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Monitoring of Pressure, Light and Precipitation in a Smart City Using Internet of Things

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Abstract

The pressure, light and precipitation of a smart city can be monitored using an IoT-based environmental parameter monitoring system. Framework is sensor-based. A Raspberry Pi board was used containing three sensors attached to it, which are used to sense pressure, light and precipitation, and the board is connected to the internet. It was linked to a channel developed on www.thinkspeak.com in order to put the prepared framework into action. The Raspberry Pi B3+ has been linked to the sensors, and data is being delivered to the www.thinkspeak.com channel. Data is gathered by sensors, and it is then transmitted through the HTTP protocol to the client. The board has been linked to the internet either through a USB dongle.On www.thingspeak.com, the results are presented in a graphical way.

Key Words: IoT, Sensors, Raspberry Pi Board,pressure, light and precipitation.

Introduction

In India wide range of seasons is available. These seasons vary throughout the entire year. Since many Indians work in many regions and the weather has a big impact on their jobs. Therefore, weather parameters monitoring and weather forecasting is very important in India. A timely weather forecast in India could prevent many of the negative consequences brought on by natural disasters dueto bad weather. The duty of weather monitoring is equally important. Different techniques are used in India to monitor the weather; these techniques are natural and artificial. However, modern technology has taken over to make things simple and accurate. As a result, cutting-edge technology can also be used for weather monitoring.Internet of Things (IoT) is one of the most significant technologies. It is a rapidly expanding technology that is significant in many fields. It has numerous applications in various fields, including the growth of urban communities, the organization of essential resources and frameworks, adaptability, transportation, and collaborations. The growth of IoT has revealed that an increasing amount of organized data is being examined, safeguarded, and communicated under various circumstances(Potu et al., 2016 **[1]** & Anonymous, 2022 **[2].**

"Internet of Things" is referred to as "IoT". It alludes to the whole network of physically connected devices. Technology makes it possible for various gadgets to communicate with each

other, the cloud, and other physical devices. The ability to connect billions of things together is made possible by the development of computer chips and high internet bandwidth. Sensors are utilized in everyday IoT-enabled appliances like vehicles, vacuum cleaners, and other machines to collect data and respond to users very smartly online. IoT may be used to gather and communicate meteorological data while taking into account various environmental and weather factors.

Historical Background

The development of an IoT-based system for monitoring environmental parameters started recently, or within the past ten years. In this regard, the work of Satyanarayanaet al. (2016) **[3]**is noteworthywho developed an IoT-based smart weather station using a raspberry pi. They claimed that the climate plays a significant role in our day-to-day life. For house and situational planning, it's important to gather knowledge about the specific climate conditions. It is now possible to gather information in-situ because to recent advancements in the Internet of Things. The study suggests a framework that adds information based on the client's demand while screening climate characteristics at a location.Through the internet, the customer can access this information at anytime, anywhere in the world. The suggested architecture uses a Raspberry Pi that has sensors attached to collect weather data. The obtained data is uploaded to the cloud for easier access.

In keeping with what was said earlier, Rao et al. (2016) **[4]** suggested an Internet of Things-based weather monitoring system. The system suggested in this study is a modified solution for examining the environmental conditions in a particular area and making the information accessible anywhere on Earth. IoT, a cutting-edge and successful solution for connecting physical objects to the internet and organizing the entire universe of things into a framework, is the innovation behind that. Everything like electrical devices, sensors, and vehicle electronic rigging similarly matters here.The device uses sensors to monitor and control common conditions including temperature, relative humidity, light intensity and CO degree. It then sends the information to a website and plots the sensor statistics as graphical estimates. The records recovered through the executed procedure are accessible online from any location on earth.

Rasal& Rana(2016) **[5]** worked on a raspberry pi-based weather monitoring system. They actualized a model for the climate observation framework. The use of the appropriate sensors to estimate temperature, relative stickiness, and barometrical weight is very helpful for current climate observation. As discussed in this study, a framework or model for climate monitoring has been developed to record and display climate characteristics such as temperature, wetness, wind direction and speed, rain falls and climatic weight. In this report, various climate checking processes have been audited. The device stores the recorded data for future use. Clients can access the data that the system has saved whenever they need to.The most recent and effective method for remote climate observation among radars, satellites, and microcontrollers is the raspberry pi.

Priyaet al.(2017)**[6]** worked on an IoT-based weather monitoring system. The framework suggested in this research is a moved solution for examining the environmental circumstances at a specific region and making the data comprehensible globally. The development behind it is called

net of factors, and it is a cutting-edge and effective solution for connecting objects to the internet and integrating the entire universe of things in a framework. The device uses sensors to monitor and adjust common parameters including temperature, relative humidity, light intensity and CO level. It then sends the information to the website's webpage, where it is quickly plotted as graphical knowledge.Anywhere in the planet can access the information recovered from the realized device through the internet.

