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IoT Based Predictive Model for Cloud Seeding

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Abstract- Weather prediction is an attempt to predict the conditions of weather in the near future and what should be expected from the weather. The parameters which determine the conditions are temperature, humidity, wind.We will consider temperature and humidity to predict the future weather conditions. The data will be collected from DHT11 sensor and FC-37, they are low-cost sensors which are used to collect temperature, humidity and rain values. The sensors installed on the raspberry pi collects the data and stores it in the pi. The data is stored in the form of CSV file which is used for analyzing the data further. R is used to do analysis on the data collected. R is a very effective language and software for analyzing data and comes with many inbuilt functionalities for statistical data analysis. The motive is to find situations in which drought could occur and generate artificial clouds over the place for temporary relief.

Keywords: Weather, Internet of Things (IOT), Cloud Seeding, Artificial Rainfall, Temperature, Humidity, Rainfall.

I. INTRODUCTION

We aim to create a system which studies the weather and raises a concern for drought-like conditions which can be further used to seed clouds over the area to improve the conditions temporarily. It employs an embedded system using Raspberry Pi to monitor weather conditions. Being an expensive technology, cloud seeding cannot be used anywhere and everywhere. We need to pin-point areas which are severely in need of rainfall. A temperature and a rain sensor will monitor the climate condition of an area for over four months with the help of a Raspberry Pi. If the average temperature is

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over 40° C accompanied with little or no rainfall, the pi will trigger an alarm which can be used as a signal for cloud seeding. The purpose is to find the conditions in which we may require the need of seeding clouds over an area to bring down temperature and increase the water level to prevent severe conditions such as a drought with the help of a compact device, i.e. Raspberry Pi 3. The prototype system uses Raspberry Pi which is an open source hardware; and weather sensors which consume low power and are cost effective. The pi has an inbuilt 802.11 wireless LAN which can be used to connect to the internet and store data on the cloud to be used or accessed from anywhere in the world, it can also be used to directly to send the results and reports. It has faster processing speed than most of the similar type of hardware available. The data gathered by the sensors is sent to the Raspberry Pi for processing and delivering results which can later be used by the Indian Metrological Department or the state government to decide if the area is in need cloud seeding. Organization of the paper is as follows. Section II describes the motivation of the research. Section III describes the objective. Section IV describes the related work. Section V describes the architecture and proposed system. Section VI describes the hardware components and software used. Section VII is the conclusion of the paper.

II.LITERATURE SURVEY

So far there are various weather monitoring systems which primarily focus on measuring the different aspects of weather such as temperature, humidity and rainfall. All of these system collects data, processes them and display their results on a screen. Other systems focus on barometric pressure along with temperature and humidity and still displays the same result on a screen using GUI and MATLAB (Lanre Joseph & Umoru Sam 2012) [1]. A low-power wireless sensor for online ambient monitoring by Folea S. C. &Mois Gtalks about a compact system that helps in monitoring the levels of CO2 in the air, temperature and other weather values. The device built can be used for low cost detection, processing and measuring of data [3]. One approach to weather station design based on rasberry pi platform by Savić T. & Radonjić M talks about which takes information about the weather by using parameters such as humidity, air temperature,

