Advanced Weather Station Using IoT

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Abstract- ***Due to the huge significance of climatic changes in various fields, weather forecasting and monitoring play a big role in the day to day life.*** **Weather is defined as the condition of the atmosphere which includes either hotness or coldness, clouds or storm and other observed conditions of the atmosphere at a particular place. Monitoring weather dates back since the earlier time where by farmers and past scientists were using various method to forecast these atmospheric conditions, but due to lack of advanced equipment's their ways of forecasting and estimation was inaccurate which resulted in providing wrong information of weather.**

The Smart Weather Station by integrating the new technology of automations with using advanced equipment and sensors and also be able to monitor and provide an accurate forecasting of weather which has a lot of benefits to everyday life of a human being. This system would assist the owner to be able to monitor his home atmospheric conditions wherever he is in the world by smart technology of IoT

I. INTRODUCTION

Advance weather station with IoT is the gadget which measure the environmental states of your home area. These climatic conditions including temperature, atmospheric pressure, humidity, rain value which are fundamental to be checked as often as possible because of their high significance which could help caution us about certain circumstance which is going to occur or would assist us with arranging our everyday exercises. This framework is a propelled framework as it is interfaced with exact and dependable accurate sensors which gauges and measure these climate parameters and print out its readings for the owner to analyze.

II. EXISTING METHODS

1. Raspberry Pi Weather Station which use to monitor the weather by using IoT (Internet of Things). This system uses raspberry pi which is connected with sensors to monitor the current changes of weather integrate them with the online readings.

2. The indoor weather station is the product that can monitor home atmospheric conditions. This product also acts as a clock and a calendar and it can display all of those data on the screen. The indoor weather station measures and compares the weather conditions of the indoor and the outdoor of your house and it compares them both together.
3. Computerized climate stations give a coordinated arrangement and allow integration of sensors that are utilized to quantify, screen monitoring, and concentrate the major area of climate and atmosphere. These stations are commonly utilized in climate, meteorology, and mesonet applications. The fundamental point of this worldwide item is to go about as a full meteorological station.
4. The "Smart Weather Station" is the system which intended to develop a phase where by it will utilize effective sensors for checking climatic conditions which is then picked and further connected to a main station. This design action procedure of the Smart Weather Station is successfully fabricated using main four basic sensors which are used in quantify four key climate parameters; temperature, atmospheric pressure, relative moistness, and light power. An implanted C8051F020 microcontroller is the CPU used where it records and analyze data change. ZigBee correspondence and communication convention protocol were used to impart between the climate stations and the Central station and in designing the framework

The main aim of this paper is to measure the weather condition of indoor and compare these readings with the readings of outdoor weather conditions.

III. PROPOSED METHOD

This framework utilizes the IOT innovation which is the web of things that associates all registering gadgets, items and people with exceptional identifiers and have the option to move information over the web.

The framework uses the functionalities of a Raspberry Pi 3 which is a minimal cost effort, little size PC that goes about as the handling and processing unit for this model. The raspberry pi empowers us for simple association and

interconnection with the web by utilizing wireless or wired LAN strategy. The sensors are interfaced to this handling unit which process the information and afterward putting them to the online cloud which are utilized for further procedures.

The sensors utilized in this framework including DHT11 which is an exact sensor to screen the encompassing temperature and relative humidity of natural environment area. BMP180 sensor is additionally used to screen the pressure of the atmosphere and give its information precisely. Additionally, different sensors like rain value sensor are likewise utilized in this venture

IV. SYSTEM DESIGN

This system mainly designed using minicomputer device which is Raspberry Pi. The Raspberry Pi is interfaced with DHT11 which measures temperature and humidity, BMP 180 sensor which measure the surrounding pressure, LDR which measure the light intensity, Rain Value sensor which monitor the presence of rain and UV sensor which measure the ultraviolet radiations in the atmosphere.

The Raspberry Pi is powered generally by renewable form of energy, in which the solar energy is collected by the solar panel which this electrical energy is used to charge a battery of 12V. We chose a rightful panel capable to charge the battery by making sure the current and the voltage ratings of the solar panel is higher than that of the rechargeable battery. This battery output is connected to the voltage regulator to turn the voltage to 5V which is used to power the Pi.

The system works by powering the raspberry pi, and connecting it with LAN connection or Wi-Fi for internet. The sensors connected to the system will collect data of the surrounding environment and send them to the Raspberry Pi CPU which these data will be temporary stored so as be processed further. The processed data is then sent online for analyzing on an IoT service.

After the data have been completely analyzed the recorded data is then displayed on 16x4 LCD, also the graphs readings is then available on the IoT services where these data can be accessed everywhere.