Sudha et al. (2017)**[7]**worked on detailed and high speed smart IoT based weather monitoring system and proposed a brilliant climate revealing framework over the web. Her proposed framework takes into account climate parameter announcing over the web. It enables the general population to straightforwardly check the climatedetails online without the need of a climate determining office. Framework utilizestemperature, dampness and rain sensor to screen climate and give livedetailing of the climate measurements. The framework always screens temperatureutilizingtemperaturesensor,stickinessutilizingdampnesssensorandfurthermorefor rain. The framework always transmits this informationtothemicrocontroller,which now forms this information and continues transmitting it to the online webserver over a Wi-Fi association. To be viewed on the online server structure, this information is continuously updated.

Satyanarayanaetal. (2017) **[8]** worked on a mobile app and IoT-based smart weather station which led to the conclusion that since climate conditions are changing daily, a framework must be created to successfully measure the environment parameters at the location of intrigue. This study expanded on a straightforward technique for calculating climate dynamics without of human intervention. The obtained temperature data in a remote area can be transported to the cloud and a particular portable application thanks to this proposed strategy's use of flexible application and IoT innovation.

Alexopoulos (2018) **[9]** worked on the architecture and creation of a framework for industrial IoT to realize services in systems for industrial product service. This framework offers architecture for creating an Internet of Things framework for implementing services in many businesses. A comprehensive prototype was created that successfully demonstrates data collection, analysis, and reporting. Additionally, it offers a range of services to meet the needs of diverse roles. The systematic information gathering, aggregation, analysis, and streamlining of user information are the main advantages of this approach. Users are informed of the output in the form of various graphs and figures. Additionally, this framework may be used in a variety of settings and gives users extended usage.

Amoduet al. (2019) **[10]** studied the data security effects of public relations professionals using the Internet of Things. In the last six months, research has been done. Public relations associations and organisations' online platforms were leveraged to solicit involvement. Online data collection has been used to gather the data. The data was analysed using SPSS, and it was discovered that there are some security concerns as a result of public relations professionals adopting the Internet of Things.

Saif Allah et al. (2020) **[11]** worked on a real-time IoT-based water quality management system to reduce or eliminate the expense of water quality tests outside of a lab and claimed that IoT can be used to monitor water quality parameters. IoT can be used to maintain parameters relating to water quality. These characteristics are cleverly maintained using IoT and checked at the input.

Zhu et al. (2020) **[12]** conducted research on an IoT-based intelligent classroom management system for schools. In this study, they created a method for managing smart classrooms in schools that uses little electricity, is inexpensive, simple to use, and is likely to be well-liked. The storage model based on MySQL and NoSQL has been found to match the ideal system requirements. MySQL is simple to use and satisfies the needs of tiny data volume information. For the vast amounts of data the IoT generates, HBase offers reliable storage and quick data. The user can swiftly read data while taking readings while using that system.

Tariqa et al. (2021) **[13]** performed a thorough review of the security requirements and challenges for smart IoT applications and discovered that the research and industry have concentrated on a number of security flaws such device vulnerabilities and attain transit related with IoT devices. Due to its limited nature, smart IoT applications have a number of security issues that must be taken into consideration while creating security measures. Important security issues related to IoT applications in smart agriculture, smart cities, and smart healthcare were also covered by the authors.

Hamdyet al. (2022)**[14]**suggested a strategy for implementing IoT in Warehouse 4.0 using Node-RED. In this study, a system using Node-RED and MongoDB has been suggested for the deployment of the IoT method in managing warehouses. In the research paper, it is explained how IoT can be deployed in a warehouse to reap benefits and prevent issues with current management systems. In order to demonstrate the significant impact that IoT has on operations warehouse, particularly on forecasting accuracy, a dataset has been employed. This solution aids in increasing speed and efficiency, reducing labor requirements, and preventing counterfeiting and inventory shortages by enabling real-time visibility of everything in the warehouse. This study gave warehouses a practical road map for enhancing their operations with IoT.

It has been found through the review of the literature that IoT technology is receiving very little attention when it comes to monitoring environmental indicators. IoT technology must be used to monitor environmental indicators as a result.

As a result, the current study is on using IoT technology to monitor environmental indicators. In this research, a framework for monitoring pressure, light and precipitation has been developed.

