

Department of Computer Science and Engineering Chemistry Cycle

###### (Even semester 2021-22)

**Experiential Learning**

Report on

**“SMART WEATHER MONITORING SYSTEM”**

By

|  |  |
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**Vision**

Leadership in Quality Technical Education, Interdisciplinary

**Research & Innovation, with a Focus on Sustainable and Inclusive Technology.**

**Mission**

To deliver outcome based Quality education, emphasising on

**experiential learning with the state of the art infrastructure. To create a conducive environment for interdisciplinary research and innovation.**

**To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.**

**To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.**

**To focus on technologies that are sustainable and inclusive, benefiting all sections of the socz**

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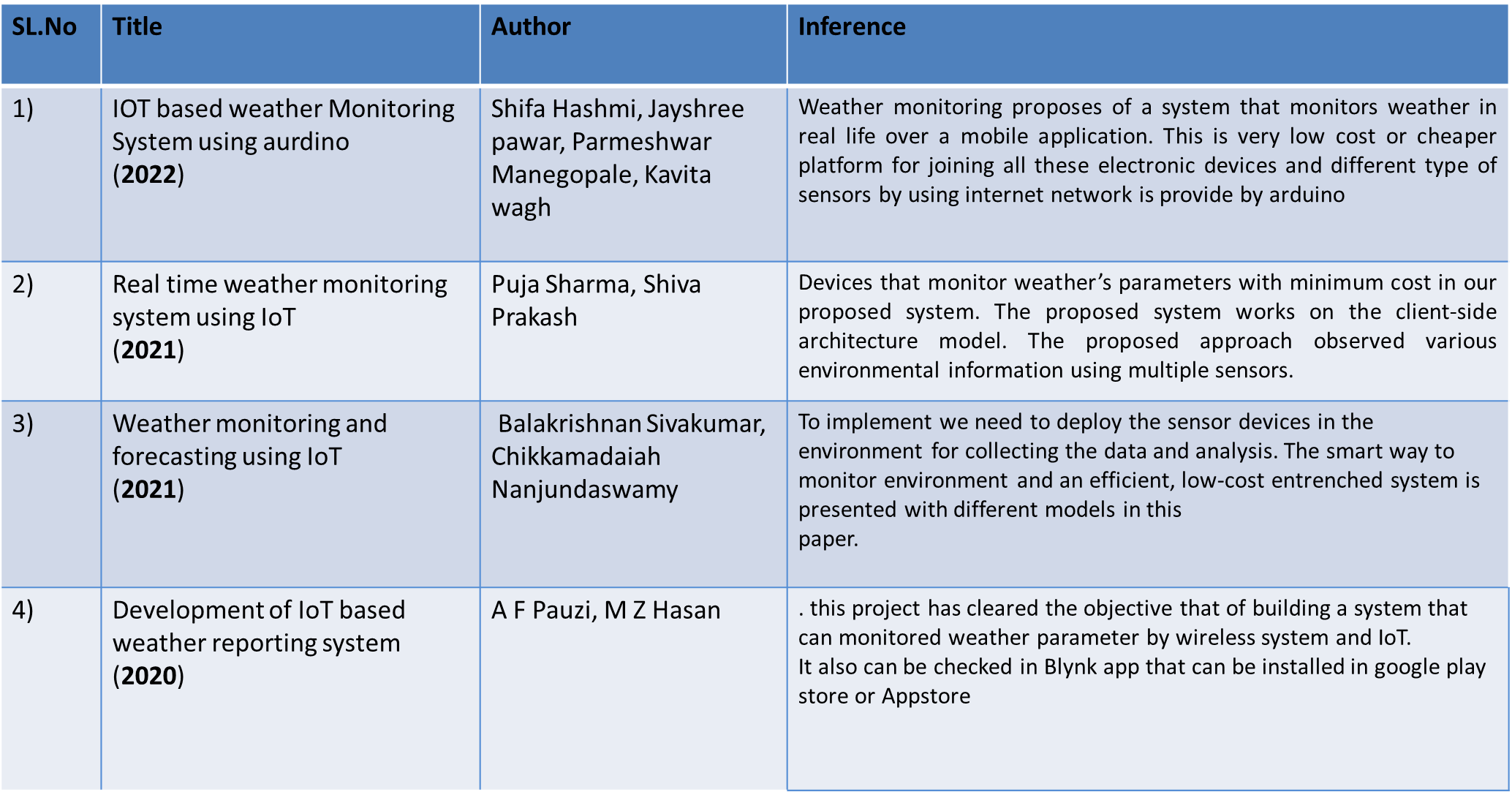
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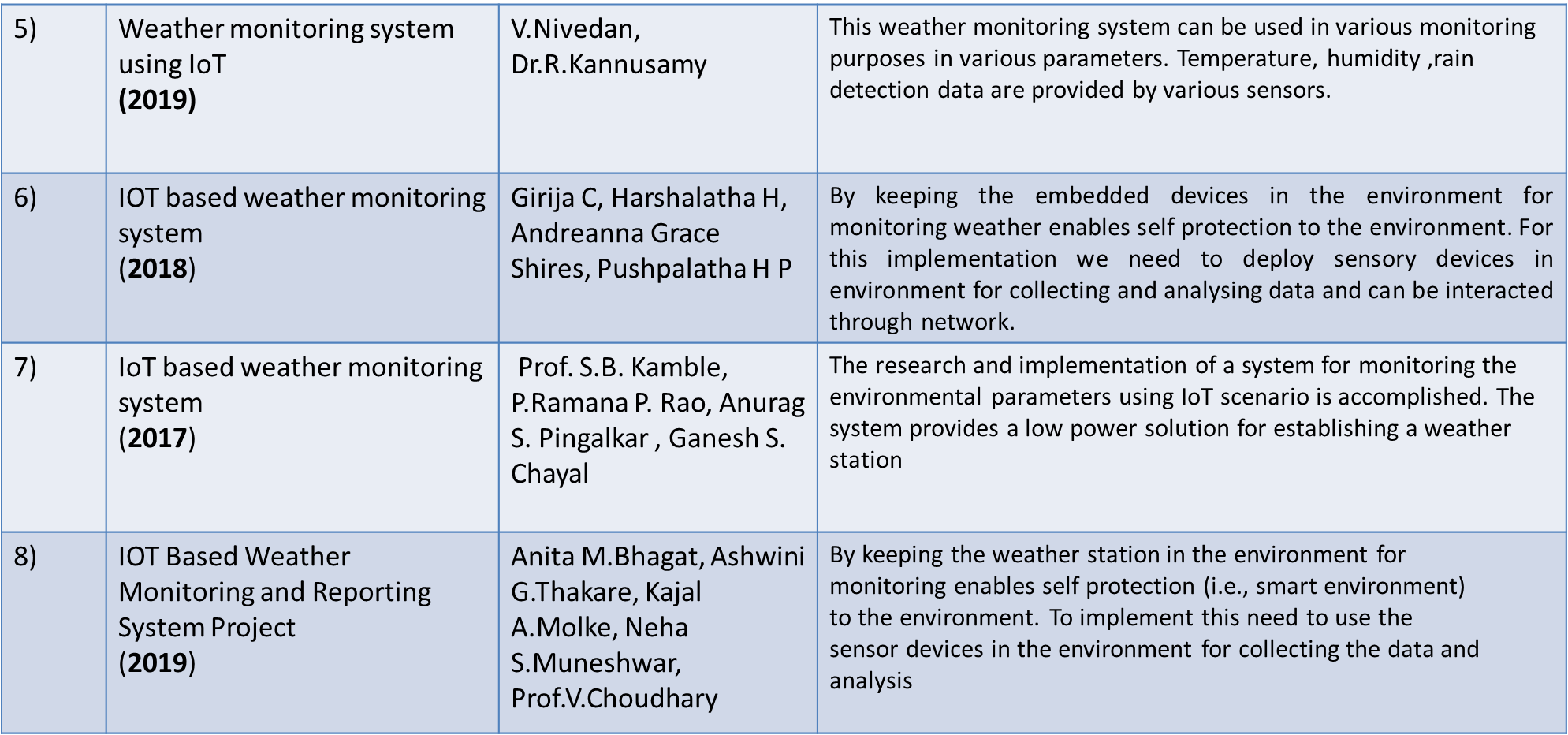
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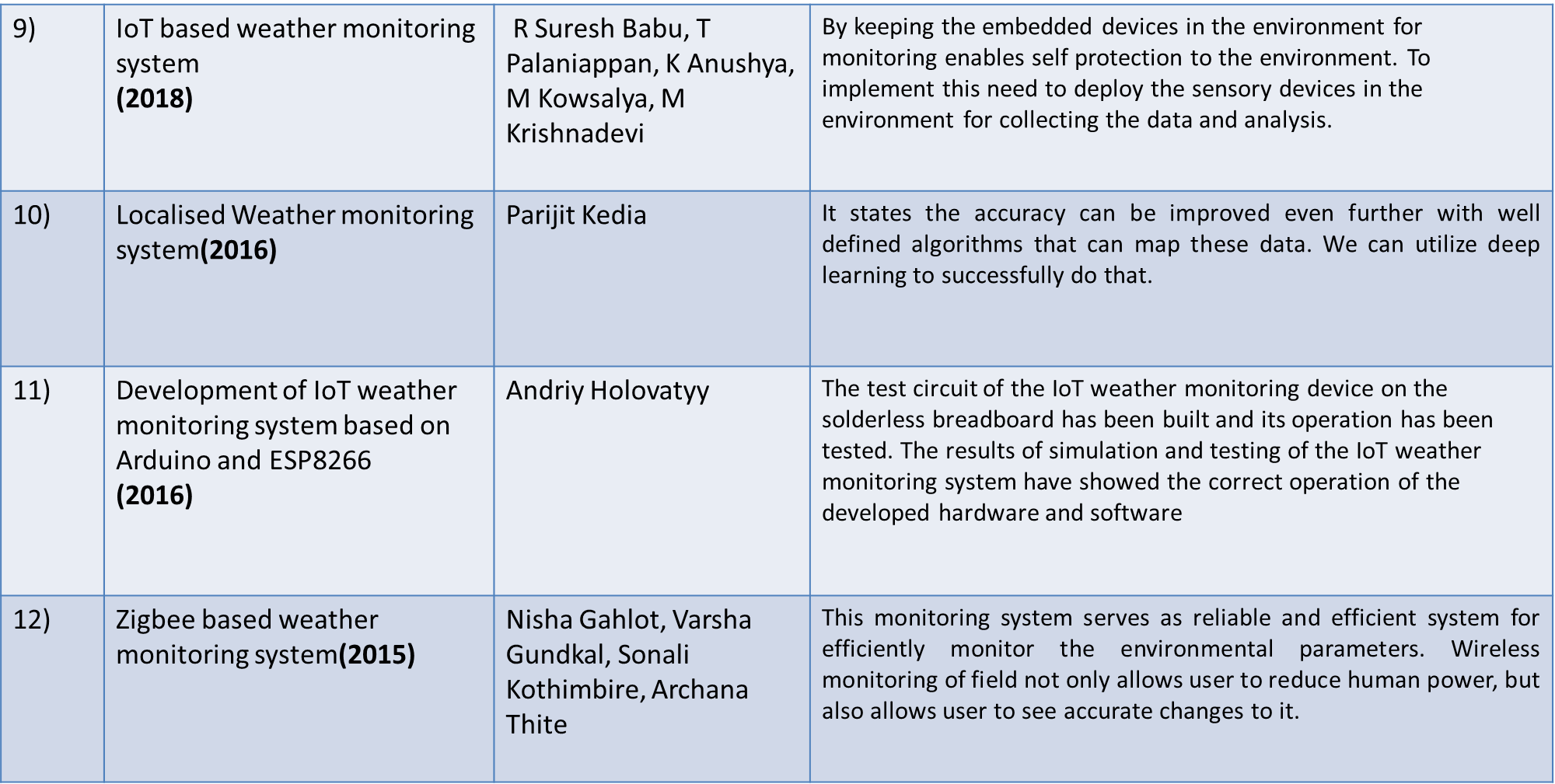
#### Abstract

