Weather Monitoring System using Arduino and IOT

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***Abstract*—Internet of thing (IOT) are gaining popular in both academy and industry . IoT devices are not limited to computers or machinery. The primary goal of the internet of things is to create self-reporting devices that can communicate with each other (and users) in real time. In This project presents a design of weather monitoring system. It stores data collected at some pre-determined sampling interval, with date and time stamps for later retrieval in real-time analysis of different environmental parameters like temperature, humidity, atmospheric pressure,light intensity and rain fall.. It consists of an ESP32 (micro-processor) which acts as a gateway to collect data and information through different probes and transfer real-time data through wifi module to iot appilications like blynk and thingspeak. Systems like this are used in sectors like Agriculture,Industries and Aqua-culture.**

Keywords:-Arduino, IOT, ESP32, Weather forecast

I. Introduction

Weather is a daily aspect but climate is the average of atmospheric conditions over a longer period of time.Although there are several parameters that define the weather of a region, such as humidity, rainfall, air pressure, wind speeds, latitude, longitude, altitude, etc., not all of these are useful for generating forecasts. Monitoring weather conditions is necessary to maintain quality working conditions and also needed for planning purposes.

In India, weather forecasting systems are setup at a proximity of 32kms, due to their cost constraint. The data gathered by those stations is insufficient, eventually the accuracy is affected to a greater extend. In order to monitor the changes an effective system needs to be designed. A weather station is used to measure atmospheric conditions at different locations at different periods. In sectors like Agriculture and Aquaculture even Slight change in weather conditions Can cause huge loss in life and cost.It is also imperative wherever there is a need to prevent condensation, corrosion, mould, warping or other spoilage of products. This is highly relevant for foods, pharmaceuticals, chemicals, fuels, wood, paper, and many other product.

Internet of thing (IOT) are gaining popular in both academy and industry.Many IoT frameworks, such as Blynk [1] and ThingSpeak [2], provide off the shelf examples to monitor various remote conditions using sensors. The sensors in the weather monitoring system are the miniaturized electronic devices used to measure the physical and environmental parameters. Using these sensors, the system will produce fast and accurate result with less power consumption.

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II. Software Requirement

A. Arduno IDE

Arduino is a famous open source hardware and software project to build electronic devices and interactional robots that can detect and regulate objects in the real world. The project's results are distributed as open-source software and hardware, which are licensed under the GNU General Public License (GPL) or the GNU Lesser General Public License (LGPL)[12], permitting the production of Arduino software and hardware distribution by anybody.

Arduino platform uses a variety of microcontrollers and processors. The Arduino boards are equipped with input/output (I/O) pins that may be connected to different expansion boards or Breadboards (shields). The Arduino boards feature many different communications interfaces, including Universal Serial Bus (USB) on some particular models. The processors are typically programmed using a dialect of C and C++ programming languages.

Fig. 1. Arduino IDE

The Arduino platform also developed an integrated development environment (IDE). The open-source integrated development environment makes it easy to program the board.Arduino IDE runs on Mac OS X, Windows, and Linux. The environment itself is programmed in Java and based on Processing [13] project. This tool can be used with any Arduino board. The Arduino IDE is illustrated in Fig.2. But arduino IDE doesn't work for the esp32 module. In order ESP to work on arduino we have add the esp to preferences and download esp boards from board manager and esp library from libraray manager. Sometimes esp goes foe trobule shooting and code doesn't upload on the module as shown in the fig3. This

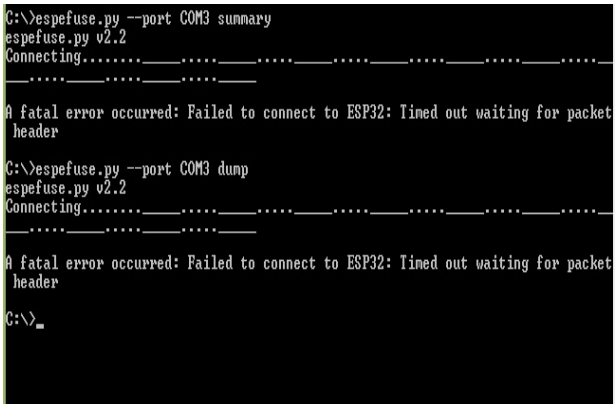

Fig. 2. troubleshoot

signifies that the module is in boot mode in order to resolve this error.

B. Blynk

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.Blynk was designed for the Internet of Things. It interfave looks like as shown in fig 3.

It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. There are three major components in the platform [10]:

- Blynk App: – It allows you to create amazing interfaces for your projects using various widgets which are provided.
  This signifies that the module is in boot mode in order to resolve this error.
- Blynk Server: – It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
- Blynk Libraries: – It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands.

