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Temperature Monitoring System Using Wifi Communication for Environmental Applications

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Abstract:
The main objective of this paper is to design an IoT (Internet of Things) based Temperature and Humidity monitoring system for an agricultural environment. Monitoring agricultural environment for temperature, humidity and soil moisture along with other factors is important for a healthy and wealthy cause, which improves the productivity of farmers by using technology driven farming. Taking care of these things manually requires lots of human work and time and also it is a costly affair. Hence the aim of the project is to make an IoT-based temperature and humidity monitoring system which reduces the human work and taking cares of these factors. The key feature of thiswork is to collected the field data by the sensor and send this to internet web, which can further be analysed using any computer or mobile anywhere on the globe to take real time decision.

In this project we controlled a single channel relay on real time basis which can further be used to control water flow on the field. IoT is the inter-networking of physical devices called 'things' or 'smart devices' which might include vehicles, buildings and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. Thus the parameters received is stored in the cloud platform (Thing speak). The changes in the environment are updated in the form of a database through the cloud computing method. Thing speak also provide a feature to create a public based channel to analyze and estimate it through the public.

An Android application is created for the direct access of the measured parameters.

I. INTRODUCTION

The demand of service over the internet necessitated the data collection and exchange in an efficient manner [1]. Internet of Things refers to the rapidly growing network of connected objects that are able to collect and exchange data using embedded sensors. It is nowadays finding profound use in each and every sector and plays a key role in the proposed environmental monitoring system too. IoT converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost microcontroller "Arduino UNO" [2]. An open source website, Thingspeak is used where the measurement of the parameters are updated. Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using the HTTP Protocol over the Internet [3]. Thingspeak is an IoT analytics platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. The cloud utilizes the operations of Graphical visualization and available in the form of virtual server for the users and the objects are communicated with the cloud via possible 'wireless internet connections' available to the users

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and the majority objects uses the sensors to tell regarding the environmental analogue data. The IoT helps bring all things together and permits us to communicate with our very own things [4]. The measurements thus received can be viewed in these scripts such as JSON, XML and CSV. In the proposed system, the environmental parameters can directly be accessed by the user, thus eliminating the need for third parties. The Internet is a living entity, always altering and evolving. New applications and businesses are created continuously. In addition to a developing Internet, technology is also changing the landscape [5]. The Internet of Things is driven by a growth of the Internet through the inclusion.

Figure 1 IOT Architecture

We are entering a new age of technology that is Internet of Things. Machine to machine, machine to environment, the Internet of the whole thing, the Internet of smart Things, intelligent system call it what you want, but it's occurrence, and its possible is vast. We see the internet of things as billions of smart, connected "things", that will include every feature of our life, and its foundation is the intelligence that embedded giving out provides. Environmental monitoring is an important IoT application which involves monitoring the surrounding environment and reporting this data for effective short term measures such as remotely controlling the heating or cooling devices and long term data analyses and measures. This paper presents the implementation details and results of an environmental monitoring system [6].

The system comprises of a central Arduino UNO board which interfaces at the input with temperature and humidity monitoring sensor DHT11 and at the output with ESP8266 Wi-Fi module which transmits the sensed data through Internet to a remote cloud storage open IoT API ThingSpeak. Through ThingSpeak, MATLAB analytics are carried out on data and trigger is generated. A mobile application is developed based on Android operating system and data is retrieved from ThingSpeak for user display from anywhere in the world. The developed is a low cost system which gives insight into the design and implementation of a complete IoT application involving all aspects from sensing and wireless transmission to cloud storage and data retrieval from cloud via a mobile application. It involves comprehensive study and deployment of Arduino development board, its interfacing with input and output modules such as sensors and Wi-Fi module, the usage of ThingSpeak open source API and finally the development of a mobile application based on the Android operating system.

II. RELATED WORK

Lately, IoT has emerged as an area which has gained immense interest of both venture capitalists and tech giants, resulting in a plethora of research activities and business initiatives. Some of the applications which have garnered attention include smart grid, smart city, smart wearable devices and smart home. Almost all of the various IoT applications involve some kind of sensors and transducers normally attached to a microcontroller along with wired or wireless transmission to either a local database or a remote cloud which transforms raw data into useful information which can be effectively utilized. The research and development activities comprise techniques of fabrication of smart objects or devices, suitable wireless technologies, development boards, designing network protocols, applications and much more. In the context of our project, we explored recent work accomplished in the development of useful and interesting applications using low cost development

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boards such as Raspberry Pi and Arduino. Some of the popular applications developed using these boards include home automation, patient monitoring systems and weather and environmental monitoring systems. In [7], temperature, humidity, light intensity, gas leakage, sea level and rain intensity are measured and the data are sent wirelessly to ThingSpeak using Arduino UNO. This work focuses considerably on MATLAB visualization and analysis. Authors in [8] monitored and controlled environmental conditions like temperature, relative humidity, light intensity and CO2 level using sensors and LPC2148 microcontroller. The data was sent to ThingSpeak cloud. In comparison with LPC2148, Arduino UNO used in our system is simple, low cost and less complex for a simple application. Authors in [9] present an IoT based real-time weather monitoring system using Raspberry Pi which is complex compared to Arduino due to Python language and Raspbian operating system.