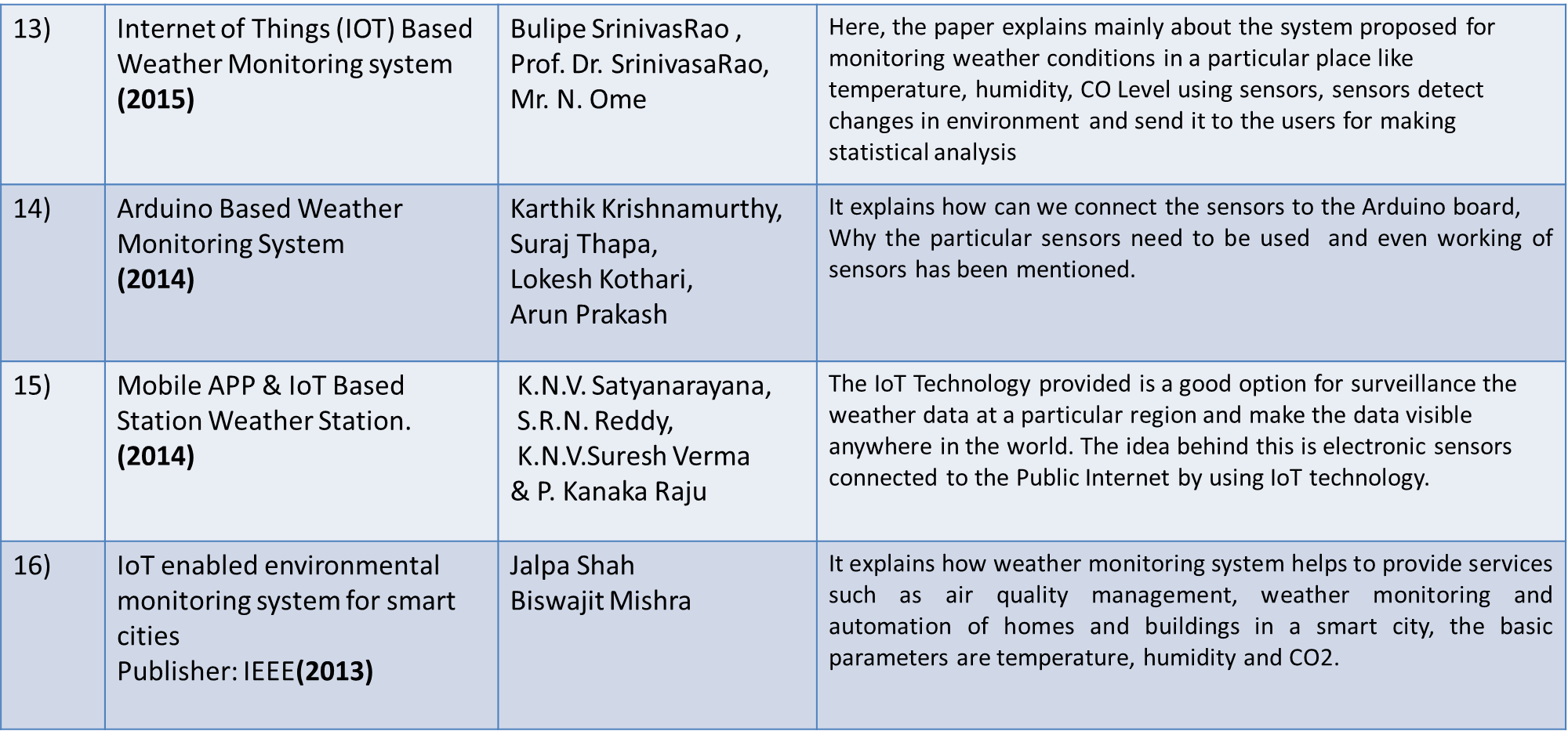
Smart weather monitoring systems and networks are designed for monitoring weather parameters – atmospheric pressure, temperature, intensity of rainfall and relative humidity. Smart weather reporting system has an application for farmers as well. Weather forecasting plays a very important role in the field of agriculture. It is really helpful for monitoring weather at places like a volcano and rainforests region. Weather monitoring system helps to predict the dangerous weatherconditions and makes the people to make preventive measures. The model is builded on Arduino UNO board with BMP180 sensor, rain sensor, LDRsensor, DHT11sensor,LCD,jumper wires. The sensors used in the monitoring system will display the data on lcd and serial monitor. Data is analyzed graphically by plotting data in Matlab, which helps us to understand changes in the weather easily.

