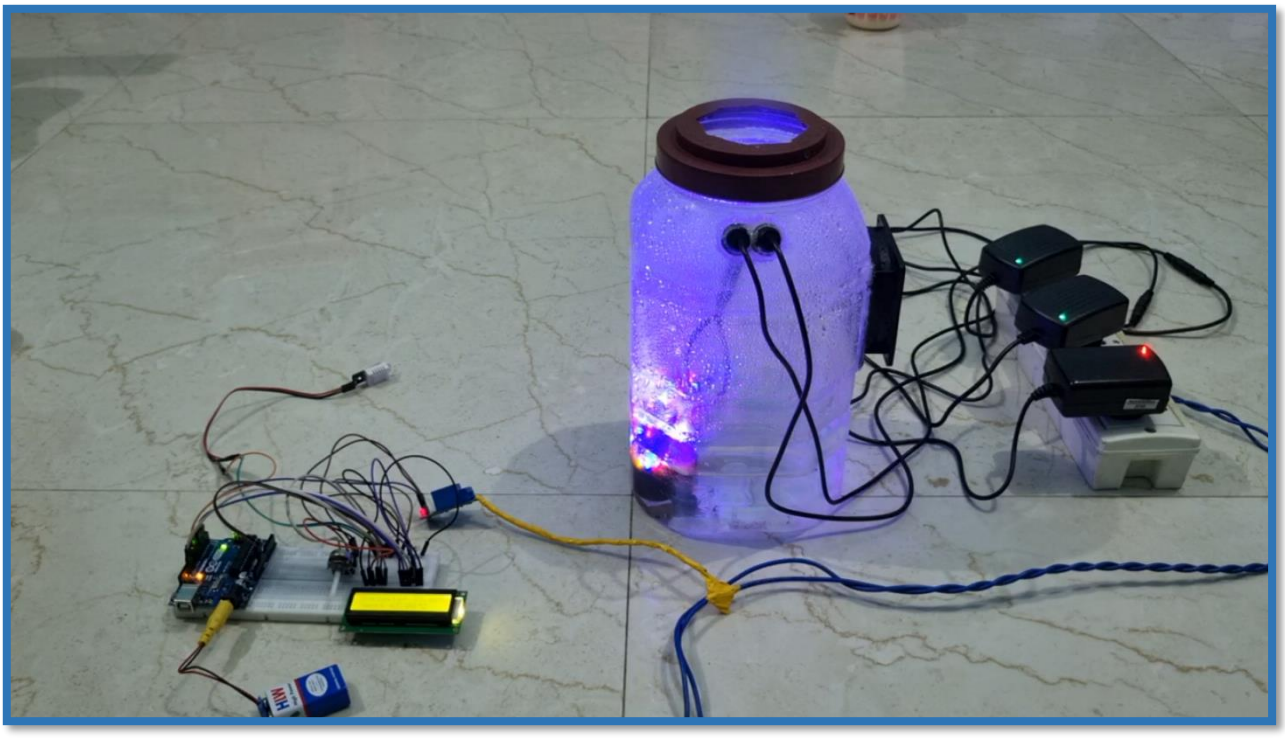
Our project reached completion by the end of WEEK-3.

Stills of the Project



In the above image the humidity is above the 40% mark and hence the humidifier is OFF.

In the below image the humidity is being artificially dropped below the 40% mark using a Hot Air Hair Dryer and as the humidity dropped below the 40% mark, the humidifier got switched ON automatically. In the below image, the mist can be seen escaping from the lid of the container.



YouTube Video Link

https://youtu.be/KEvwqEnCCts

Work Distribution

TEAM MEMBERS	ROLL NUMBER	CONTRIBUTION
YASHRAJ SINGH	20CS10079	Assembling, Programming and Video Making
NIKHIL SARASWAT	20CS10039	Schematic Design, Programming and PPT Making
GONUGUNTLA SWATHI	20CS30020	Background & Research Work
SIRIPURAM BHANU TEJA	20CS10059	Background & Research Work

References

- DIY Humidifier
  https://youtu.be/GzB21JOmbBM
- Learning Soldering
  https://youtu.be/6D5nylyWTK0
- LCD Setup
  https://youtu.be/Mr9FQKcrGpA
- Custom Character generator for LCD
  http://omerk.github.io/lcdchargen/
- DHT22 Temp and Hum Sensor Setup and '<dht.h>' library download
  https://www.ardumotive.com/how-to-use-dht-22-sensor-en.html

THANK YOU