Methodology

Three sensors for monitoring pressure, light and precipitationwere used to make the framework created for this study, which analyses pressure, light and precipitation in the surroundings to predict when it will rain or not. A Raspberry Pi board with these sensors

continuously transfers data to a cloud server so that users can access it hourly or at any other regular interval of time of desire. Data collected from these sensors is converted to cutting-edge formats by Arduino and sent to the Raspberry Pi, acting as a standard analogue to digital converter in this way. Additionally modem has been attached for signal conversion which transforms analogue to digital and digital to analogue signals. As a result, a straightforward framework with less complicated components and accessible portions has been created.Framework has the ability to gather a change in values of environmental parameters using the sensors attached to the Raspberry Pi 3 B+ board. These data are then integrated and the memory chip on the Pi board stores the information acquired, just like the memory chip on the liquid crystal display linked to the result display. The same has been accomplished using software tools and Python, a programming language. The Think Speak site is used to view the outcomes.It has been linked to a channel developed on www.thinkspeak.com in order to put the prepared framework into action. The Raspberry Pi B3+ has been linked to all the three sensors and data is being delivered to the www.thinkspeak.com channel. The Raspberry Pi b3+ board includes two operating modes on the framework side: web server and information security. Data is gathered by sensors, and it is then transmitted through the HTTP protocol to the client. The board has been linked to the internet either through a USB dongle. On www.thingspeak.com, the results are presented in a graphical way. All the three fields have been added to a single channel on www.thingspeak.com so that results can be displayed graphically.

Results

When a personal channel is signed in to www.thingspeak.com, results are shown graphically on the computer screen. Figures 1, 2 and 3 display the outputs of the findings as follows:

