R & D Project Report

Academic Year- 2022-23

On

Design and development of smart weather station

Submitted by

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(Computer Science)

Under supervision of

Prof. Jetendra Joshi

NIIT UNIVERSITY

THE UNIVERSITY OF THE FUTURE

Industry-linked | Technology-based | Research-driven | Seamless

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CERTIFICATE BY SUPERVISOR

This is to certify that the present R&D project entitled **Design and development of smart weather station** being submitted to NIIT University, Neemrana, in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology, in the area of BT/CSE/ECE/GIS, embodies faithful record of original research carried out by **Himanshu Choudhary** They have worked under my guidance and supervision and this work has not been submitted, in part or full, for any other degree or diploma of NIIT or any other University.

Place: NIIT University

Jetendra

Prof. Jetendra Joshi with signature

Date:25/05/2023

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DECLARATION BY STUDENTS

We hereby declare that the project report entitled **Design and development of smart weather station** which is being submitted for the partial fulfillment of the Degree of Bachelor of Technology, at NIIT University, Neemrana, is an authentic record of our original work under the guidance of **Prof. Jetendra Joshi**. Due acknowledgements have been given in the project report to all other related work used. This has previously not formed the basis for the award of any degree, diploma, associate/fellowship or any other similar title or recognition in NIIT University or elsewhere.

Place: NIIT University

Date:25/05/2023

Himanshu Choudhary	**Computer Science**	**Signature**	Himanshu Choudhary

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1. Abstract

A smart weather and soil management system's design and development is a difficult process that requires careful consideration of numerous factors. By giving them access to real-time information about the weather and soil conditions, this technology is intended to assist farmers and agriculturalists in making better judgments.

The hardware implementation of this system consists of the development of sensors that are useful in measuring the temperature, humidity and rainfall content in a region. Collected data is

sent to the central hub (connecting the sensors) for processing and then pushed to a cloud-based platform to analyze.

Gathered data can prove to be useful for making informed decisions regarding agricultural practices. Another useful importance of the weather data is in the field of climate predictability. The farmers around the world can utilize the weather data to their benefit by planting and harvesting the crops according to the forecast information.

Ensured scalability, power consumption and robustness is incorporated mindfully in the design of the sensors.

Research based on design and development of a smart weather station proves to be an important step in this development era. Overall, the system is carefully designed to cater the need of the farmers, agriculturists and ensure food security for the entire population. From taking informed decisions to increase in crop yields due to the real-time information about the weather conditions, this research paper proposes a system to cater all such requirements.

2. Introduction

The economy of all the developing countries is based on the agriculture sector of that country. The consistent production of food and additional requirements ensures that the population is well nourished. The weather conditions play a prominent role in the agricultural practices led by the farmers. Uncertainty of weather conditions proves to be challenging for farmers and agriculturists to ensure prosperous crop yields. Catering the needs of the agriculture sector is increasingly becoming a priority in the research field.

Multiple sensors, to collect information on temperature, humidity and rainfall, are connected to design the overall structure of the system. Collected information travels from the sensors to a central hub for being analyzed which further leads it to being uploaded on a cloud-based portal, where the end consumers can access the real-time data.

Smart weather stations are responsible for collecting real-time data and transmitting them using various connected sensors. The obtained data is transmitted using the internet to any electronic device capable of displaying the gathered information in a user-readable format. These weather stations have an edge over the traditional weather stations in the terms of accurate information, access to data being received from a distance and the advantage of viewing real-time weather information.

To accomplish this, we have to incorporate a modeling and implementation framework to ensure that the system is curated in a systematic way.

Objective of the framework being designed is to provide power efficiency, accurate information and instant data processing.

A seamless user experience, including user interface and data visualization, is an inevitable priority of the design to ensure easy access to the weather data.

Overall, a methodical procedure including modeling and implementation is essential in the design of an efficient weather station. To support data accuracy and real-time information, the curated framework should be power efficient, accurate with the results and promote a seamless user experience.

The research paper also studies the difficulties encountered in developing and implementing a system with power efficiency, robustness and scalability as its top features. The research highlights the revolutionizing potential held within the smart weather station by ensuring food security and proper support to the agriculture sector by giving farmers access to real-time data that can help them with making informed decisions.

3. Related Works

Building smart weather and soil management systems for precision agriculture in smart cities has gained popularity in recent years. The LoRa-based intelligent soil and weather condition monitoring system with IoT, which Singh et al. (2021) demonstrated, is one such system. This system transmits real-time data on temperature, humidity, rainfall, soil moisture, and other pertinent parameters to a cloud-based server using low-power long-range radio (LoRa) technology. Through the use of precision agriculture, the system's data can help farmers manage their crops more effectively and increase their total production.

Faid et al. (2021) present their Agile AI and IoT-augmented smart farming system as a further cost-effective smart farming option. The system incorporates a cognitive weather station that gathers and analyzes weather data using IoT and AI technologies. The method is appropriate for small-scale farming operations because it is made to be scalable and economical.

Similar to this, Shahadat et al. (2018) suggest an effective Internet of Things-based weather station that may be applied to precision farming. The system makes use of inexpensive sensors to gather information on the weather and soil moisture, which is then sent to a cloud-based server for analysis.

Smart sustainable agriculture systems have also been developed using machine learning and AI. A survey of several machine learning and AI techniques that have been used to crop management and yield prediction is given by Menaga and Shanmugam (2021). The authors go over how these methods might be applied to raise crop productivity and make the best use of available resources.

Urban sectors are placing a lot of emphasis on smart irrigation systems that use IoT and AI. A smart irrigation system that automates the processes of irrigation and soil management is suggested by Rajesh Kumar et al. (2018). The system includes sensors for measuring soil moisture and optimizes watering based on weather predictions.

Currently, we urgently need an automated system to control crop yields and soil conditions. An IoT-based smart agriculture system for efficient crop planning is suggested in the study "An IoT Based Smart Agriculture System for Efficient Crop Planning" by S. Manikandan et al. (2018). This system would use IoT to track crop growth and give farmers the information they need for crop planning. Sensors that measure soil moisture, temperature, and humidity are used to collect data, while cameras are used to examine crop growth. Farmers can access the data after it has been analyzed using machine learning algorithms.

Utilizing smart farming methods, prediction models for precision agriculture have also been created. A thorough analysis of smart farming prediction models is provided by Kwaghtyo and Eke (2021), who also explore their benefits and drawbacks. The authors also offer information about how these models can be adjusted for various crop varieties and growth environments.

Finally, methods for spatiotemporal modeling have been used to forecast soil moisture for intelligent irrigation that is sustainable. A spatiotemporal model that forecasts soil moisture levels based on meteorological information, soil properties, and land-use patterns is presented by Yarehalli et al. (2020). The authors provide examples of how this model might be applied to improve irrigation scheduling and protect water supplies.