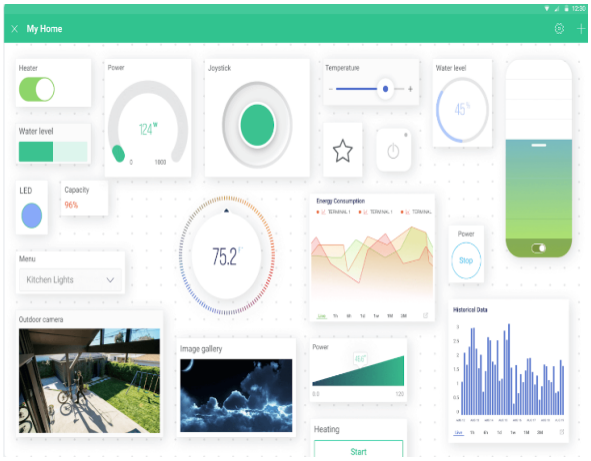

Fig. 3. BLYNK interface

III. Weather Mointoring System Design

The Weather Mointoring System is assembled with many components: We have an DHT11 for Measuring Humidity and Temperature. We have pressure and altitude sensor to measure temperature, pressure and altitude. We have a ESP32 module to establish communication channel between the system and the IoT software like blynk on control devices, such as mobile phone or PC it captured real time to send back to control devices. We have Light sensor to check sunlight intensity and The rainsensor to check the rain intensity . We have power bank on board to support the system running alone without power line connection.

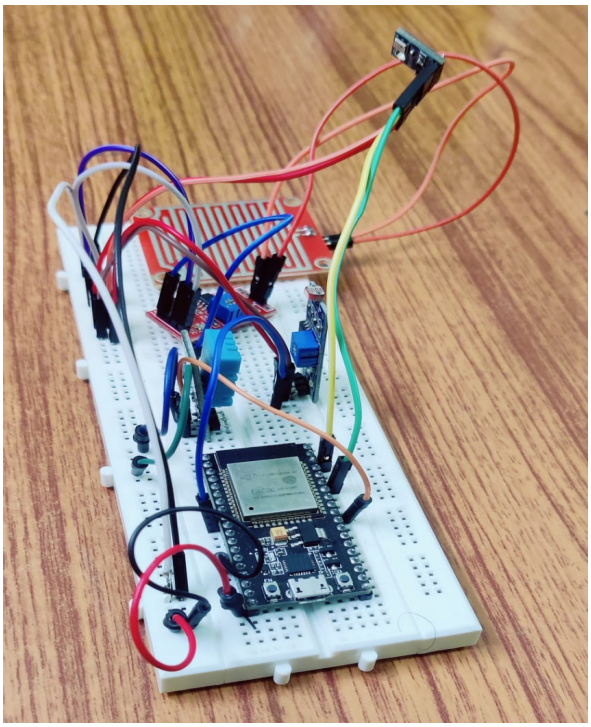

Fig. 4. Weather Mointering System Body

A. Main Components

Tabel 1 lists the main components of Weather Mointoring System.

TABLE I
COMPONENTS OF THE WEATHER MOINTORING SYSTEM

Weather Mointoring System	**Components**
Body	Breadboard
Control and communication	ESP32
Sensors	DHT11, BMP180, LDR and SEN5
Power Supply	Powerbank
Connectivity	USB cable and Jumper wires

The main body of weather mointering system is mainly made of sensors .lets discuss the DHT11 senses the temperature of the surrounding. Its a 4-pin device. We should connect a 10k resistor between pin 1 and pin 2. Pin 1 is connected to the 3.3V. Pin 4 is connected to GND. Pin 2 is the output pin which gives input to the nodemcu pin D4. Pin 3 is left empty.It consits of a humidity sensing component,a NTC temperature sensor and a IC on a backside of the sensor.

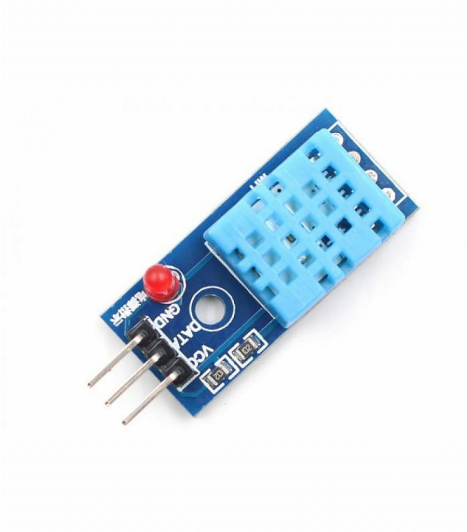

Fig. 5. DHT11

BMP 180 is a digital barometric pressure sensor that measures the pressure of the environment. It follows BMP085 and brings many enhancements. It has ultra-low power consumption down to 3micro ampere. It operates on 3 to 5V dc voltage .The pressure-sensing rate of BMP 180 is 300-1100 hPa (9000-500m above the sea level).The operational range of BMP is -40 degrees to +85 degrees Celsius. This chip uses I2C 7- bit address 0X77.