Internet of Things represents a common concept for the talent of network plans to intellect and collect data from the world about us, and then split those data crossways the Internet where it can be process and utilized for various attractive purpose.
Many companies in the world have problem to know the actual condition of the machine. The reason to know the condition of the machine is to make the prevention and to avoid the machine from breakdown, so this project is developing to monitor the temperature sensor system [10]. A lot of work has been carried out for monitoring temperature sensor. Most recent work is in the direction of developing Wireless sensor for temperature monitoring.

ExistingSystem	Home Automation System via Raspberry pi	Web Based Temperature Monitoring System	Microcontroller Based Temperature Monitoring system	IOT Based Temperature Monitoring System
Features	Interoperability Remote Access time-Tested	Platform Independent. More Manageable		
Advantages	Provide availability of GPIO GPIO provides easy connectivity	DHT11 Relatively cheaper	Flexibility: Faster Speed of Execution Human effort can be saved	Scalability Transportation Accessing web user intelligence Automation and control
Drawback	With Raspberry pie Node js is used to directly connect cloud.	Only JavaScript is used Less control over computer	Complex architecture Functionality is quite difficult	Safety Privacy/Security

III. SYSTEM ARCHITECTURE

The core idea is to interface temperature sensor with Raspberry Pi collect the temperature readings and display those readings on the mobile phone. Also we would use h adopt cluster to save all the temperature changes. These temperature recordings maybe used for analysis in the future.

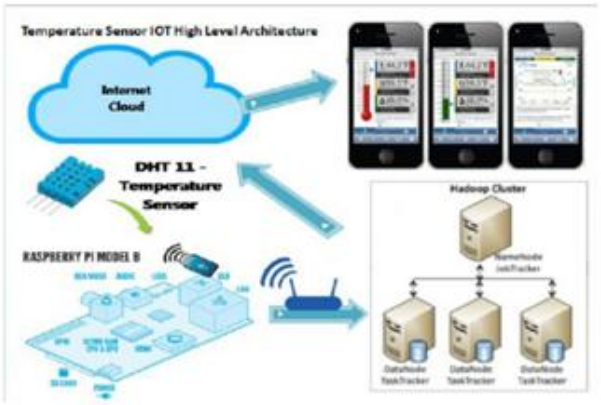

Figure 2 System Architecture

IV. EXISTING SYSTEM

Recently climatic change and environmental monitoring and management has received much attention. The paper introduces three different IoT based wireless sensors for environmental and ambient monitoring: one employing User Datagram Protocol (UDP)- based Wi-Fi communication, one communicating through Wi-Fi and Hypertext Transfer Protocol(HTTP) and third one using Bluetooth Smart. The above presented systems help in recording data at remote locations and viewing it from every device with an Internet connection. Here Zigbee is used to monitor and control application where wireless connectivity is required. UDP based cyber physical system monitors the temperature and relative humidity. Here the losses are caused by the network itself. The WiFi sends the UDP or HTTP packets to a Cloud Platform which makes it available only to the administrator who decides whether the data must be public or private. BLE consist of sensors placed at various areas at which they produce a beacon when data is received and the server takes the information from the sensors whenever the beacon is produced.

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The available Environmental Monitoring System (EMS) uses UDP protocol which requires the establishment of connection and IP matching every time. Direct access of the geographical information is not available since the information is sent to a centralized platform and admin plays a major role.

V. PROPOSED SYSTEM

The proposed system keeps track on the parameters such as moisture, temperature, humidity, rainfall, gas content and earthquake intimation with the help of the real time sensors. These parameters are continuously monitored by an open source platform called Thingspeak for an interval of every 2 minutes. The data can be viewed in any one of the three formats such as JSON, XML and CSV. The sensors in the proposed system collect the data such as the temperature, humidity, soil moisture, pollution level, rain water level and movement in the earth surface. The Wi-Fi network helps in the process of sending the collected data to the open source platform, Thingspeak. Alternate to that, an app is made for the purpose of viewing the collected data in even more easier manner. Through the application/Thingspeak, the user will be able to know about the status of his/her own agricultural land and counter-measures can be taken after the keen observation of the parameters of the land.

