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Internet of Things Mobile -Weather and Air Pollution Monitoring System

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ABSTRACT: Environmental monitoring is extremely important due to recent changes in climate, for ensuring a safe and wealthy life of both humans and artifacts. This field is based on remote sensing and wireless sensor networks for gathering data about the environment.Recent advancements, such as the vision of the Internet of Things (IoT), the cloud computing model, and cyber-physical systems, provide support for the transmission and management of huge amounts of data regarding the trends observed in environmental parameters. In this context, the proposed system is based on weather prediction using multiple different IoT-based wireless sensors for environmental monitoring: one employing User Datagram Protocol (UDP)-based Wi-Fi communication, second communicating through Wi-Fi and Hypertext Transfer Protocol (HTTP), and third one using Bluetooth Smart. The solution permits supervisors on-site not only to have an immediate idea of the current situation by using their smart-phones but also to monitor remote sites through the Internet. All measurements are redundantly stored at different concentration levels to guarantee a safe back-trace and to provide quality assurance also in case of network failure or unavailability. The proposed system is useful in predicting rain condition and also monitoring rain, temperature, humidity and carbon mono oxide level etc.

KEYWORDS: Wireless Sensor Network, IoT, weather predictions, environment monitoring

I. INTRODUCTION

The environmental care has become one of the biggest concerns for almost every country in the last few years. Even though the industrialization level has been increasing without any control in the last decades, the current situation is clearly changing towards more environmentally friendly solutions. Water and air quality are essential to maintain the equilibrium between human development and a healthy environment. It is also important to notice that by means of looking for a more efficient production in factories both pollution and consumption of natural resources can be decreased. Processes, such as boiling, drying, binding, and so forth, are being carried out by almost every kind of the current factories. Those processes are responsible of a great amount of gas emissions and polluted water discharges. Although the majority of the factories have their own sewage plants, it is crucial to measure the quality of the waste water that is being poured into the public sewer.

Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind, and so on. These are similar to wireless ad hoc networks in the sense that they rely on wireless connectivity and spontaneous formation of networks so that sensor data can be transported wirelessly. The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other item embedded with electronics, software, sensors, actuators and connectivity which enables these things to connect, collect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits, and reduced human exertions.

II. LITERATURE SURVEY

Nowadays several solutions for monitoring different environmental parameters, based on wireless nodes, have been proposed earlier. The solution described in this paper, even though conceived with a similar approach, pays particular attention to the data storage and safety. The architecture proposed in [1] by Luca Lombardo and et al relies on a

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multiple-level data storage, which provides a strong data safety. In particular, it gives the possibility to retrieve the whole measurement history of the monitored site, avoiding any issue connected with cabling and network connection break. In paper named as "Wireless Sensor Network application for water quality monitoring in India" [2], aim of author Dr.SeemaVerma and prachi is to discuss requirement and suitability of WSN for water quality surveillance.

There has been a growing concern over environmental issues like global warming, radiation, energy conservation, efficient energy usage etc. These concerns have been given a significant research attention over the years. The advent of Wireless Sensor Networks (WSN) has provided an efficient technique of data collection in a wide variety of application. There are a large number of prior efforts in building low cost WSN for environmental monitoring applications. However, predicting such environmental data for easy decision and preventive measures has not been given a considerable attention. Thus, paper [3] presents the development of a real time wireless sensor network for any environmental data prediction using naïve prediction model. Thedeveloped system was implemented on intranet; Low forecast metric error result obtained shows the accuracy of the naïve model.I.F. Akyildiz and et al describes the concept of sensor networks in their paper "Wireless sensor networks: a survey" [4] which has been made viable by the convergence of micro electro-mechanical systems technology, wireless communications and digital electronics. First, the sensing tasks and the potential sensor networks applications are explored, and a review of factors influencing the design of sensor networks is provided. Then, the communication architecture for sensor networks is outlined, and the algorithms and protocols developed for each layer in the literature are explored.

Open research issues for the realization of sensor networks are also discussed. Wireless micro sensor networks have been identified as one of the most important technologies for the 21st century. Paper [5] traces the history of research in sensor networks over the past multiple decades, including two important programs of the Defence Advanced Research Projects Agency (DARPA) spanning this period: the Distributed Sensor Networks (DSN) and the Sensor Information Technology (SensIT) programs. Technology trends that impact the development of sensor networks are reviewed and new applications such as infrastructure security, habitat monitoring, and traffic control are presented. Technical challenges in sensor network development include network discovery, control and routing, collaborative signal and information processing, tasking and querying, and security.