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pressure of atmosphere by using the desired sensors. It then transfers the data from one point to a location far away using UDP protocol and real time data transfer as a solution to cost reduction [4]. Environment Monitoring System aims to create a system with the help of miniature sensors with WSN which can be used at any scale, universally, to monitor the parameters. The users can access the data through internet with the help of web server. The system aims to help farmers by providing them future weather information [13]. A Monitoring System Based on Wireless Sensor Network And An Soc Plateform In Precision Agriculture by Jzau-Sheng Lin,Chun-Zu Liu talks about a WSN field monitoring system which collects field signals using sensors and then convert them digital signal which is then displayed on a web page [8]. A reliable and feasible remote sensing system for temperature and humidity measurement [5] deals with the recording of humidity and temperature using the combination of analogue and circuit with different techniques of programming in order to create a remote system for monitoring of temperature and humidity. Arduino based weather forecasting station by Ucgun and Kaplan talks about using adruino based processor for minimizing cost. Such small stations can be given to individual user to get weather data on their own adruino based hardware [11]. Automated irrigation and fire alert system based on hargreaves equation using weather forecast and ZigBee protocol by Sirohi, Tanwar usesautomated irrigation system with the use of WSN and zigbee. It uses different nodes to keep track of smoke, temperature and humidity which sends sms or an update to the land owners in case of a miss happening such as a fire [15]. Low Cost Real-Time Syxtem Monitoring using Raspberry Pi uses deals with the creation of a low cost system which provides surveillance without using much space and keeping anomalies to a minimum. The paper follows motion detection for activation and saving storage space when nothing else is happening. This helps in reducing the size and saving the cost of buying expensive hardware for continuous 24x7 surveillance [14]. System of Wireless Temperature and Humidity Monitoring Based on Arduino Uno Platform [10] is used as a control system. The system uses a DHT11 and a temperature sensor and the data is

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transmitted through WSN and a LCD is used to display the results. Raspberry pi-based weather monitoring system by Meetali and Jaideep talks about implementation of a weather station prototype model, while keeping in mind various techniques of monitoring weather. The main objective of the paper is to record and display the weather information [2]. AutomatedThingSpeak Weather Monitoring System [12] is an automation station which can be used for the automation of many systems. It uses the BMP180 sensor which is used to 771 collect data and represents data in a graphical format. It is programmed in Python. The data is stored into google spread sheets. Globally accessible machine automation using Raspberry Pi [9] uses Pi as a brain to think and control other devices with the help of sensors. The Pi is connected to all the appliances as customized by the user to connect the devices. The cloud helps in controlling the pi from wherever necessary. Low-cost controller-based weather monitoring system by Kamarul talks about the developing a device which studies the pressure and temperature using digital and analogue components and to display the measurements, are using a LCD screen. They are using a GUI PC to transfer the data onto the hard disk of the computer and then using it to process the data collected by the device [6]. We are not only focusing on displaying the weather forecast but tackling a more complex problem. Our work does not finish after collecting, storing, analyzing and displaying data. We also focus on using this data to help create artificial rainfall by providing the potential areas which may suffer from conditions that can bring water scarcity and can be very difficult to live in. Weather forecasting using raspberry pi with internet of things (IOT), For this we make use of the raspberry pi, which is faster, cheaper and uses less energy compared to similar devices.

III.PROPOSED SYSTEM

The proposed work collects data, stores it and analyzes it. Appropriate sensors are used to collect different real time data. DHT11 sensor is used to collect the temperature and humidity values, FC-37 sensor is used to collect rain data. The aggregated data is stored as CSV.

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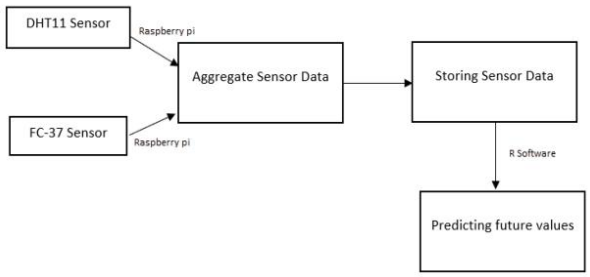

Fig. 1. System Architecture

The hardware connections are made as per requirement. Here, the Raspberry Pi is connected to two different sensors, one of them being the DHT11 for temperature and humidity and the other being FC-37 for Rain.