The ability of smart agriculture systems to increase crop yield and maximize resource use is causing them to become more and more popular. Various IoT-based solutions have been put forth by researchers to address the difficulties that modern agriculture faces. In order to monitor soil moisture levels and adjust irrigation as necessary, Gokul Krishnan et al. (2019) created a smart agricultural monitoring and irrigation system. Similar to this, Velayudhan et al. (2022) explore IoT-enabled water distribution systems in their paper titled "IoT-enabled water distribution systems-a comparative technological review" and offer a thorough analysis of these systems. The authors compare and contrast various IoT-based water distribution systems, highlighting their benefits, drawbacks, and difficulties. They also go through the various technologies and protocols employed in these systems, such as big data analytics, cloud computing, sensors, actuators, and communication protocols. A Smart Farming strategy for emerging economies is proposed in the study "Smart Farming For Emerging Economies A LoRaWAN Based Approach" by Kimogol et al. (2019) and is based on the LoRaWAN technology, which is an LPWAN protocol. The system designed by the researchers uses LoRaWAN sensors and gateways for tracking several environmental factors such as temperature, humidity and water level.

Kolhe et al. (2020) suggests in their study, a cloud based temperature and humidity examining system for predicting and monitoring reasons. Gathered information using the sensors is utilized by the system and examined and processed by a cloud-platform.

Huang et al. (2021) discusses in his paper the idea of IoT based intelligent automated weather station (IAWS). The intentions behind curating IAWS was to gather and monitor meteorological real-time data and give access to accurate weather information, helpful to the urban agriculture sector. Another paper by Marwa et al. (2020) discusses developing a cost efficient weather station and IoT based monitoring system for agriculture. System discussed in the paper comprises sensors measuring temperature, humidity, soil moisture and intensity of the light.

Sensors, responsible for collecting and transmitting data to a cloud-based platform for further examination, are connected to a microcontroller. The design and execution of a low-cost smart weather station using Arduino and ZigBee technologies is presented by Hussein et al. (2020). A microprocessor called an Arduino is attached to sensors for temperature, humidity, wind speed, wind direction, and rainfall. The sensor data is processed by the microcontroller before being wirelessly transmitted to a ZigBee module, which subsequently delivers the information to a base station. A paper on an IoT-based smart garden with a weather station system was presented by Bin Sadli et al. in 2019. For data collection on temperature, humidity, soil moisture, and light intensity, the system integrates a number of sensors. Wirelessly transmitting the gathered data to a cloud-based platform allows for analysis and visualization for user-friendly interpretation. A case study on intelligent weather forecasting using machine learning in Tennessee was given by Jakaria et al. in 2020. The scientists created a weather forecasting model that could forecast the local temperature, humidity, and precipitation using machine learning techniques. An IoT-based smart weather monitoring and real-time alarm system was discussed in a work by Rahut et al. (2018). A network of sensors is used in the system to collect information on temperature, humidity, and rainfall. Wirelessly transmitting the gathered data to a cloud-based platform allows for real-time analysis.

In order to monitor and manage soil health, A. G. Patil et al. (2021) proposed a smart agricultural system that employed IoT and machine learning. The system gathers data on soil moisture, pH, temperature, and humidity in real-time using a variety of sensors. Last but not least, M. T. Islam et al. (2021) suggest utilizing IoT and machine learning to create a smart weather monitoring and forecast system for precision agriculture. Sensors for measuring temperature, humidity, pressure, rainfall, and wind speed are part of the system. Additionally, a bibliometric study was carried out by Abdollahi et al. (2021) to determine the present state of research on wireless sensor networks (WSNs) in agriculture. The authors examined 405 pertinent publications published between 2000 and 2020 using information from the Web of Science database.

In conclusion, research suggests that precision agriculture can greatly benefit from smart weather and soil management systems.

S.No	Paper	Cost	Scalability	Security	Reliability	Evaluation
1.	LoRa based intelligent soil and weather condition monitoring.	**NO**	**NO**	**NO**	**NO**	**NO**
2.	Efficient IoT-based Weather Station	**NO**	**NO**	**NO**	**NO**	**NO**
3.	Smart Sustainable Agriculture Using ML & AI	**NO**	**NO**	**NO**	**NO**	**NO**
4.	Smart Farming Prediction Models For Precision Agriculture	**NO**	**NO**	**NO**	**NO**	**NO**
5.	Smart Weather Data Management Based on AI	**NO**	**NO**	**NO**	**NO**	**NO**
Our Initiative	Design And Development Of A Smart Weather System	**YES**	**YES**	**YES**	**YES**	**YES**

Table 3.1: Comparative Study Table

4. Proposed Methodology:

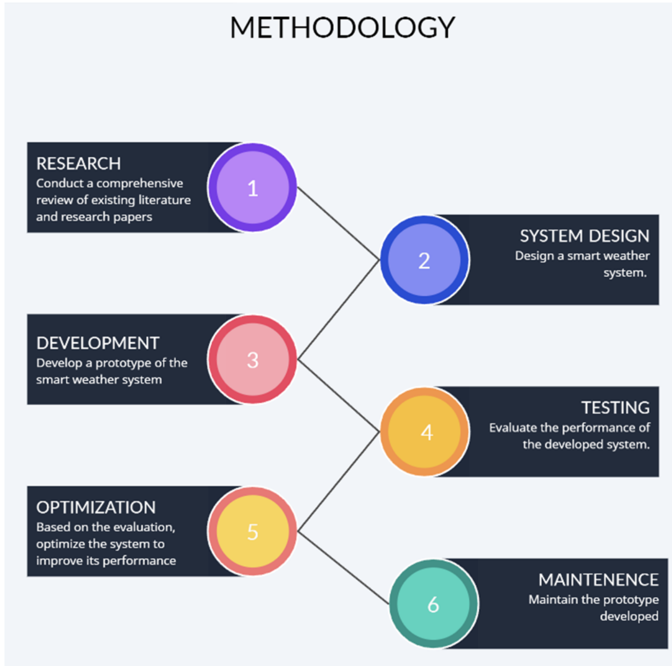

Fig 4.0 Methodology

The study of numerous research papers and the drawbacks mentioned in each of them, we have curated the following procedure to complete our initiative efficiently.

Research: Gather information by studying and analyzing various research papers on the topic. Examine the challenges and drawbacks faced by each researcher while researching on the topic to work and ensure an efficient design.

System Design: After research we move to system design. On the basis of research, we design an efficient system addressing maximum gaps and challenges faced by other researchers. The system should comprise of hardware elements responsible for data gathering and transmission along with software components for examination and processing of data.