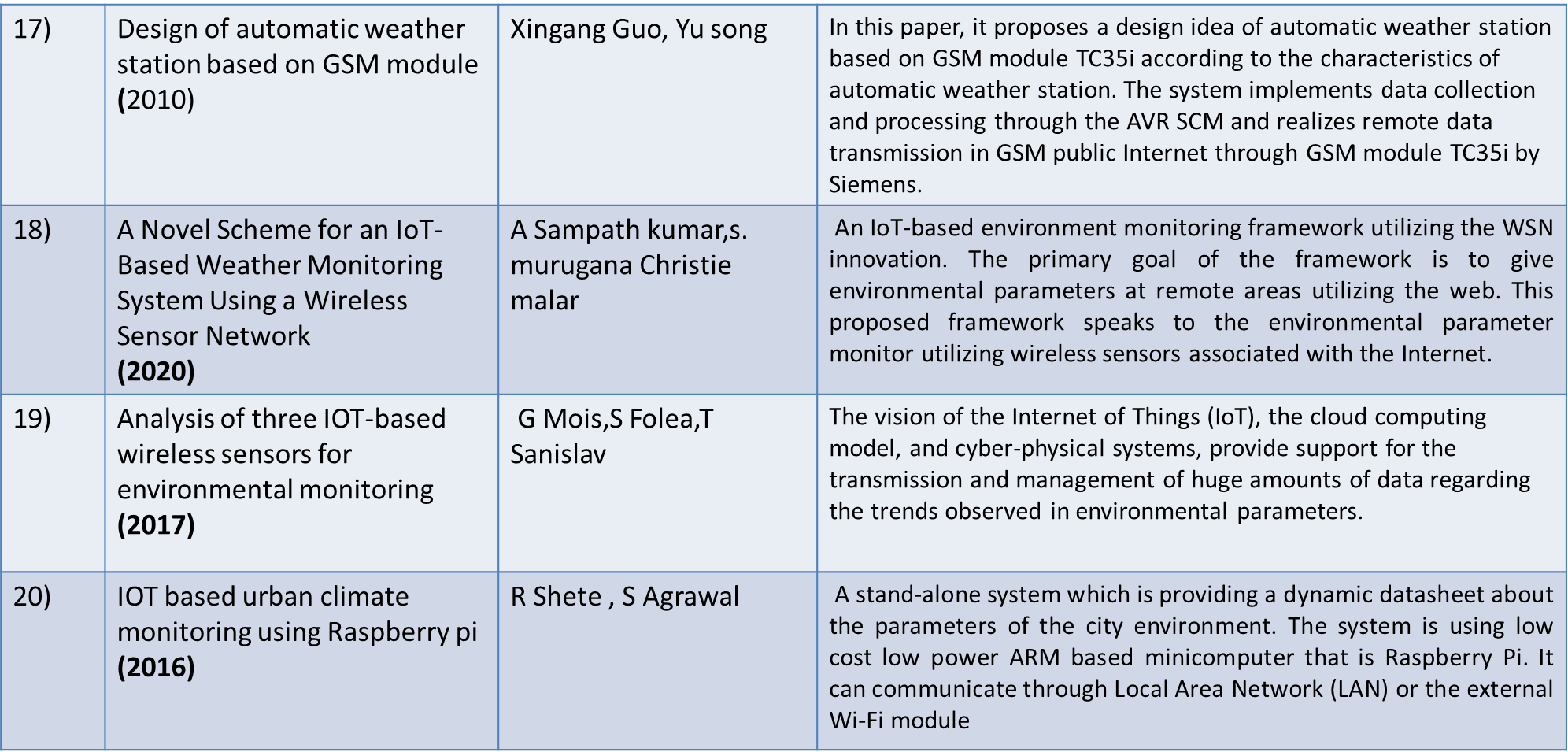
* **Literature Review**

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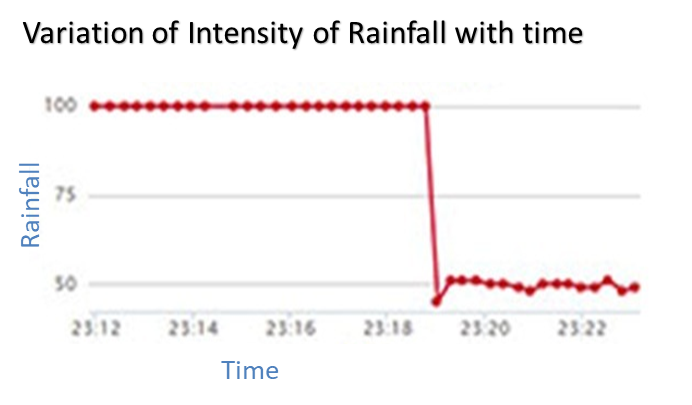
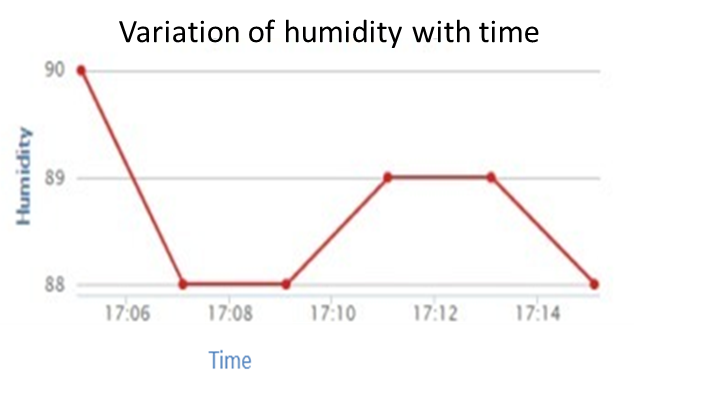
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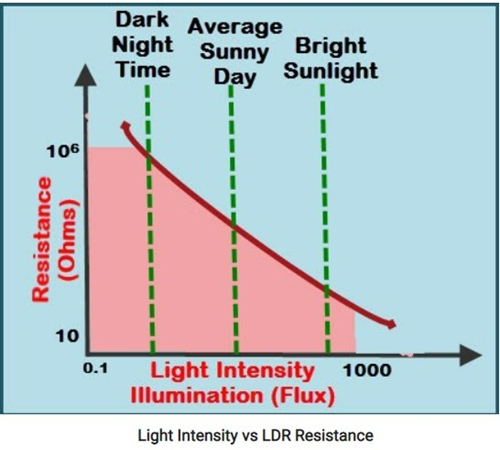


* **COMPONENT OF EACH SUBJECT:**

**MATHEMATICS:**

* The radius within which sensor can detect the identity of any other sensor is known as **broadcast radius**.
* The **cover radius** is the radius within which the sensors perform their sensing tasks.
* The weather parameters detected by sensors is displayed on lcd and serial monitor and plotted as the graphical statistics**.**
* **R α** , In rain sensor good conductivity occurs when more water flows over the sensor surface, and there will be poor conductivity because of small amount of water.
* **Intensity α** ,In LDR sensor, when the light falls on its surface, then the material conductivity enhances.
* **GRAPHICAL ANALYSIS:**

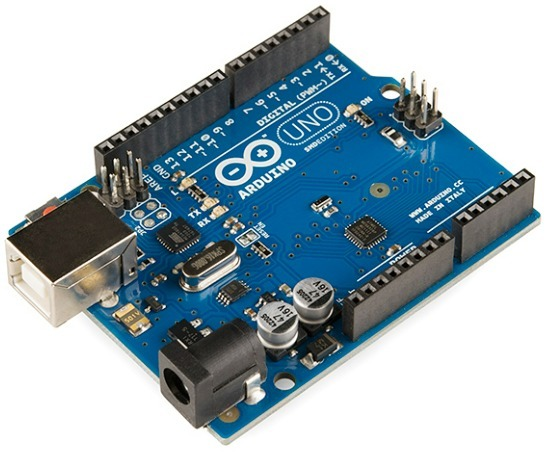
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**ELETRONICS:**

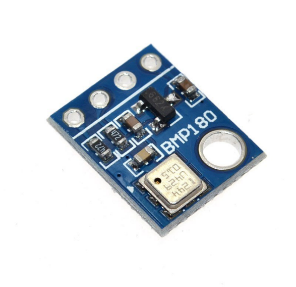
1. **Arduino UNO:**

* Arduino UNO is a microcontroller board based on the ATmega328P.
* It functions essentially as a micro-controller kit that collects data from external components like sensors and motors.
* It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button.
* It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



1. **Rain Sensor:**

* **Rainfall sensor** easily **measure the intensity of rainfall** through this sensor.
* It is made of two parts: Sensor part and the module one.
* R α .
* Therefore, good conductivity occurs when more water flows over the sensor surface , and there will be poor conductivity because of small amount of water…this concept, make us to get a output voltage.
* The sensor pad presented above should be connected to module. So, we can get the output voltage of the sensor pad as an analog value through this module.

1. **BMP180 Sensor :**

* This sensor mainly measures atmospheric pressure, also as the pressure decreases as it

raises above sea level, it can also be used to get altitude.

* It includes a chip called the BMP180. This chip measures both pressure and temperature.
* It operates with a potential range of 3.3 to 5v. We can also get the values of this

sensor through I2C communication.

* Through this, we can get the values of all the three factors of temperature, pressure,

and altitude.

1. **LDR Sensor:**

* It is called a Light Dependent resistor or a photoresistor. This is a semiconductor device, depending on the

amount of light falling on the sensor surface, the resistance value increases or decreases.

* As intensity of light increases, the resistance value decreases as current is easier to flow and vice-versa.



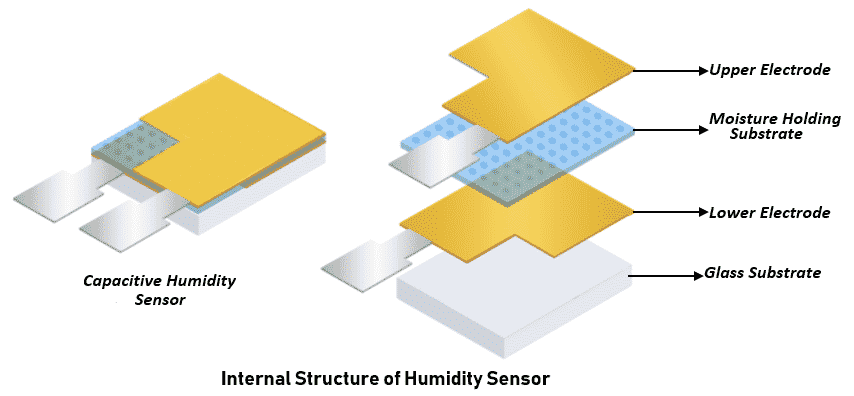
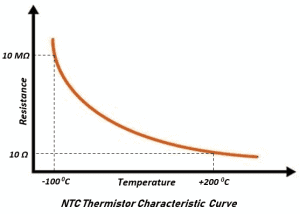
## CHEMISTRY:

## In LDR, resistance varies with the amount of light falling on the surface i.e., resistor works on the principle of photo conductivity. It is nothing but, when the light falls on its surface, then the material conductivity enhances.