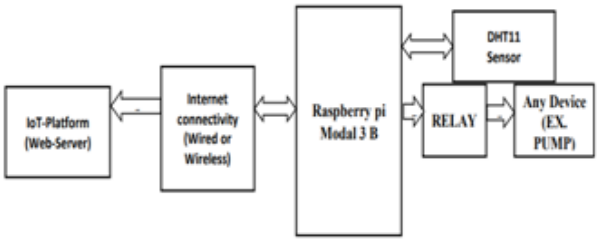

Figure 3:- Block diagram of monitoring system

The system consist a DHT11 sensor, Raspberry pi modal 3 B with internet connectivity. The connection of sensor with pi is shown in the block diagram above with a prototype. In the given system sensor analyze outside temperature and humidity and convert the exact information into a digital signal output.

The output obtained from the sensor is fed to the Raspberry pi. Which uses a python program and library to convert information of sensor into numerical values for temperature and humidity? This data is stored in a file over the period of time, which are then placed on internet using IoT. Nowadays lots of free open data IoT platform and other services are available on internet, which can also be done by building a web server. In this project we used one of the IoT cloud service provider named "Thingspeak" that has an application programming interface (API) which has the facility to post and review the data from IoT sensor. Thingspeak facilitates to create a channel (publicly or privately) on which all the data obtained from the sensor is displayed with date and time anywhere on the globe. End user can access this data from anywhere and can control the attached relay.

VI. EXPERIMENTAL RESULTS

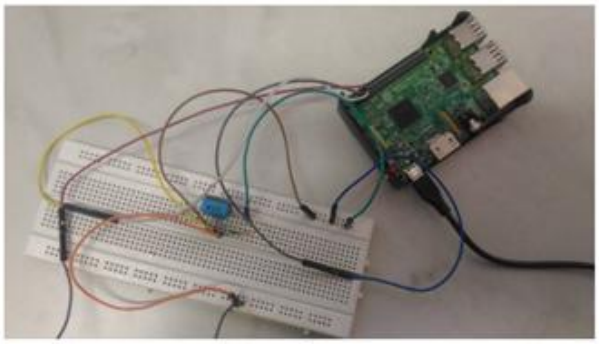

Figure 4: - Prototype of monitoring system

IoT-Based temperature and humidity monitoring system provide an efficient and reliable system for monitoring agricultural parameters. The results for monitoring temperature and humidity can be seen by login to the website http://thingspeak.com account and the by clicking on the broadcast channel options. The results obtained for monitoring temperature and humidity using temperature, humidity senor DHT11 on Think speak is shown below.

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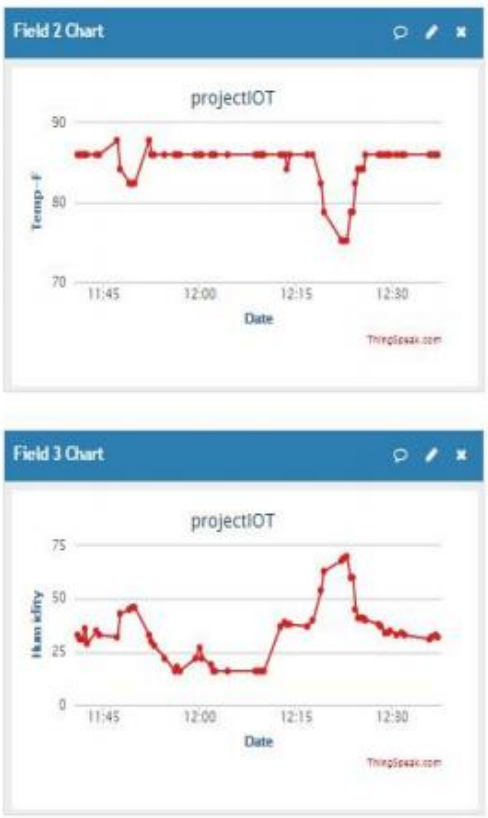

Figure 5:- Temperature and Humidity Monitoring

VII. CONCLUSION

The measured parameters from the sensors are continuously updated and are thus viewed by the user using the EMS (Environmental Monitoring System) application. Thus the data is directly accessed and is purely independent of third parties. This paper presents an environmental monitoring system for real-time monitoring of temperature and humidity of surrounding environment. The sensed data is sent through Wi-Fi to the cloud where both real-time data and its graphical analyses can be viewed. An Android application is developed for the end user who can monitor the environment of the area where the hardware is deployed using a smart phone. This system can be extended to implement a home automation system where the monitored values of temperature and humidity can be used to trigger some action and control the devices for heating or cooling via the mobile application.

This system is a crucial step in understanding the IoT applications development and implementation and serves as a building block for a number of useful innovations in this direction.

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