Prototype Development: At this stage we would develop a prototype based on the above design, with the help of all important hardware and software elements. Evaluation of the prototype in a real-world scenario is appreciable to ensure its effectiveness.

Testing: Evaluate the performance of the developed system by comparing its results with the data obtained from traditional weather and soil monitoring systems. Analyze the accuracy, efficiency, and effectiveness of the system in managing weather and soil conditions for optimal crop growth.

Optimization and Future Scope: Based on the evaluation, optimize the system to improve its performance and address any identified limitations. Identify areas for future research and development to further improve the system and its applications in precision agriculture.

Maintenance: Maintain the prototype developed and keep integrating the necessary requirements with time.

Research on various sensors and cost of each sensor enabled our team to develop two sensors, namely, Rain Gauge Sensor and Cup Anemometer organically for measuring rainfall and wind speed. The sensor has been built using a permanent magnet and hall effect sensor (used to detect the presence of magnetic field).

4.1.Rain Gauge Sensor:

Fig 4.1 Rain gauge sensor

4.2. Working Model Of Rain Gauge Sensor:

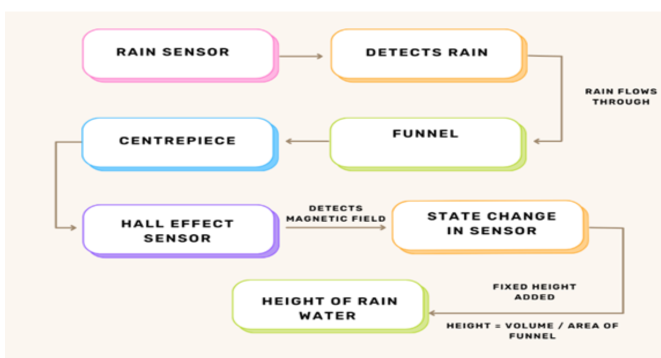

Fig 4.2 Rain Gauge Sensor Working model

1. Rain sensor helps in detecting the presence of rain after a certain amount of rain has accumulated on the rain sensor.

2. The rain water flows through the funnel to a centerpiece that has two cups with an area to accumulate a certain amount of water before it topples.

3. A permanent magnet is attached at the top of the centerpiece to enable the hall effect sensor used to detect the presence of magnetic field.

4. Due to every state change in the hall effect sensor, we increment a fixed amount of height.

5. Here the height signifies the level of precipitation(mm) in a specific area.

6. To calculate the height we divide the volume of water required to topple the centerpiece with the area of the funnel.

7. With this calculation we get the height of the water in mm. This helps us to analyze the amount of rain in a particular area.

4.3. Cup Anemometer:

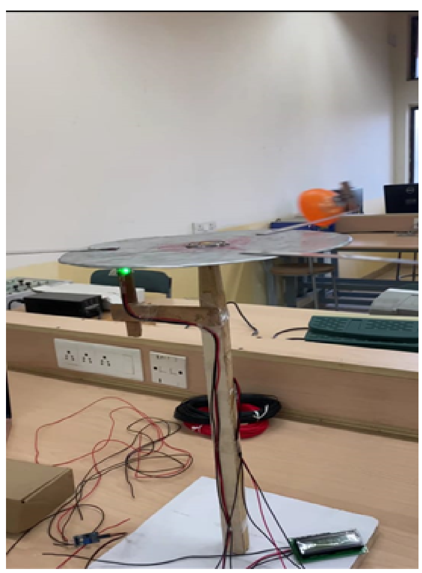

Fig 4.3 Cup Anemometer

We are measuring wind speed using a Cup anemometer. Hall effect sensor is used, since we know that it helps in detection of the presence of a magnetic field. Along with the detection of magnetic fields, the hall effect sensor acts as a catalyst in the process of measuring the RPM (i.e.

revolution per minutes) of any moving object which has mechanisms to create a change in the magnetic field around the hall effect sensor.

So in case of cup anemometer we have attached a permanent magnet over one of the blade of cup anemometer , so in every time whenever the magnetic blade of the anemometer pass above the hall effect sensor it detect the proximity of hall effect sensor and interrupt is set up on pin to detect a blade passing by. Each time the interrupt is triggered and the number of revolutions is incremented and the loop function checks if given blade revolutions have occurred or not . If it satisfies the given condition , it calculates the revolutions per millisecond and resets the revolution count, then the revolutions per millisecond are used to calculate the current speed in kilometers per hour (kph) by multiplying with the circumference of the blades and converting the result to kph.

4.4. Working of Cup Anemometer:

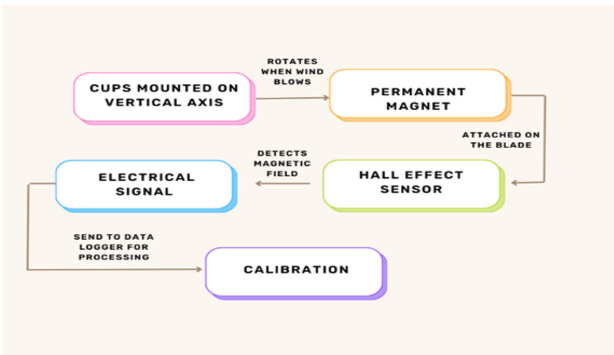

Fig 4.4 Cup Anemometer Working model

1. The cup anemometer consists of three or four cups mounted on a vertical axis that rotate when wind blows. The rotation rate is proportional to the wind speed.

2. A permanent magnet has been attached along one of the blades of the cup anemometer.

3. A Hall effect sensor is located near the permanent magnet. When the cups rotate, they pass by the magnet, causing a change in the magnetic field.

4. The Hall effect sensor detects this change and converts it into an electrical signal. The electrical signal from the Hall effect sensor is then sent to a data logger or other device for processing.

5. The data logger can calculate the wind speed based on the rotation rate of the cups and the calibration of the anemometer. The calibration takes into account the size and shape of the cups, as well as other factors such as air density.

5. Results and Analysis:

After completing the model, the team worked on the accuracy of the output generated and to store the data gathered on firebase.

A firebase project was created and configured to get data from the prototype by using a Firebase ESP Client.

The structure of the representation of the data was outlined as, pressure, temperature, latitude and longitude values.

Creation of root nodes in the database along with the child nodes for storing the pressure, temperature, latitude and longitude values was implemented.