## These photons in the incident light must have energy greater than the band gap of the semiconductor material . This makes the electrons to jump from the valence band to conduction.

## DHT sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature.  The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels.[.](https://cdn.nerdyelectronics.com/wp-content/uploads/2020/08/capacitive.png)

## For measuring temperature this sensor uses a NTC (Negative Temperature Coefficient) thermistor, which means that the resistance decreases with increase of the temperature as shown in the graph below ,it is usually made up of semiconductor ceramics or polymers.

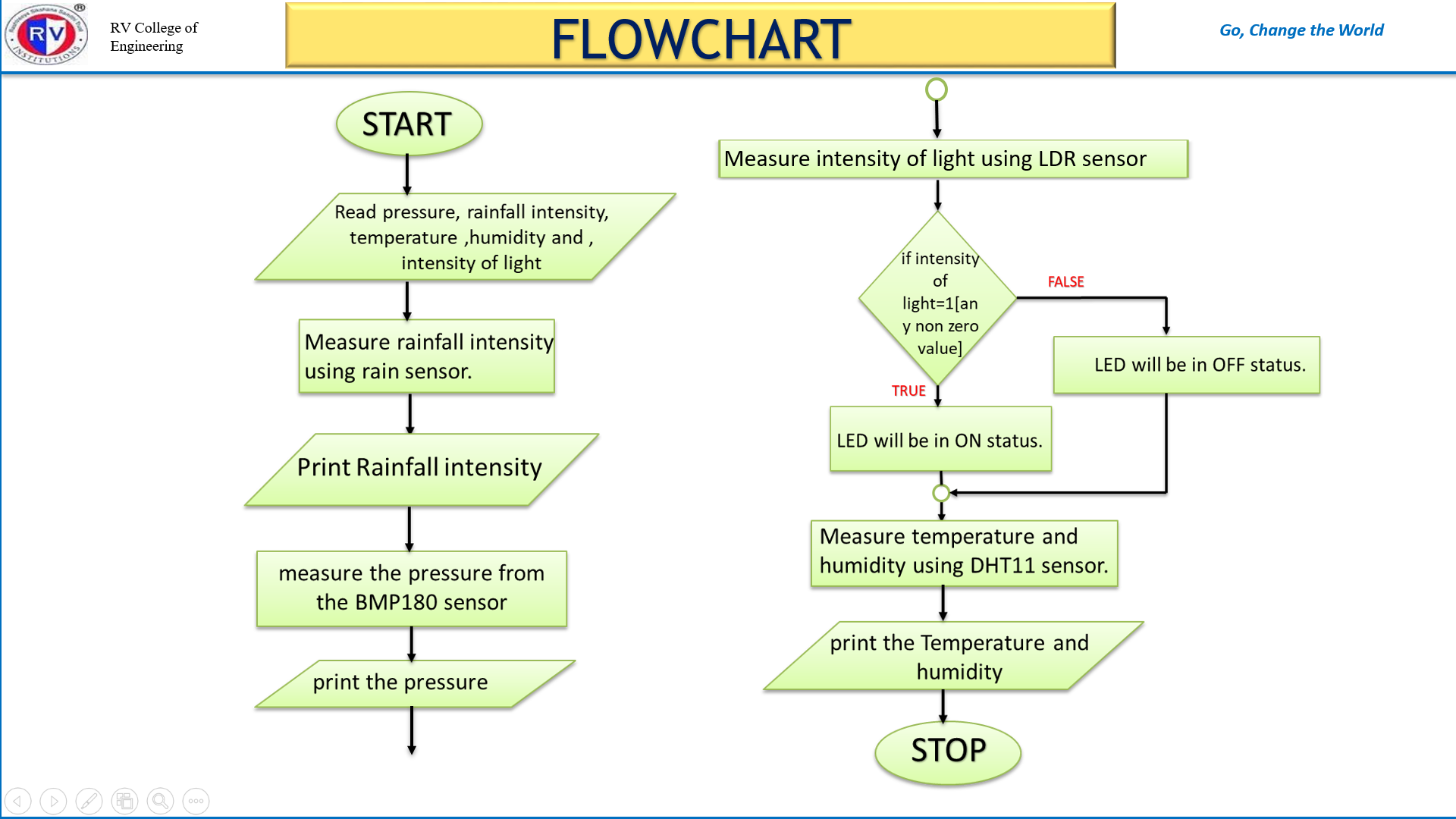
* The **rain sensor** module includes a **sensing pad which includes two series copper tracks coated with Nickel.**
* The volume of raindrops on the surface of the pad increases then its conductivity increases and resistance decreases.
* BMP Sensors and are all designed to **measure Barometric Pressure** or **Atmospheric pressure,** Barometric Pressure isnothing but weight of air applied on everything. The air has weight and wherever there is air its pressure is felt.