In addition to these recorded data, if certain abnormalities occur in the measurement where they exceed certain limits the device is then connected to Arduino UNO system which will also warn the owner if there is abnormality in the measurement by sending him a notification of a message notifying him about the current condition of weather at his home surrounding.

The message Notification is handled by the GSM module SIM900 which will immediately send information to the respective owner and would require him to control certain automations regarding that abnormality condition that is going on at his place.

Furthermore, a record of reading of each of the weather parameters mentioned above will be continuously recorded after each certain interval to keep this readings and recordings for the purpose of big data analytics. A CVS file is the format which will record these readings which is light on memory size and could handle the information for a long period of time.

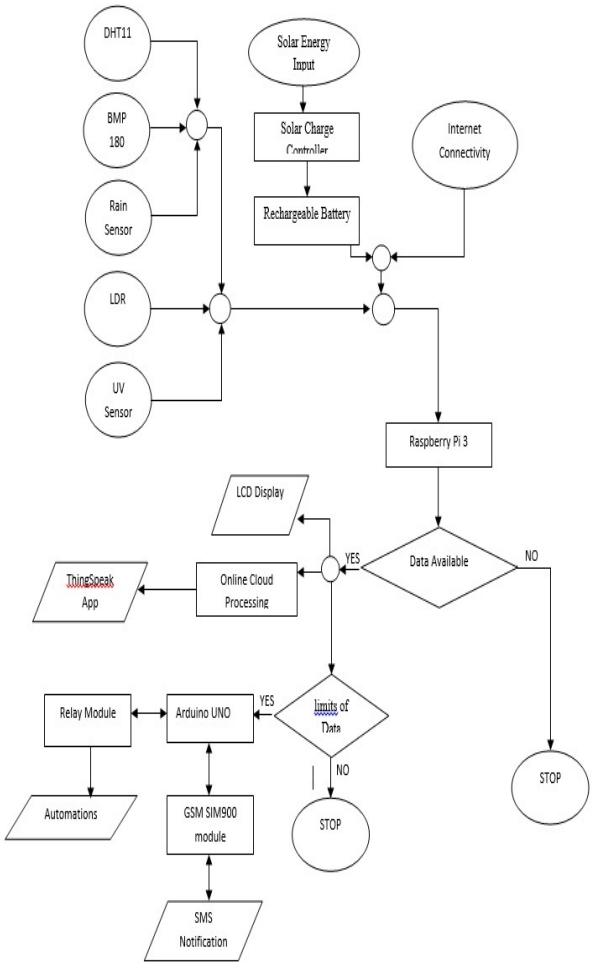

Fig 1 Advanced Weather Station Flow Chart

V. FUNCTIONAL TEST

The prototype was tested by using three steps of testing. These processes are unit testing, integrated testing and system testing. In the unit testing each of the sensor was tested individually with the Raspberry Pi and obtain its reading of the data and check its accuracy of that reading by checking the internet reading if it close to it.

Second stage, is integrated testing this is when all the sensors were interfaced with the raspberry Pi and trying to collect the data from all sensors all together. Doing this required mixing of the python programming language and libraries of each of the individual sensor all together to obtain a single program which would capture all of the sensors reading and time of the individual reading.

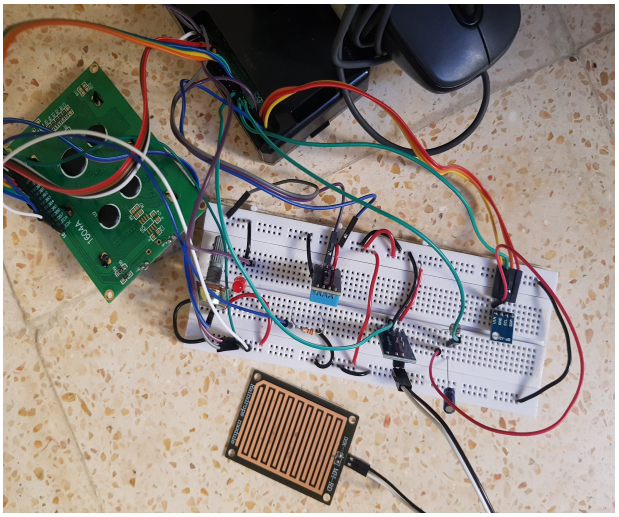

Figure 2: Testing of sensors

The figure below shows the stage of the system testing which as mentioned above was conducted to test the whole overall system performance. The picture shows “It’s Raining” which was the test we conducted by trying to create a simulation of rain to the module to see if we will get any reading notification from it and as show in the picture the system responded perfectly.