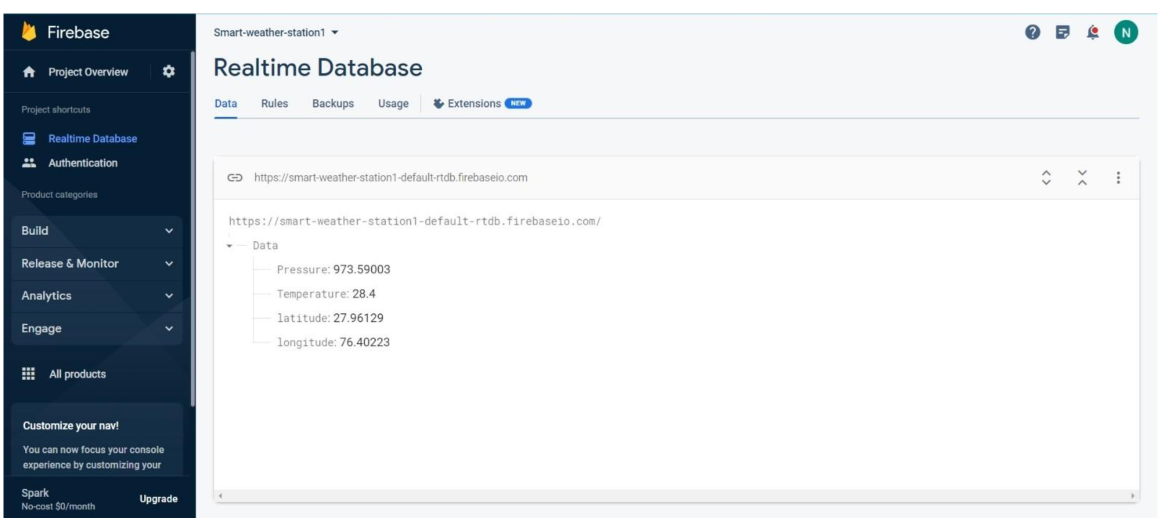

Fig 5.1 Firebase Real-time Database

5.1. Calculation of result data for Cup Anemometer:

Calibrating a cup anemometer with the help of a digital anemometer involves the following steps:

Step-1 : We have set up both anemometers (cup anemometer and digital anemometer) in an area with good wind flow, so initially we have chosen a wall fan to calibrate cup anemometer. Since a wall fan has three modes of speed, low, medium and high modes, we can monitor and compare the reading on three different modes of both anemometers.

Step-2 : Now, we have measured the wind speed using the digital anemometer and cup anemometer and recorded the reading in particular timestamps for each anemometer .

Fig 5.2 Digital Anemometer

High wind Mode	Medium wind Mode	Low wind Mode
25.30 kph	22.31 kph	20.40 kph
25.22 kph	22.28 kph	20.45 kph
25.35 kph	22.20 kph	20.50 kph
25.28 kph	22.24 kph	20.55 kph
25.25 kph	22.35 kph	20.38 kph

Table 5.1 Reading of Digital Anemometer

High wind Mode	Medium wind Mode	Low wind Mode
8.34 kph	6.20 kph	4.30 kph
8.38 kph	6.34 kph	4.55 kph
8.25 kph	6.30 kph	4.45 kph
8.30 kph	6.25 kph	4.48 kph
8.40 kph	6.45 kph	4.33 kph

Table 5.2 Reading of Cup Anemometer

Difference High wind Mode	DifferenceMedium wind Mode	Difference Low wind Mode
16.96 kph	16.11 kph	16.10 kph
16.84 kph	15.94 kph	15.90 kph
17.10 kph	15.90 kph	16.05 kph
16.98 kph	15.99 kph	16.07 kph
16.85 kph	15.90 kph	16.05 kph
MEAN : 16.946 kph	MEAN : 15.972 kph	MEAN : 16.034 kph

Table 5.3 Corresponding Difference of both Anemometer on different Mode

Since, Calibration factor is Mean of difference Hight , Medium and Low wind Mode :
Calibration factor = (16.946 + 15.972 + 16.034) ÷ 3 = 16.31733333
The approximate value of 16.31733333 up to two decimal points is 16.32.

Therefore , Calibration factor = 16.32.

Hence , we are able to get the desired results by adding the Calibration factor with the formula of wind speed .
Some of snapshot sample output of digital and cup anemometer on particular timestamp

Fig 5.3 Digital Anemometer Output

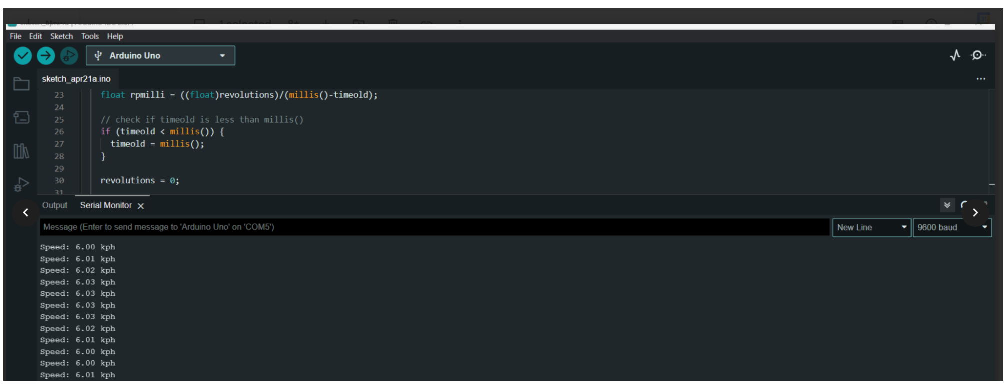

Fig 5.4 Cup Anemometer Output

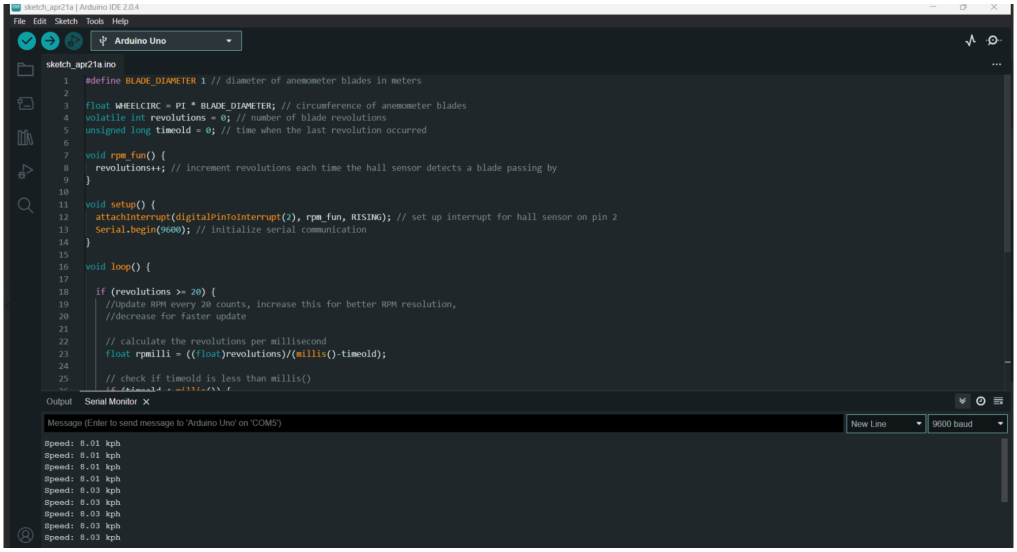

Fig 5.5 Cup Anemometer Output

Step-3 : Plot the Graph Between the the Difference mode on cup anemometer and Digital Anemometer

5.2. Calculation of result data for Rain Gauge Sensor, Rain Sensor and BMP180:

First we are measuring the Temperature and pressure in °C and hPa by using BMP180 sensor which is connected to the ESP8266.