**COMPUTER SCIENCE:**

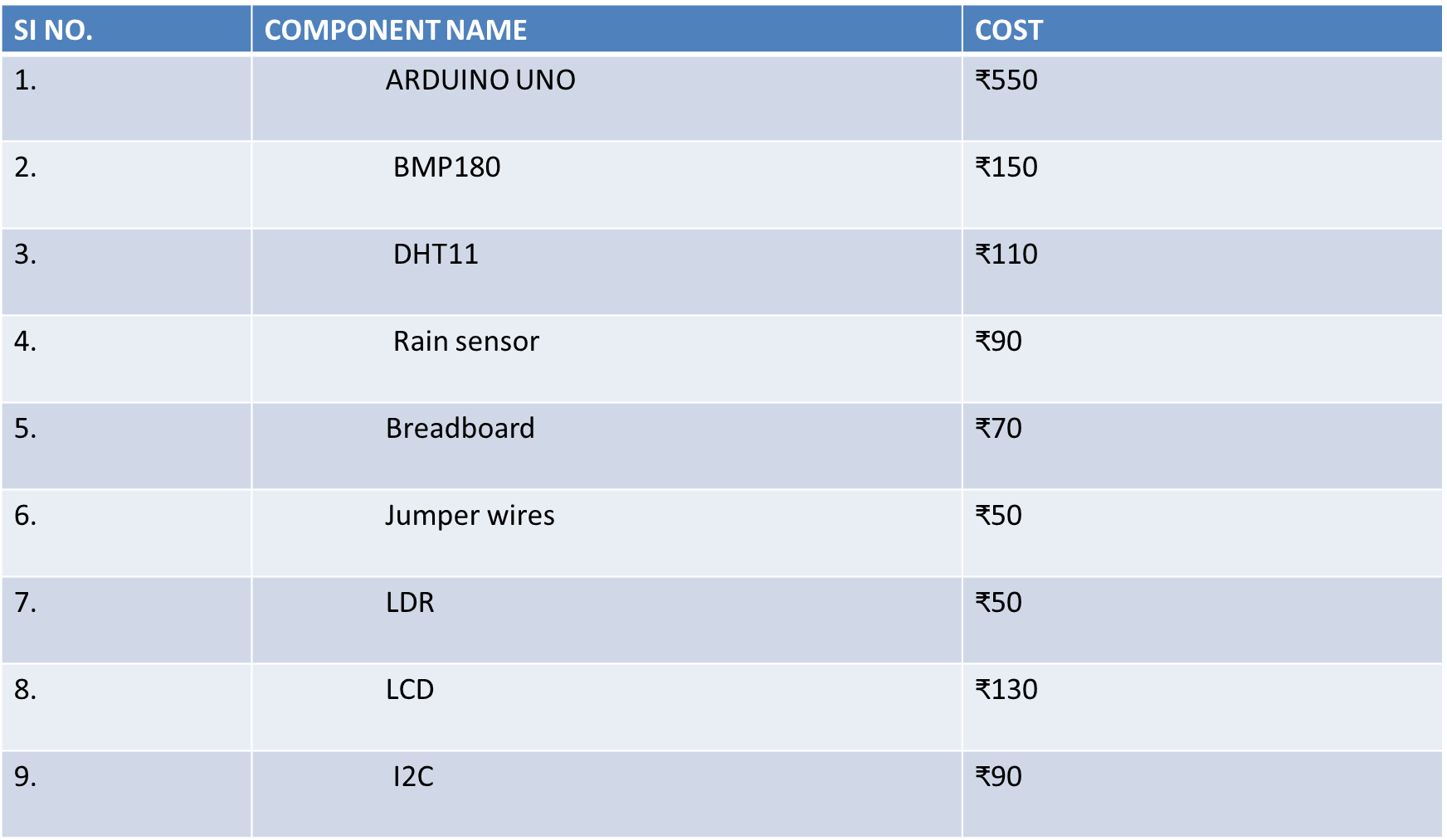
**Algorithm for source code:**

* START
* Read pressure, rainfall intensity, temperature and humidity, intensity of light
* Measure rainfall intensity from rain sensor
* Print rainfall intensity value
* Measure pressure from BMP180 sensor
* Print pressure value
* Measure intensity of light from LDR sensor.
* If intensity of light=0 LED will be in OFF status.
* If intensity of light=1[any nonzero value] LED will be in ON status.
* measure the Temperature and humidity from the DHT11 sensor.
* print the Temperature and humidity
* STOP

**FLOWCHART:**



* **COMPONENTS USED & COST**

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* **Source Code**

#include<dht.h>

#include <SFE\_BMP180.h>

//I2C pins declaration

LiquidCrystal\_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3, POSITIVE);

dht DHT;

#define DHT11\_PIN 2

int temp;

int humid;

const int ldr\_pin = 7;

const int led\_pin = 13;

#define ALTITUDE 902 //Altitude where I live (change this to your altitude)

SFE\_BMP180 pressure;

void setup() {

Serial.begin(9600);

lcd.begin(16,2);//Defining 16 columns and 2 rows of lcd display

lcd.backlight();//To Power ON the back light

pinMode(2,INPUT); //DHT11

pinMode(A0, INPUT); //Rain Sensor

pinMode(ldr\_pin,INPUT);

pinMode(led\_pin,OUTPUT);

Serial.println("Program started");

lcd.print("WEATHER MONITORING");

if (pressure.begin()) //If initialization was successful, continue

Serial.println("BMP180 init success");

else //Else, stop code forever

{Serial.println("BMP180 init fail");

}

}

void loop() {

int chk = DHT.read11(DHT11\_PIN); //Reading data from sensor

temp = DHT.temperature;

humid = DHT.humidity;

int A\_Rain = analogRead(A0);

A\_Rain = map(A\_Rain, 800, 1023, 100, 0);

char status;

double T, P, p0; //Creating variables for temp, pressure and relative pressure

if( digitalRead( ldr\_pin ) == 1){

digitalWrite( led\_pin,HIGH);

}

else{

digitalWrite( led\_pin , LOW);

}

Serial.println( digitalRead( ldr\_pin ));

delay(100);

status = pressure.startTemperature();

if (status != 0) {

delay(status);

status = pressure.getTemperature(T);

if (status != 0) {

Serial.print("Temp: ");

Serial.print(T, 1);

Serial.println(" deg C");

status = pressure.startPressure(3);

if (status != 0) {

delay(status);

status = pressure.getPressure(P, T);

if (status != 0) {

Serial.print("Pressure measurement: ");

Serial.print(P);

Serial.println(" hPa (Pressure measured using temperature)");

p0 = pressure.sealevel(P, ALTITUDE);

Serial.print("Relative (sea-level) pressure: ");

Serial.print(p0);

Serial.println("hPa");

}

}

}

}

Serial.print("You provided altitude: ");

Serial.print(ALTITUDE, 0);

Serial.println(" meters");

lcd.setCursor(0,0);

lcd.print("T:");

lcd.print(temp);

lcd.print("C");

lcd.print(" ");

lcd.print("P:");

lcd.print(p0);

lcd.setCursor(0,1);

lcd.print("H:");

lcd.print(humid);

lcd.print("%");

lcd.print(" ");

lcd.print("R:");

lcd.print(A\_Rain);

// lcd.print("%");

Serial.print("Current humidity = ");

Serial.print(DHT.humidity);

Serial.print("% ");

Serial.print("temperature = ");

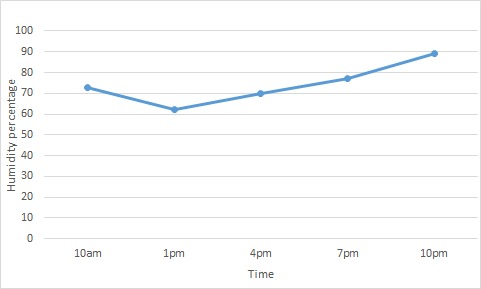
Serial.print(DHT.temperature);

Serial.println("C ");