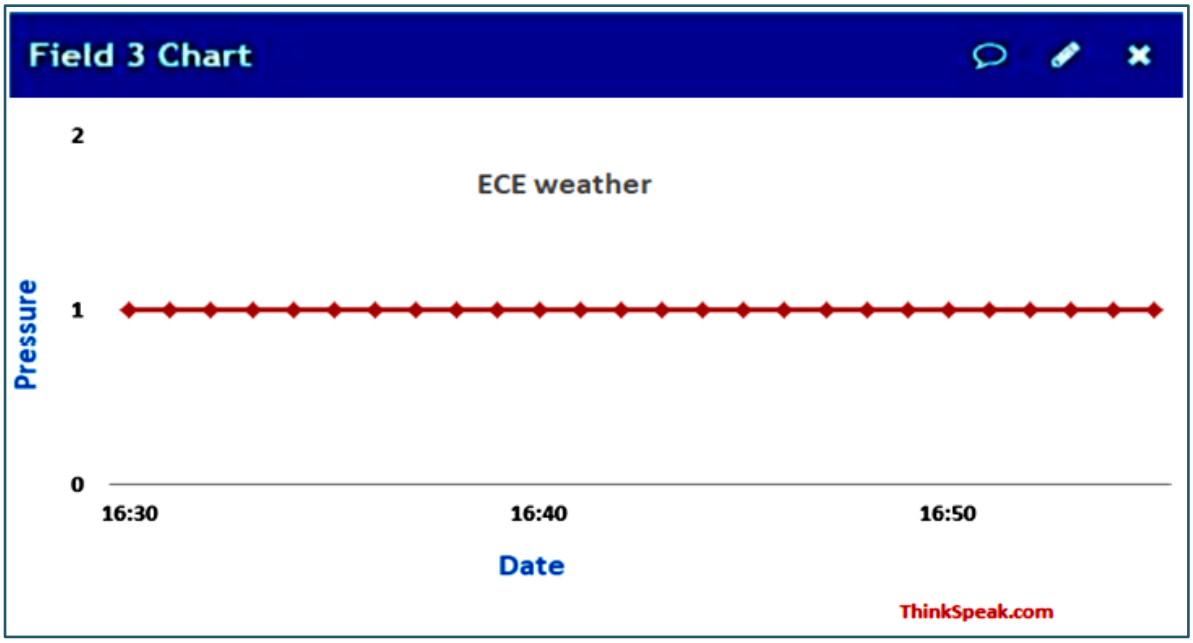

Fig. 1: Pressure Monitoring Chart

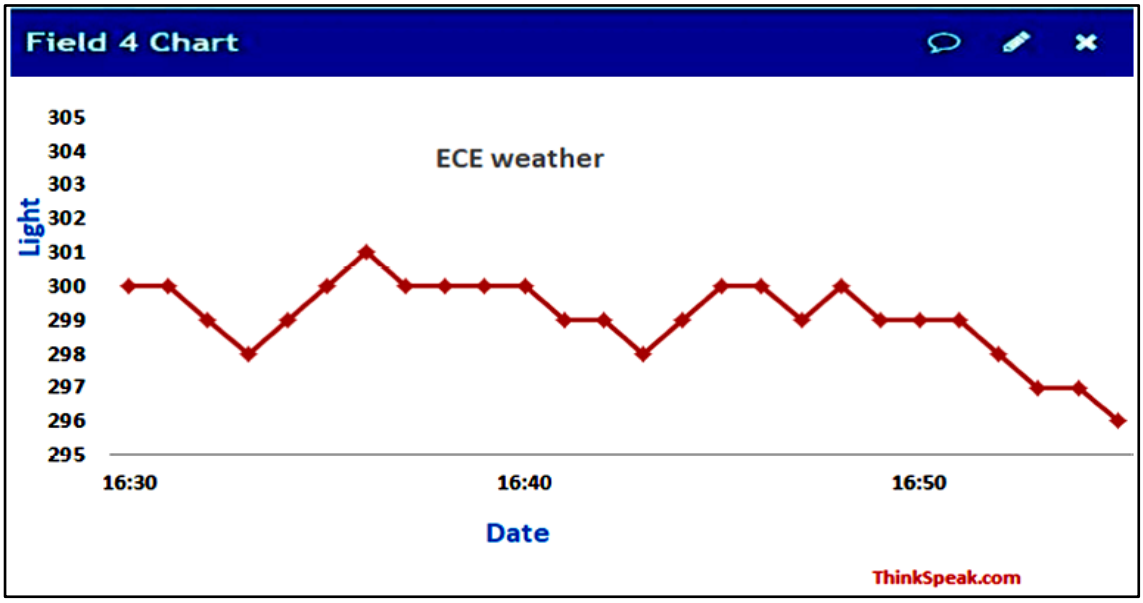

Fig. 2: Light Monitoring Chart

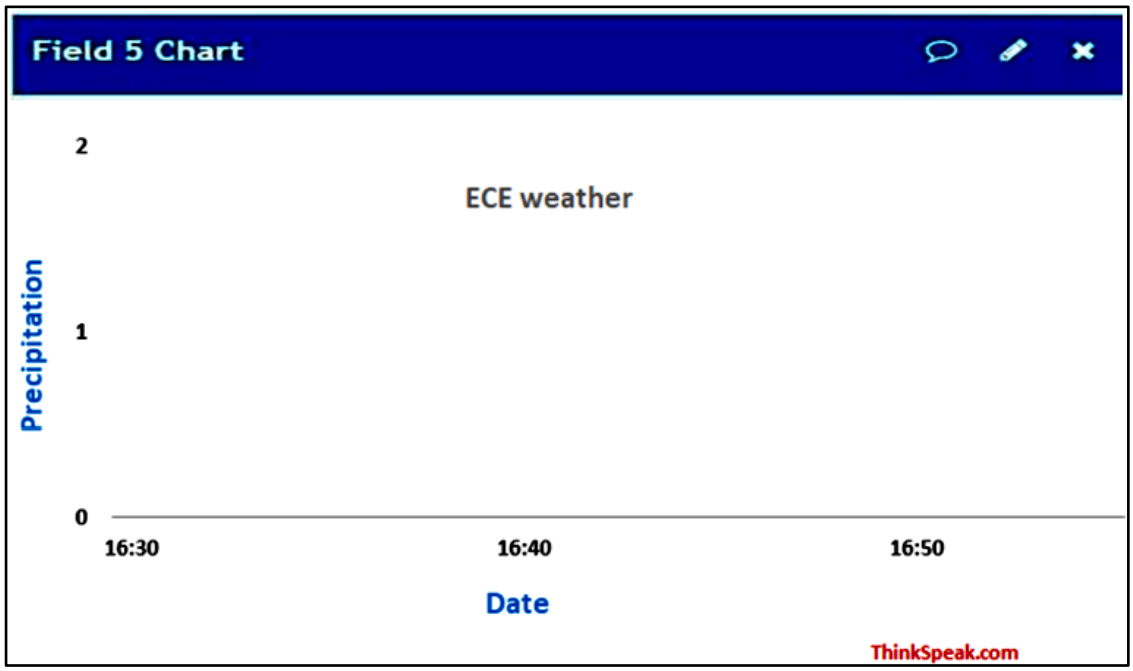

Fig. : Precipitation Monitoring Chart

Variation in pressure, light and precipitationof the study area are shown in the aforementioned charts in relation to a half-hour time interval. These graphs show that IoT technology is used to monitor temperature and humidity.

Conclusion

The framework that is now in place can monitor the pressure, light and precipitation in a specific area. IoT technology, combined with sensors and software, is the foundation of the

framework. One of the key technologies employed today is IoT technology. The employment of this technology, together with sensors and software, may make any system intelligent. The current study has drawn the conclusion that intelligent systems can be created to monitor various environmental variables.Different frameworks can be created utilizing various onboard sensors to monitor various environmental factors. It is also possible to use the information gathered from these frameworks to forecast the weather and prevent environmental catastrophes. The IoT has the potential to greatly improve human life and create new commercial opportunities. Our best efforts to create systems and devices that are smarter and more secure are continually being hindered by this technology.

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