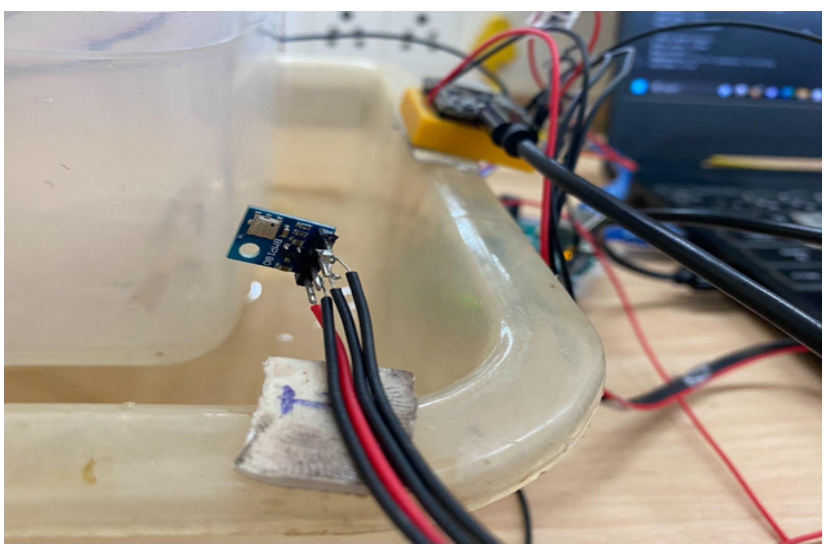

Fig 5.6 BMP180

Then we are using a Rain sensor to know if rain is falling in a region or not ,we have connected the rain sensor to a digital pin of ESP8266.

· Plate is dry when there is no rainfall then it gives us a digital output zero

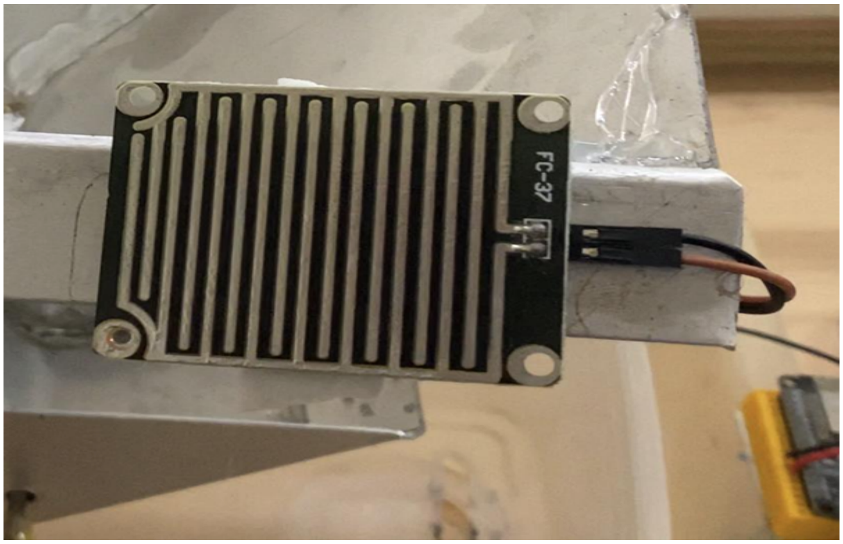

Fig 5.7 Rain sensor Plate (Dry)

· Plate is wet then it gives us a digital output as one.

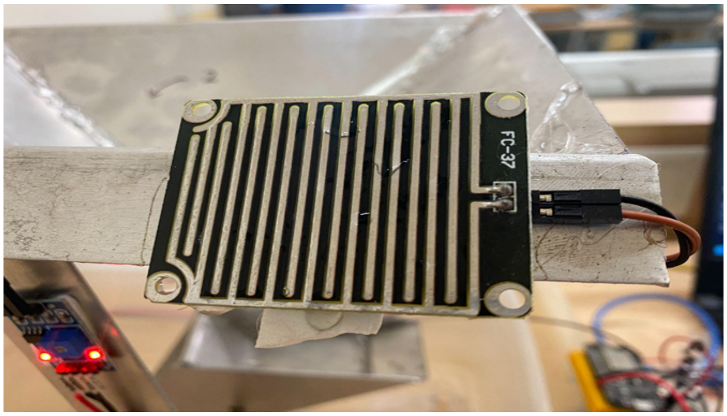

Fig 5.8 Rain sensor plate(Wet)

Rain gauge sensor is using the hall effect sensor to gather the data of state change of hall effect sensor which is happening because of the magnet connected to the centerpiece and in this way calculating the amount of rainfall in mm by incrementing a certain value for every state change of the hall effect sensor and we have that logic in our ESP8266 microcontroller and connected the hall effect sensor to a digital pin of ESP8266.