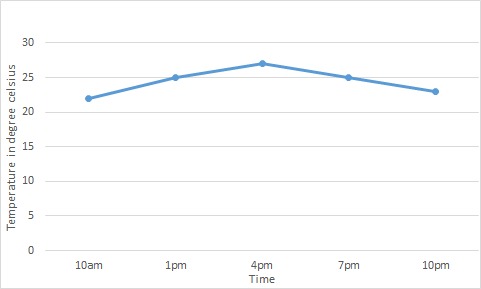
delay(1000);

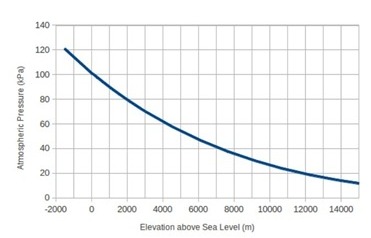
}

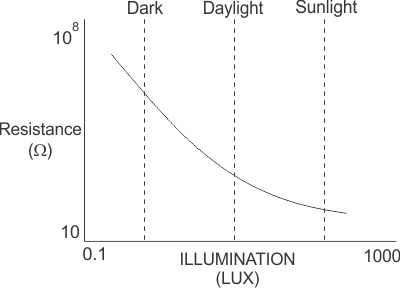
* **OBJECTIVES**:
* To measure and display various weather parameters such as temperature, humidity , rainfall , pressure etc..
* To implement this need to deploy the sensor devices in the environment for collecting the data and analysis.
* To provide accurate information about weather parameters.
* It is designed to collect quantitative data about the weather condition of a region in order to be able to known and predict weather conditions in a region.
* **METHODOLOGIES FOLLOWED**:
* To understand the need of Weather monitoring system.
* Going through the journals and research papers.
* Building a model using required components.
* Collecting the data detected by the sensors.
* Visualizing the obtained parameters on LCD.
* Displaying the measure values on serial monitor for reference.
* To do Graphical analysis using Matlab.
* By this way, detecting the weather parameters in the respective implemented areas.
* **GRAPHICAL ANALYSIS:**

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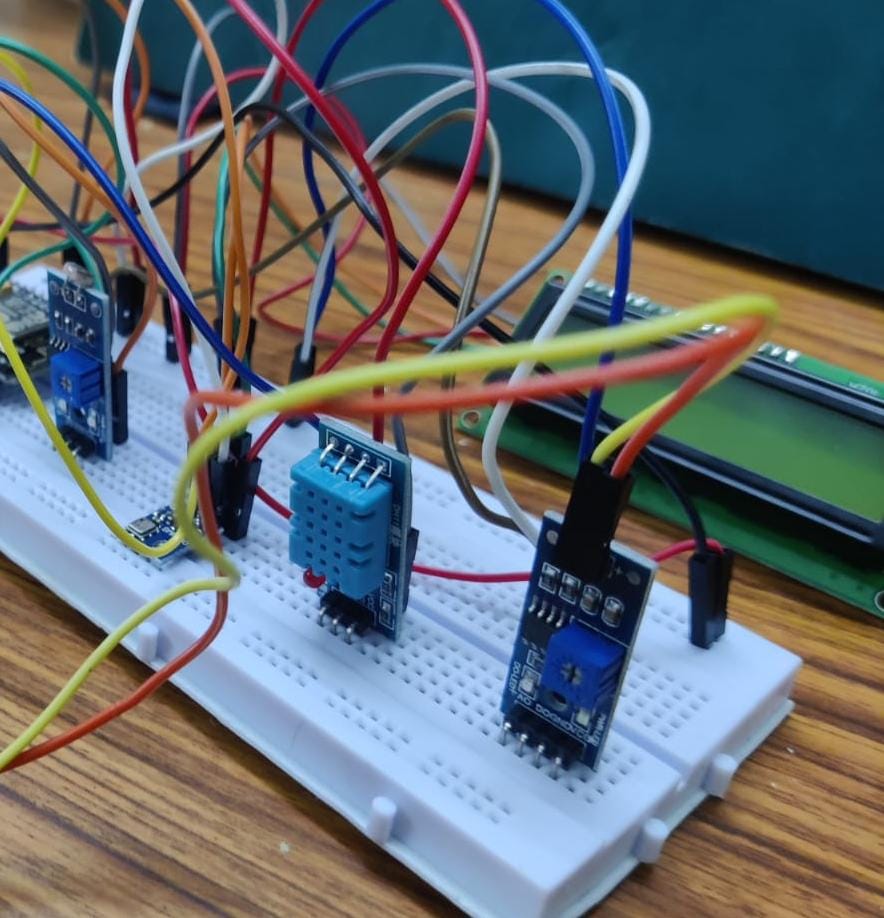
* Here, graph is plotted b/w humidity percentage and time..
* Here also, temperature in Celsius is plotted against time.
* Here, graph is in b/w intensity of light and resistance..by this relation daytime and nighttime difference is noticed.