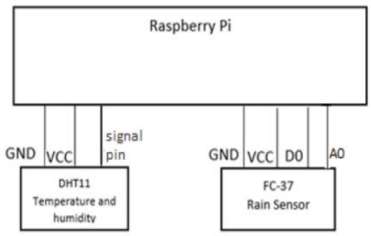

Fig. 2. Circuit Diagram for Data collection

The Raspeberry pi is connected to the DHT11 through GND, VCC and Signal pin. The GND of DHT11 is connected to the GND pin of Pi, the VCC pin of DHT11 is connected to the 5V pin of Pi and the Signal pin of DHT11 is connected to the GPIO 4 pin of Pi. Similarly, GND pin of FC-37 is connected to the GND pin of Pi, VCC pin of FC-37 is connected to the 3V3 pin of Pi, and D0 pin of FC-37 is connected to the GPIO18 pin of Pi.

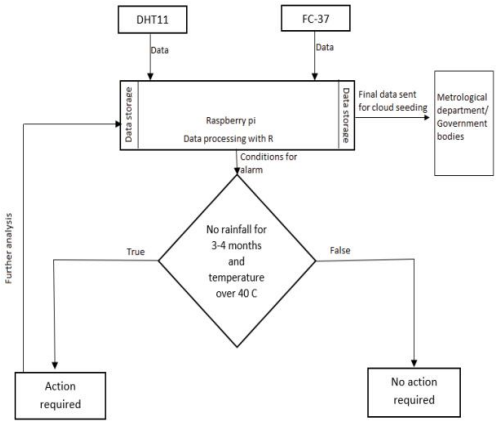

Fig. 3. Conditional diagram

Figure 3. Shows the sensors – DHT11 and FC37 sends data to the Raspberry pi where the data is stored, processed and analysed. The analyzed data gets checked for the condition of no rainfall and high temperature. If both the conditions are true, the pi sounds an alarm and the data is further processed to generate report and alert the concerned authoroties. If one or 772 both the conditions are false, there is no need to take any action.

INTERNATIONAL JOURNAL OF TECHNO-ENGINEERING
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Fig. 4. Flowchart

Figure 4. Shows the flow of the system. Information is gathered through sensors, which is then stored and processed. The condition is checked, which decides if an action is require or not. If true, reports are generated, and information is sent to the concerned authority.

IV.RESULT

1. Hardware components

A. Board

Raspberry Pi 3 Model B [7] is a small, card sized minicomputer. It is powered with a USB cable. Raspbian is one of the many Operating System made specifically for the Pi. It is the main board used for studying the weather. As depicted in Figure 5.

B. Sensors

DHT11 (Figure 6) - It is a sensor used for reading the values of temperature and humidity (Figure 5). It is a low-cost sensor. DHT11 will be used with the Pi to collect data for studying the weather.

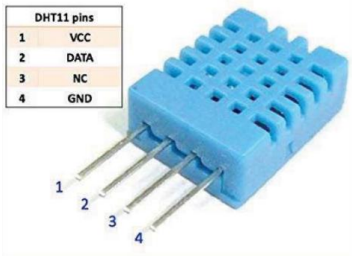

Fig. 6. DHT11 Temperature and Humidity sensor

FC-37 (Figure 7) – It is a rain sensor. It is used for detecting rain and also measuring rainfall. It is used side-by-side with

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DHT11 in our study.

2. Software Components

A. Python

Python is used as simple, dynamic language which has a vast variety of libraries available to be used. As Pi runs on Raspbian, a Unix-like OS, it is simpler and most efficient to use python. Python code for reading from CSV file: import csv, sys with open('datafile.csv','r') as csf: data = csv.reader(csf, skipinitialspace=True) data = filter(None, data) data = dict(data) SQLite It is a lightweight database used commonly in Raspberry Pi, we will be using the database to store clean, transformed values. It reads and writes to the disk of the Pi. Installation for SQLite: $ sudo apt-get install sqlite3 reating a Database: $sqlite3finaldata.db

V. CONCLUSION

In this paper, main objective of the study was to analyze the weather over a period of time and collect data to predict the weather in the near future and take appropriate measures to tackle the problem related to drought caused due to the continuous rise in temperature accompanied with little or no rainfall while keeping the cost to a bare minimum. Using the sensors and board (Raspberry Pi) we can help in reducing the cost of collecting the data for the purpose of artificial rainfall by sending data for places where it is absolutely necessary to seed as the region is suffering with harsh climatic conditions and need immediate relief. With the help of this research, we can pin point areas and pick only those which need immediate relief from drought.