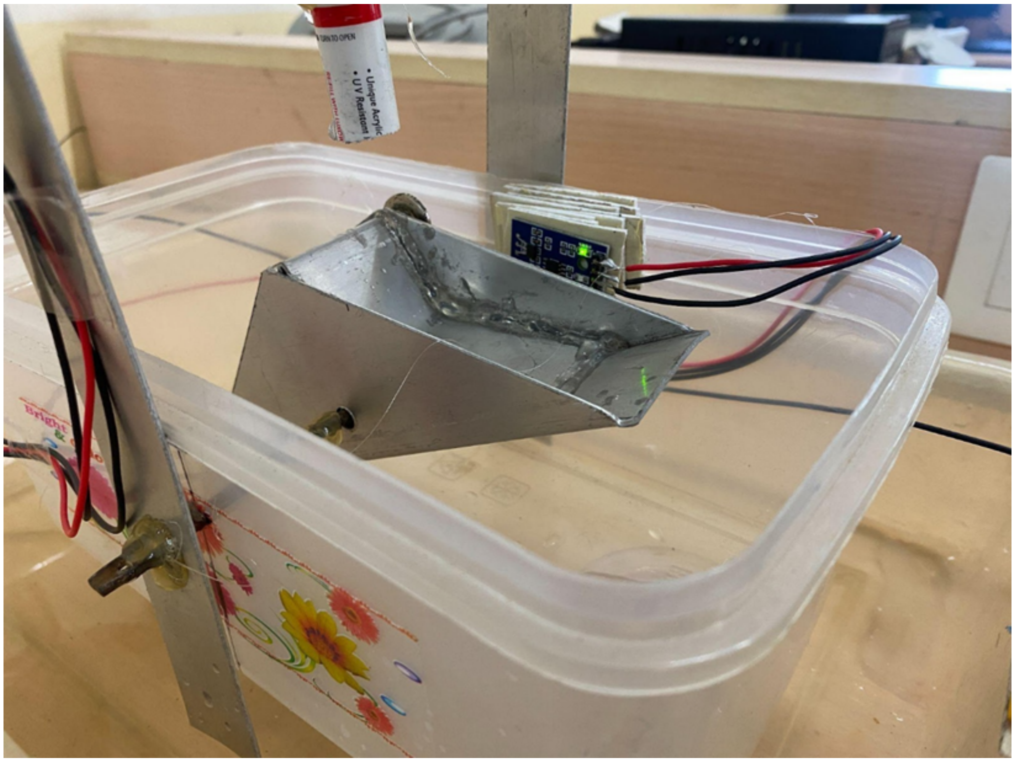

Fig 5.9 Rain gauge sensor

Latitude and longitude are calculated to identify the location of the smart weather station for which we are calculating the results.

ESP8266 is further connected to wifi and authenticated with firebase to send this data to firebase.

Result data before and after raining-

In our prototype we observe that, before raining our prototype shows the data of temperature, pressure, latitude, longitude and as it is not raining the Rain status is 0 and Total rain is also zero. When it starts raining the rain gauge sensor reading will change and also the rain status and that will be reflected on the realtime database.

5.3. Result data on firebase:

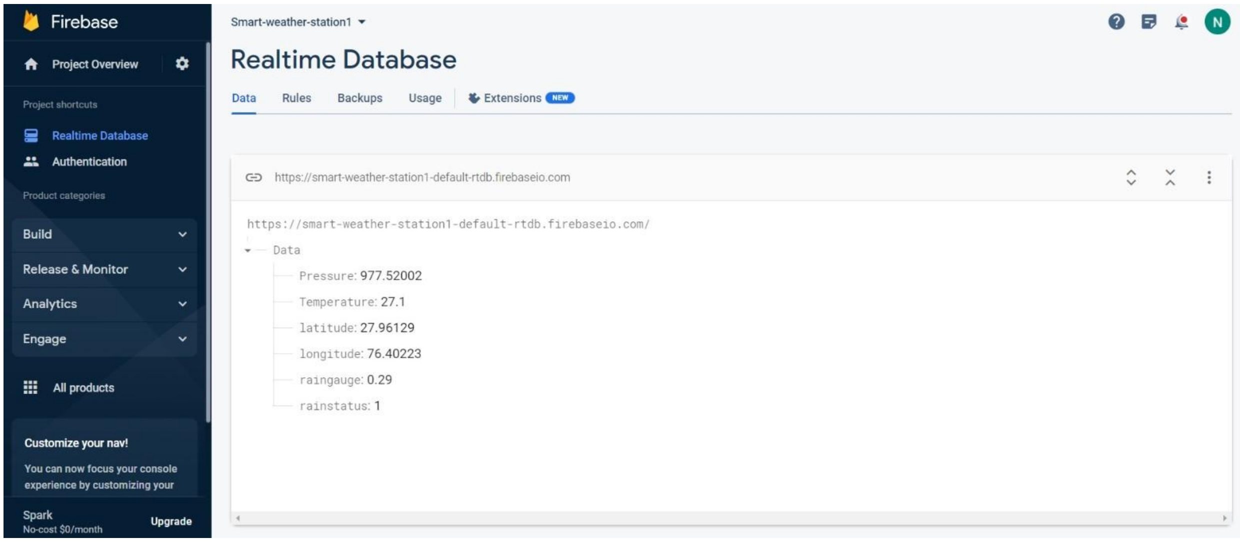

Fig 5.10 Firebase Realtime Database

5.4. Comparative Analysis between Internet-sourced Data and Prototype-derived Data

Internet-sourced Data vs Prototype derived data from BMP180

Data obtained from accuweather.com on 25th May 2023 in the time interval of 10:00 AM to 10:00 PM of temperature in degree celsius and pressure in hectoPascals (hPa) of Neemrana and in the scale of Time(Hrs) 0 corresponds to 10:00 AM and 12 corresponds to 10:00 PM