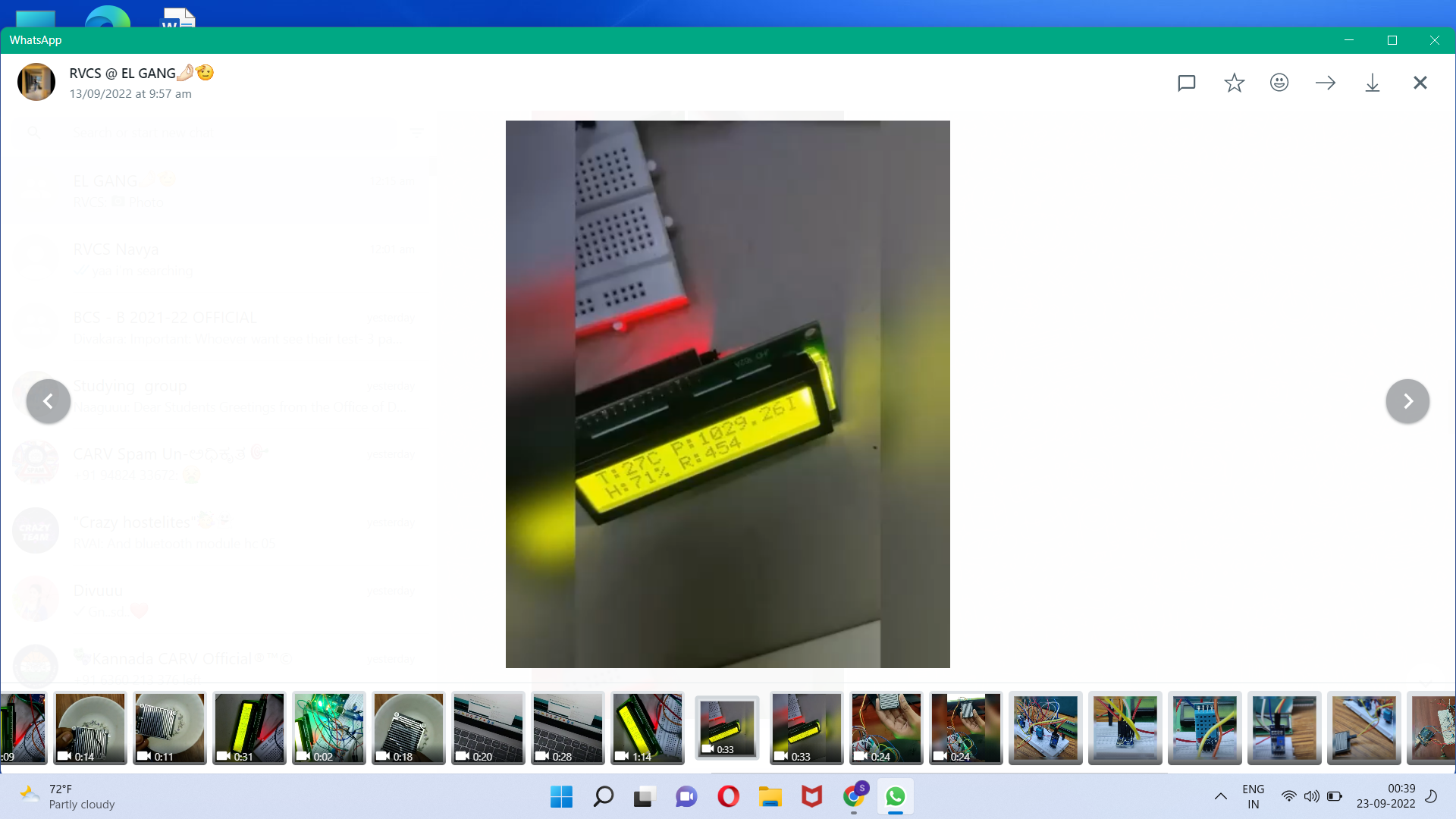
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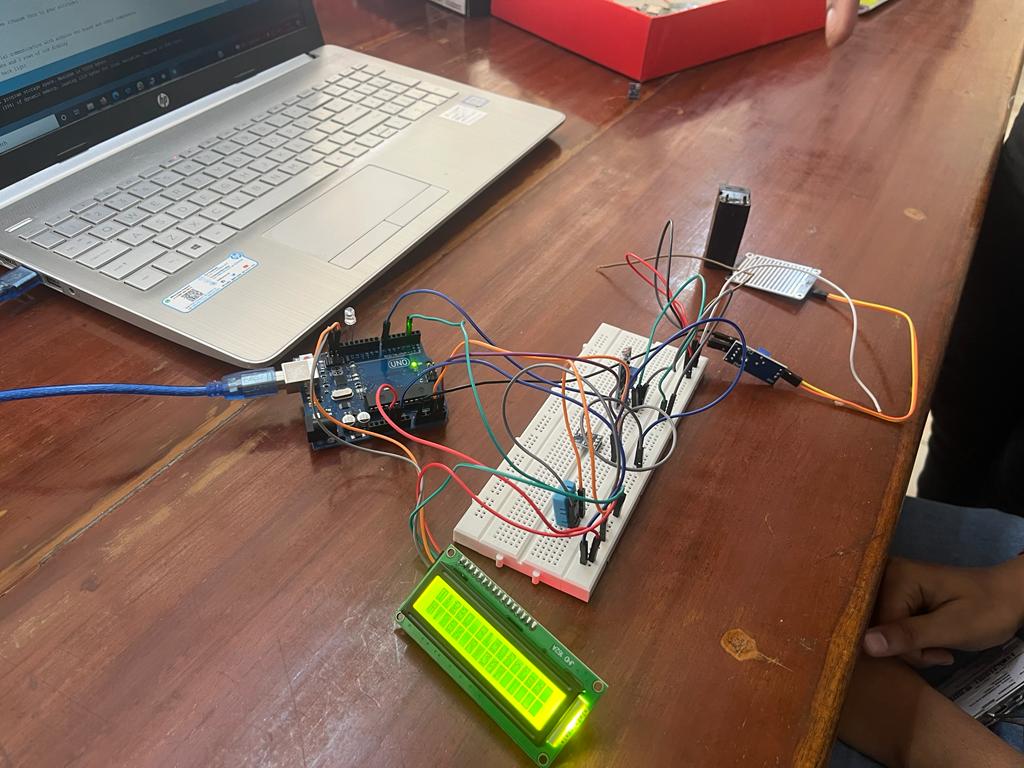
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* **FINAL IMAGES OF PROJECT:**







**RESULTS AND DISCUSSION:**

1. We are using some sensors with the Arduino UNO such as the DHT- 11 sensor, Rain sensor, and LDR sensor , BMP 180 sensors to measure temperature, humidity , rainfall intensity , intensity of light.
2. The DHT-11 sensor is used to calculate the temperature and humidity values in the environment.
3. Then we have a raindrop sensor that can detect the rainfall intensity.
4. We are using an LDR sensor that is a light-dependent resistor so that the intensity of sunlight can be detected.
5. Barometric pressure(BMP180 Sensor) Sensor measures the atmospheric pressure by considering the altitude of a given place.
6. So, weather monitoring system is measuring the pressure, rainfall, intensity of sunlight, temperature humidity of a particular place at a given time.
7. All the captured data is displayed on a 16x2 LCD display.
8. Plotting the graph by obtained results for analysis of a particular region over a period of time.
9. Analysis of graph helps us to notice the trending changes in weather of a particular place.
10. This data will help us to know the changes in our atmosphere and to take precautions in some dangerous situations.

* **CONCLUSION:**

So, weather monitoring system or a weather station is a small meteorological device that is developed to measure and display one or more atmospheric conditions through several different weather sensors (both indoor and outdoor). Basing on many sensors and temperature monitors, the device provides users information about the climate, the weather around them as well as the environment that they might be in so they can be aware of the changes in the weather and hence take necessary precautions in case of emergencies.

* **REFERENCES**
* [https://www.researchgate.net/publication/354220741\_Weather\_monitoring\_and forecasting\_system\_using\_IoT](https://www.researchgate.net/publication/354220741_Weather_monitoring_and%20forecasting_system_using_IoT)
* <https://www.itm-conferences.org/articles/itmconf/pdf/2021/05/itmconf_icacc2021_01006.pdf>
* <https://ieeexplore.ieee.org/document/9333535>
* <https://www.irjet.net/archives/V5/i10/IRJET-V5I10158.pdf>
* <https://iopscience.iop.org/article/10.1149/10701.17439ecst/pdf>
* <https://ieeexplore.ieee.org/abstract/document/8070824?casa_token=0XdMBUku0awAAAAA:xZjGgZIWcq0EpEYn5mT1ed7uOMZLdbUmjvnYWUT4G2dIrPuEnR4uA31CTzijpuyF-GpXBa9xtaj_>
* <https://www.academia.edu/35073563/MOBILE_APP_and_IoT_BASED_SMART_WEATHER_STATION>