REFERENCES

[[1]. G. Jagga Rao, Y. Chalapathi Rao " Robust Bit Error Rate Optimization for MASSIVE MIMOCEM System using Channel Coding Method "in Volume 8-Issue 4S2, pp. 180-184, March 2019.

[2]. M Sumalatha,Dr. P V Naganjaneyulu, and K Satya Prasad —Low-Power and Area-

ISSN: 2057-5688

Efficient FIR Filter Implementation Using CSLA with BEC‖ Journal of Microelectronics, Electromagnetics and Telecommunications,https://doi.org/10.1007/978-981-10-7329-8_14 Jan-2018,Volume -8 , Issue -3 ,ISSN: 0976-4860,pages:137-142, Springer.

[3]. A. Ravi,Dr. P. V. Naganjaneyulu ,Dr.M.N. Giriprasad —SAR images denoising using a novel stochastic diffusion wavelet scheme‖,Springer, Cluster Computing Journal ,USA,July-2017,DOI 10.1007/s10586-017-1001-6,ISSN:1573-7543,Pages:01-09,Springer.

[4]. P SekharBabu,Dr. P V Naganjaneyulu, and K Satya Prasad —Adaptive Beam Forming of MIMO System using Low Complex Selection of Steering Vector‖ International Journal of Advancements in Technology,Jan-2017,Volume -8 , Issue -3 ,ISSN: 0976-4860,pages:01-06, Elsevier.

[5]. D. Rajendra Prasad, Dr. P. V. Naganjaneyulu ,Dr. K. Satya Prasad —A Hybrid Swarm Optimization for Energy Efficient Clustering in Multi-hop Wireless Sensor Network‖ Wireless PersCommun DOI 10.1007/s11277-016-3562-8 Springer Science+Business Media New York 2016, Pages:2459-2471.

[6]. P. Ravikumar, P.V. Naganjaneyulu, K. Satya Prasad —Peak to Average Power Ratio reduction method for Orthogonal Frequency Division Multiplexing in 4G Communication‖, I J C T A, 8(5), 2015, pp. 1703-1708m.

[7]. M Sumalatha, Dr.P .V .NaganjaneyuluandDr.K .Satya Prasad —ADVANCED FAST FOURIER TRANSFORM USING RADIX-8 BOOTH MULTIPLIER‖ ISSN 2319 - 2518 Int. J. Elec&Electr.Eng& Telecoms. 2015, Special Issue, Vol. 1, No. 3,pp (27-32) November 2015.(Impact factor – 0.454).

[8]. U.Sreenivasulu, Dr. P.V.Naganjaneyulu, —Performance of bit-interleaved coded multiantenna OFDMA systems over space-frequency‖ National Conference on Advanced Communication Systems &Applications,held at Madanapalli 0n June 2013 , INDIA proceedings pp.161-168.

[9]. T.Srinivas,Dr.P.V.Naganjaneyulu,P.Sandeep Mohan,R.Shiva Shankar ,Ch.Surender Reddy —Face Recognition Using PCA and Bit-Plane Slicing‖ PEIE 2012, LNEE, Springer-Verlag Berlin Heidelberg 2012 , pages: 401-407, 2012.

[10]. G. Jagga Rao, Y. Chalapathi Rao, Dr. Anupama Desh Pande "Detection For 6G-NOMA Based Machine Learning Optimization for Successive Adaptive Matching Pursuit Analysis", Q3, pp. 1803-1812, Jan 2020.

[11]. P.V. Naganjaneyulu, Dr.K.Satya Prasad, An adaptive blind channel estimation for OFDM system multimedia by improved H∞ approach (for high data rate)‖, International conference on computer intelligence and multimedia applications held at Siva Kasi on Dec. 2008, vol.4,

ISSN: 2057-5688

pages:252-256, Dec. 2008, Published also in IEEE computer society in the portal.acm.in.