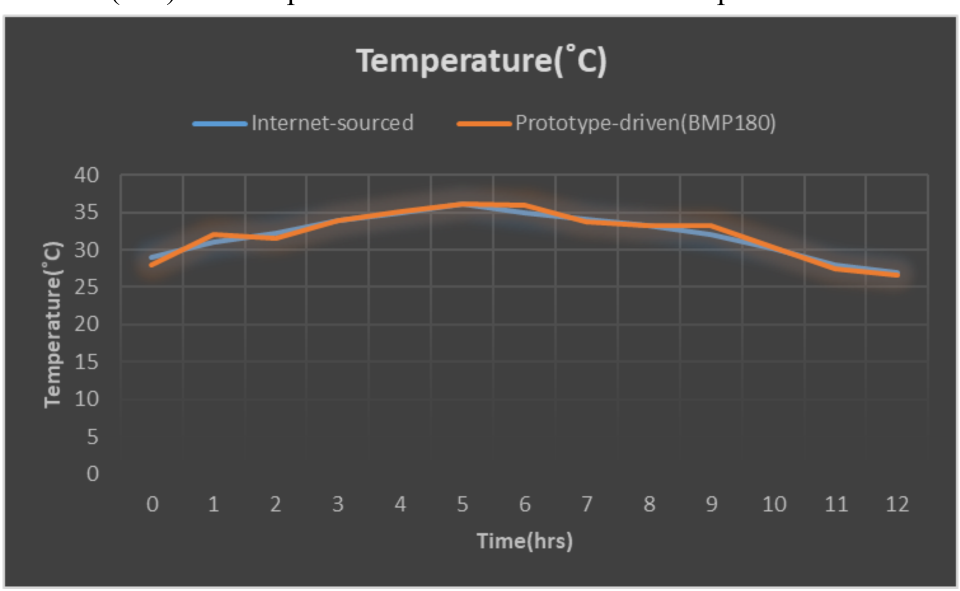

Fig 5.11 Internet-sourced Temperature Data

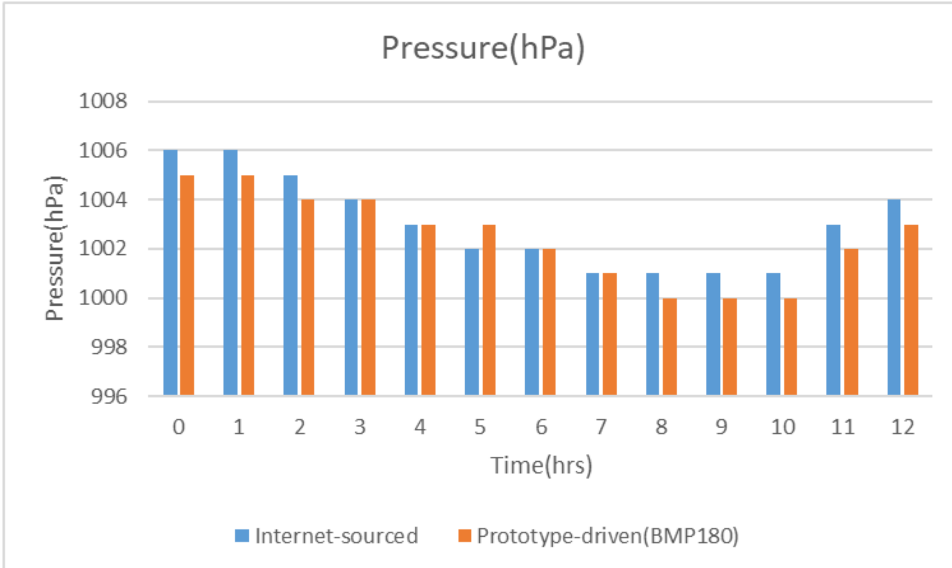

Fig 5.12 Internet-sourced vs Prototype-driven Pressure Data

For error calculation for temperature data we can do so from the table

Time(hrs)	Internet-sourced	Prototype-driven(BMP180)	Error Percentage
0	29	28	3.448%
1	31.1	32	2.889%
2	32.2	31.5	2.177%
3	34	34	0%
4	35	35.2	0.571%
5	36.1	36.1	0%
6	35	36	2.857%
7	34.1	33.7	1.173%
8	33.2	33.2	0%
9	32	33.2	3.75%
10	30.2	30.4	0.662%
11	28	27.5	1.786%

12	27	26.6	1.481%

So, from the above table we can calculate the average error that came out to be 1.598%
Following the same procedure as done for temperature the error percentage for Pressure came out to be 0.06900868%

5.5. Integration of Real-Time Data and Google API for Sensor Data Visualization in an Android App using Kotlin

Effective mobile application development demands the effective use of technologies such as real-time data retrieval from remote locations like Firebase as well as features such as real-time sensor analysis, and location-awareness components powered by Google API on map-based platforms like Android systems. This study examines these concepts critically by building an operational Android app using the Kotlin programming language

Key technology used: real-time data, Firebase, Google API, Android app, Kotlin, sensor data, longitude, latitude, and data visualization.

This study documents guidelines for tasks involving real-time data retrieval methods while simultaneously applying a reliable cloud-based database solution known as Firebase. Google API is equally utilized effectively for accurate location information gathering.

With these procedures suitably carried out in producing needed output signals conveniently displayed on interactive UI interfaces; readers can benefit from both technical solutions employed (Sensors) alongside library visualization components which provide engagement opportunities with dynamic databases stored on cloud infrastructures.

Real-Time Data Retrieval with Firebase
For seamless and efficient management of information across various devices, developers can utilize Firebase's high-performing databases offering consistent and effortless synchronization through frequent updates. It starts with establishing connectivity between Android applications through FirebaseSDK which then provides instant access for interaction through the associated database. It allows software apps like this study's case; to regularly monitor variables utilizingFirebase'sreliableand precise notification methods. This research on creating ideal solutions uses Firebase's basic properties of retrieving temperature and pressure values to implement real-time monitoring.

Integration of Google API for Location Data
The research uses the Google API to get longitude and latitude data to improve the app's functionality. The app has access to the device's location information by using the Google Play

Services Location API. The app can retrieve the current position coordinates by using this API, which offers location updates and geocoding services.

Android App Development with Kotlin

Kotlin, a cutting-edge programming language that offers terse and expressive syntax, is used to create the Android app. When it comes to developing Android applications, one must consider using Kotlin as an option. This programming language blends well with established Java codes effortlessly, making the process much smoother. For displaying information effectively on screen, developers made sure that the Graphical User Interface (GUI) design was aimed towards fostering easy operation via simplicity while enhancing data visualization capabilities accurately.

Data Visualization on the App Front End

A beautiful visual representation of real-time sensor data alongside accurate location information awaits users on the app front end. To ensure clarity in understanding this data, several graphical components were incorporated into the interface—including charts, graphs, as well as maps displaying longitude and latitude details. Meanwhile! The GUI effortlessly updates pressure and temperature data in order to enable continuous seamless live monitoring activities.

5.6. Security:

Dos Attack :

Tool used :

1. **Hping3:** With hping3, you can choose how often and when to send packets, as well as how to create and edit packet headers. It is frequently used to test the security of networks and devices by network managers, security experts, and ethical hackers.

Or

2. **Low Orbit Ion Cannon (LOIC):** LOIC is a popular open-source tool that may be used to flood a target system with TCP, UDP, or HTTP data.
3. **Motives of an attacker :** The attacker may have any malicious intent on the organization in which the attacker may want to spoil the company reputation and may be also the financial gain , may be by expecting some ransome from the organization
4. **Attack Vector :** Attackers may or may not follow the same vector as if other attackers used to; in the following section, the attack's illustration will be shown. Denial of

Service: As the attacking vector of the attacker and following the procedures show, the Denial of Service primarily affects the Availability Triad in the traid cycle.