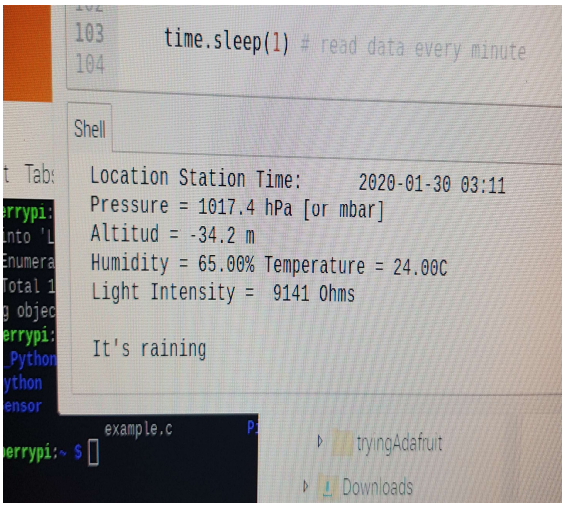

Figure 3: System Testing

VI. RESULTS DISCUSSION

After multiple testing procedures conducted on this system, we found out that the system is efficient enough and functioning well for it to be used and implemented in the real-life scenarios. The readings of the data were accurate due to the accuracy of the sensors used and also confirmed with their reading by comparing with the internet readings of the particular values. There was a slight different between the reading the internet values and the values we obtained in our system, this is due to the distance where we are testing our device from the nearby weather station, this is a disadvantage of weather readings from the internet sources and local news station because if your

particular location is much further from the nearby weather station means the readings that you will obtain are inaccurate. By this reason we concluded that our system readings were the ones which are more correct.

In order for the whole system to be fully equipped and work with solar energy then a bigger solar panel is required and a rechargeable battery that is capable enough to power all the components in the system. But for us we are limited to power only few of the circuits in the whole system with the solar panel and other circuits will be powered with normal AC outlets.

Data that are logged locally in the device for it to be shared and analyzed for the big data analytics this file will need to be accessed within the system and then be shared to other members for analysis and achieve the goal of analysis of the data and information for a long period of time.

Never the less, the notifications that are sent with GSM module could also be expanded and add more notifications methods like using of tweets and email to send the message to the owner of the system if there are any abnormalities at the place where this prototype is placed at.

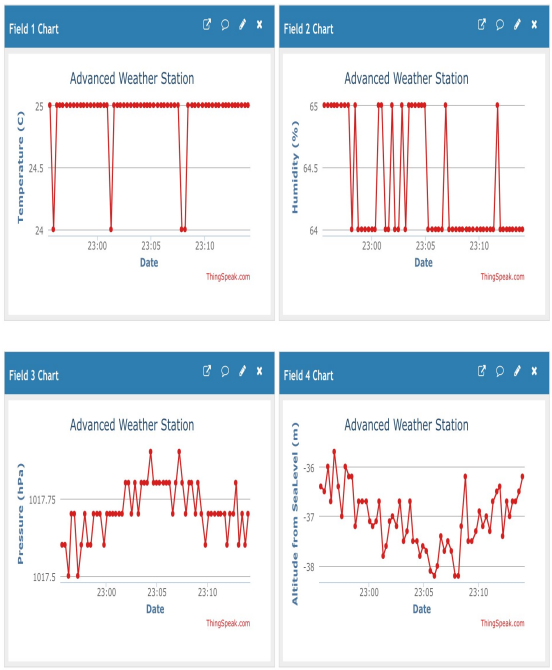

Fig 4: Graphs showing deviations of internet readings and the circuit readings

VII. DISCUSSION

From graph the results obtain in the testing of the system, these four fields represent four different parameters of the readings. The first field represents the Temperature which we measure in the unit of degrees centigrade and by testing the device for 10 minutes from 23.00 to 23.10 we saw the slight fluctuation from 25 degrees to 24 degrees.

The second field is the humidity field which is determined by the DHT11 sensor. This shows the percentage of the vapor present in the atmosphere and at the time of testing we see a little fluctuation only because the testing time which was graphed was for 10mins.

The rest of the field 3 and field four shows the fluctuation of the pressure and while testing this prototype we were varying the height to see the change of the altitude from sea level.

VIII. CONCLUSION

In conclusion, the changes in weather conditions such as temperature and humidity may be reflected negatively or positively with environmental activities and agricultural projects by using IoT.

This research was done and it obtained an electronic system that can monitor temperature and humidity accurately and instantaneously at a local area, rather than the readings that are provided from the news station and the Internet.

This paper is an open gate for further studies and experiments concerning weather parameters, as it will help to provide the base ground for the researchers to learn more and discover on this topic.

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