Rain Guage module (SEN5) is used for the detection of rain. It can also be used for measuring the intensity of the

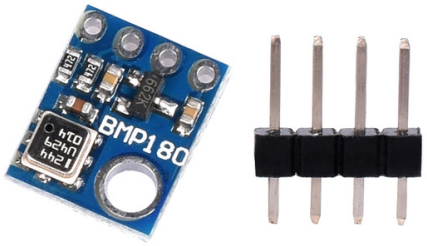

Fig. 6. BMP180

rain. It has both digital output as well as analog output. This module measures the moisture through analog output pin and when the threshold of moisture exceeds too much it provides a digital output. The more water or the lower resistance means lower output voltage. Where as, the less water means higher resistance,i.e, high outpu

Fig. 7. RAIN SENSOR

LDR Module is a A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity In other words, it exhibits photoconductivity. Maximum power dissipation is 200mW. The maximum voltage at 0 lux is 200V. The peak wavelength is 600nm. Minimum resistance at 10lux is 1.8k. Maximum .resistance at 10lux is 4.5k. Typical resistance at100lux is 0.7k.

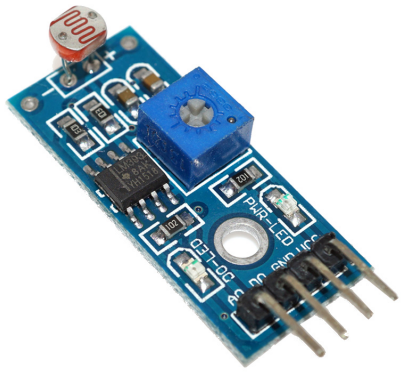

Fig. 8. LDR SENSOR

B. Control Workflow

The field station consists of sensors and an ESP32 microcontroller board which is used to read the sensors, process the data, then send them to the server simultaneously in a row of strings. The overall workflow of Weather Mointoring system illustrated in Fig 9. The ESP32 reads in the Temperature and Humidity from DHT11, Pressure and Altitude from BMP180, Light intensity from LDR and Rain fall intensity from rain sensor the data is processed and then sent via serial communication as output to the main microcontroller or the ESP32 board and Sends the real time data by inbuilt Wi-fi module in the ESP32.

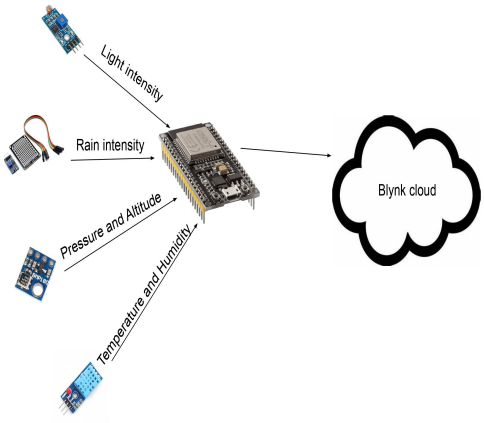

Fig. 9. LDR SENSOR

Then ESp32 sends the real time data to a specific channel with a unique authorization id whichis generated by creating a desktop in device in blynk website. This realtime data plotted in from of graphs displayed realtime on the desktop we created in the device, this realtime daa can also be access by the blynk appp for Android and iOS.

IV. Simulation Result

After sensing the data from different sensor devices, which are placed in particular area of interest. The sensed data will be automatically sent to the web server, when a proper connection is established with server device Each factor is monitored at

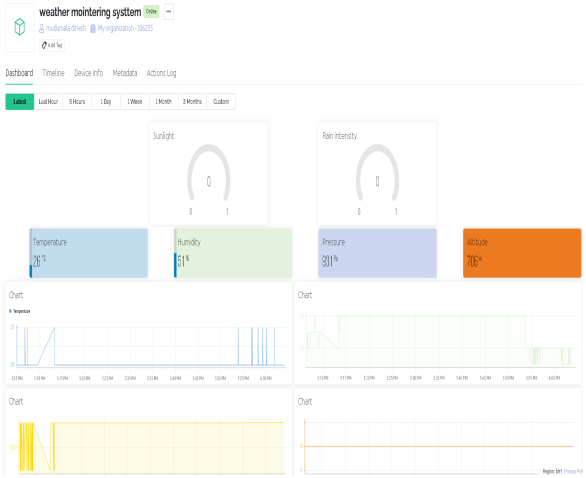

Fig. 10. Sensor simulations

different intervals of time to observe the variations in various environmental factors. we have created a channel that contains four fields to store four different environmental factors temperature, humidity, pressure and altitude we can observe that the varition of the factors like temperature ,pressure,humididty and sun light over the time peroid in the simulation. we can see decrease in the temperature and sunlight in the evening time and increase in humididty can be observed in the simulation.

V. Conclusion

We observed the weather conditions (that includes temperature, humidity, pressure and altitude) with our “Web-server based weather monitoring system using ESP32”. The observed real time data is stored on the ThingSpeak server which can be accessed globally. The different values of each (mentioned earlier) environmental factor at different intervals in time are also observed (given in table 5) and the observed result clearly shows the changes in the weather conditions for a full day cycle. Hence, we have successfully implemented and tested the web server based weather monitoring system with ESP32 and blynk web server.

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