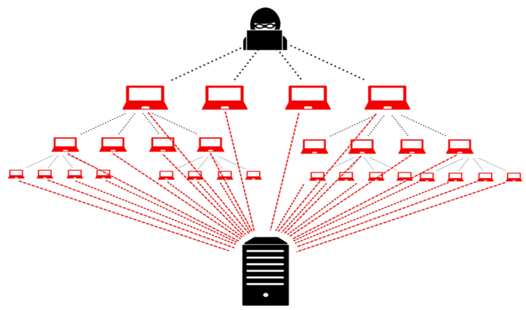

Fig 5.13 Illustration of An attacker creating a bot network and flooding a server

Outcomes :

● Here we are going to quickly demonstrate simply running both VMs from the perspective of both attacker and victim's perspective as the attacker is using Linux and the victim's system is taken as Windows

● And now we are going to use a tool which is hping3 as it is used for the packet flooding through a designated IP of the victim and here the Nmap is used for port scanning

● Firstly we need to scan the ports in the victim system and analyze the open ports in the victim system and then attacker manages to find the most vulnerable among all and executes the packets through that open port

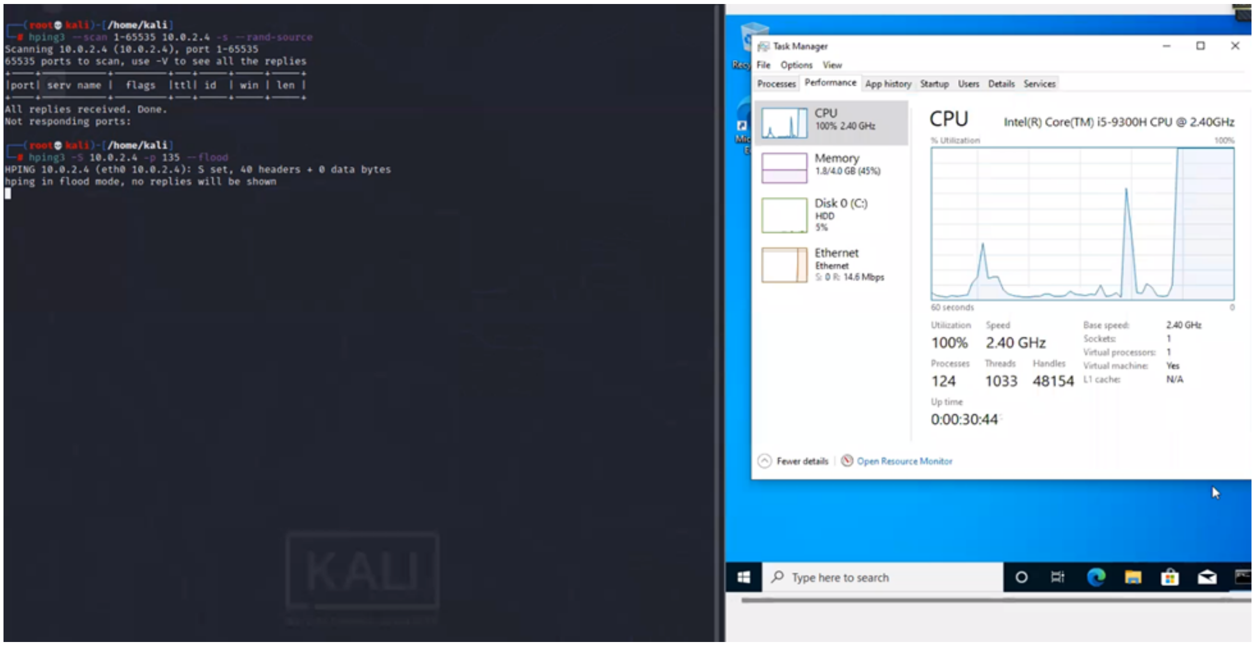

Fig 5.14 Illustrated Results of a virtual machine which is acting as a victim of Dos attack

Mitigation of Dos/DDoS Using Snort IPS/IDS :

- IDS/IPS: The Open source IPS/IDS Snort is the most popular in the world, The IPS which is Snort finds the packet which is going against the set of rules, it is helped for identifying harmful network behavior , and gives prompt and Alerts for the users

- With that being said , Snort can be implemented in the organization for blocking these kind of harmful packets,Basically the Snort is mainly works on three applications as a tool called tcp dump , for working like packet logger which may be helpful in troubleshooting traffic of network

Procedure for setting up :

- After the prior installation of Snort IDS/IPS in Ubuntu linux machine. In the respective file where we should be writing the rules which needs to be followed while the IDS/IPS is working according to the rules

- We can customize our rules according to the requirements of the individual organizational needs

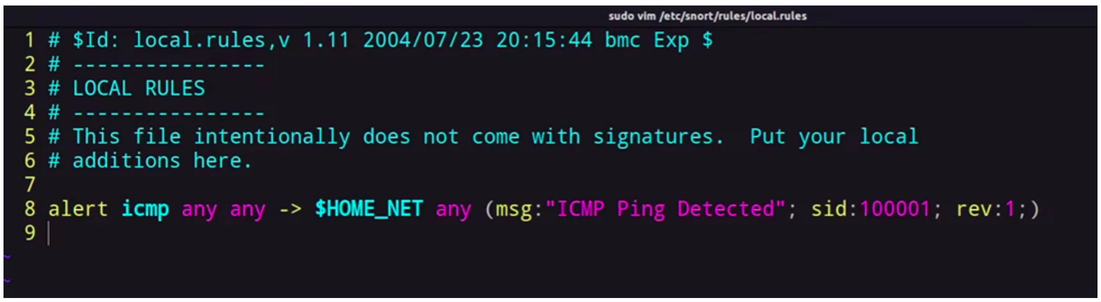

Fig 5.15 Creating Rules Using Vim editor

- After Snort being kept in the active state

- In the above Fig as we can see that snort is actively working as it gives a number of prompts as they are incoming packets which are ICMP

6. Conclusion and Future Scope:

In conclusion, this report presents the design and development of a smart weather system utilizing IoT (Internet of Things) and AI (Artificial Intelligence) technologies. The system was developed to address the need for efficient monitoring and analysis of weather conditions in real-time. AI technologies such as machine learning and deep learning models are employed to derive meaningful insights and predictions from the collected data. The evaluation of the system demonstrated its effectiveness in providing accurate and actionable information for weather and soil management. Overall, this research contributes to the advancement of smart farming due to real time weather updates and underscores the significance of IoT and AI in transforming traditional decision making skills of farmers post the dataset available with them.

Future Scope:

Some potential future scopes include:

1. **Data Storage:** We can store the data gathered over a period of time, from our smart weather station on a database.
2. **Data Modeling:** We can model the stored data using AI and ML algorithms, for predicting several weather-related parameters such as temperature, pressure, precipitation, wind speed etc. These predictions are valuable for a wide range of applications, including agriculture, transportation, outdoor activities, energy management, and urban planning. The accuracy and availability of these predictions can significantly impact decision-making and planning in various sectors.

By exploring these future directions, the smart weather and soil management system can continue to evolve, revolutionizing agriculture practices and contributing to the development of a more sustainable and productive farming industry.

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