[12]. P.V. Naganjaneyulu, Dr.K.Satya Prasad, ―An adaptive blind channel estimation for OFDM system by improved H∞ approach‖, International Conferences on advanced communication systems held at CIT Coimbatore on Oct. 2007, preceding pages:33-36.

[13]. Dr. k. Raju, A. Sampath Dakshina Murthy, Dr. B. Chinna Rao,G. Jagga Rao "A Robust and Accurate Video Watermarking System Based On SVD Hybridation For Performance Assessment" International Journal of Engineering Trends and Technology (IJETT) – Volume 68 Issue 7 - July 2020.

[14]. P.V. Naganjaneyulu, Dr.K.Satya Prasad, ―A Study of blind channel estimation in OFDM system by H∞ approach‖, National conference on Communication and signal processing held at IEEE, Mumbai on Feb 2007, NCCSP-07, pages:20-24, Feb. 2007.

[10] Wang Y. & Chi Z. 2016, July. System of Wireless Temperature and Humidity Monitoring Based on Arduino Uno Platform. In: Instrumentation & Measurement, Computer, Communication and Control (IMCCC), 2016 Sixth International Conference on. IEEE. pp. 770-773.

[11] Ucgun, H., & Kaplan, Z. K. (2017). Arduino based weather forecasting station. 2017 International Conference on Computer Science and Engineering (UBMK). doi:10.1109/ubmk.2017.8093397

[12] International Journal of Engineering Trends and Technology (IJETT) – Volume 33 - March 2016‘An AutomatedThingSpeak Weather Monitoring System using Raspberry PI’M. Ramesh1, Dr. S.A.K. Jilani2, Mr.S.Arun3 Department of Electronics &Communication Engineering, MITS, Madanapalle, India

[13] Kavita Nadlamani, Gurav Jadhav, “Environment Monitoring System using raspberry Pi”, International Journal of Computing and Technology, Vol.2,PP.489-494,Dec-2015.

[14] Huu-Quoc Nguyen, Ton Thi Kim Loan, Bui Dnih Mao and EuiNam Huh, “Low Cost Real-Time Syxtem Monitoring using Raspberry Pi”, IEEE, PP. 857-859, 2015

[15] Sirohi, K., Tanwar, A., Himanshu, & Jindal, P. (2016). Automated

ISSN: 2057-5688

irrigation and fire alert system based on hargreaves equation using weather forecast and ZigBee protocol. 2016 2nd International Conference on Communication Control and Intelligent Systems (CCIS). doi:10.1109/ccintels.2016.7878191.

[16] Fatma Al Shuhaimi; Manju Jose; Ajay Vikram Singh, "Software defined network as solution to overcome security challenges in IoT", 2016 5th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO) at AUUP, NOIDA, India, September 07-09, Year: 2016 Pages: 491 - 496, DOI: 10.1109/ICRITO.2016.7785005.

[17] Siham Al Hinai; Ajay Vikram Singh, "Internet of Things: Architecture, Security challenges and Solutions", 2017 International Conference on Infocom Technologies and Unmanned Systems (ICTUS'2017) (Trends and Future Directions) at Amity University Dubai, UAE, 18 – 20 December, 2017 Pages: 202 - 205, IEEE Conference Publications.

[18] Seema Nath, Subhranil Som, "Securing Data in Internet of Things Using Novel Neural Elliptic Galois Cryptography and Optimal Matrix XOR Steganography", Journal of Advance Research in Dynamical & Control Systems, Vol. 10, 14-Special Issue, pp: 1399-1409, 2018.

[19] Shivani Chowdhary, Subhranil Som, Vipul Tuli, Sunil Kumar Khatri (2017), "Security Solutions for Physical Layer of IoT", International Conference on Infocom Technologies and. Unmanned Systems (Trends and Future Directions) (ICTUS'2017), December 18-20, 2017, IEEE Conference, indexed with SCOPUS, Amity University Dubai Campus, Dubai International Academic City, Dubai.