This paper presents the design details, the development, and the analysis of three different sensors that enables the achievement of Internet connected solutions for monitoring the environment or the ambient at remote locations: one employing UDP-based Wi-Fi communication [6], one based on the HTTP protocol, and one consisting in power harvesting Bluetooth Smart. Being provided with Internet connection capabilities, the developed sensors represent a part of the Internet of Things (IoT), the vision that "allows people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service" [7]. Donnoet al. [8] propose a solution where self-powered Radio-frequency identification tags, equipped with temperature, light, and acceleration sensors, are used. The device has the ability to harvest RF energy and its operation has been validated through two real-world experiments, in which the acquired data are collected by a host PC with the help of a reader antenna. The design achieved a transmission range of up to 10 and 20 m in fully passive and battery-assisted-passive modes, respectively.

The proposed system can be used for monitoring the ambient or outside weather parameters, and, if the host PC is provided with an Internet connection, can be part of an IoT-based solution. In [9] we reported the development of Wi-Fi sensors sending temperature and relative humidity measurements to a base station using UDP. A battery lifetime of 2 years with a 20 min measurement cycle was achieved. This encouraged the development of a device using HTTP, for investigating the power efficiency of this more reliable solution, from the communication point of view. J. ramprabul describes a low cost and holistic approach to the water quality monitoring problem for drinking water distribution systems as well as for consumer sites in their paper [10]. Their approach is to develop sensor nodes for real time and in-pipe monitoring, assessment of water quality on the fly and to calculate the amount of water delivered.

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Wireless Sensor Networks (WSNs) have been achieved widespread applicability in water quality monitoring. However, existing WSN-based monitoring systems are not adequate for monitoring pond and lake water, city water distribution and water reservoir. Moreover, these frameworks cannot be reused in other monitoring applications since they use static and application specific sensor nodes and are not dynamic to the changing requirements. Thus, author of paper [11] introduce a reusable, self-configurable, and energy efficient WSN-based water quality monitoring system that integrates a Web-based information portal and a sleep scheduling mechanism of sensor nodes. The test bed and simulation results show that the framework can monitor the water quality in real-time and the sleep scheduling mechanism increases the network lifetime, respectively. Finding patterns in large, real, spatio/temporal data continues to attract high interest (e.g., sales of products over space and time, patterns in mobile phone users; sensor networks collecting operational data from automobiles or even from humans with wearable computers). In paper [12], AnastassiaAilamaki and et al describe an interdisciplinary research effort to couple knowledge discovery in large environmental databases with biological and chemical sensor networks, in order to revolutionize drinking water quality and security decision making. They describe a distribution and operation protocol for the placement and utilization of in situ environmental sensors by combining (1) new algorithms for spatial temporal data mining, (2) new methods to model water quality and security dynamics, and (3) a sophisticated decision-analysis framework.

The work proposed in [13] by S. KaviPriya and et al is based on the development of low cost fuzzy based water quality monitoring system using wireless sensor networks which is capable of measuring physiochemical parameters of water quality such as pH,temperature, conductivity, oxidation reduction potential and turbidity. Recent advancement in wireless communications and electronics has enabled the development of low-cost sensor networks. The current state of the art of sensor networks is captured in this article, where solutions are discussed under their related protocol stack layer sections. The article presented in [14] also points out the open research issues and intends to spark new interests and developments in this field. One of the immediate benefits brought by the acquisition of such physical proprieties, like soil moisture, temperature, and salinity, can be seen in agriculture, where significant water resource savings can be achieved [15]-[17]. Wireless sensors and sensor networks have been successfully used in the implementation of solutions belonging to various fields, including environmental monitoring [18]–[19], natural disaster prevention , current consumption monitoring in large buildings , monitoring systems for the dosimetry of radiology operators in healthcare applications [20]- [21].

III. METHODOLOGY

For determining temperature and humidity of atmosphere we are using temperature and humidity sensor (DHT11) which will help in predicting environmental conditions. CO sensor is used for detecting Carbon Monoxide in environment, whereas rain sensor is used for detection of rain. The system is placed in 3 different locations and data from each location is collected by the server as shown in figure1. The server stores and displays the current values of all 4 parameters. A look up table is generated which contains the values of temperature and humidity and is used for predicting the current environmental conditions like if humidity is more and temperature is less then chances of rain is more, if humidity is less and temperature is more then chances of rain is less etc. System is placed at three different positions and each position uses different protocol for transmission of data. First place uses UDP+TCP/IP protocol to communicate with server. It transfers the data to mobile using the rules setup by TCP/IP protocols. The second place's system uses HTTP protocol to communicate with the webpage. The data is automatically updated in each 5sec. a webpage is developed to receive and transmit data using this protocol. The system placed at 3rd position uses Bluetooth module to transmit data on mobile. This system uses Bluetooth protocols and communicates with mobile app according to those protocols. Smartphone transfers data to webpage or mobile app using the mobile internet.

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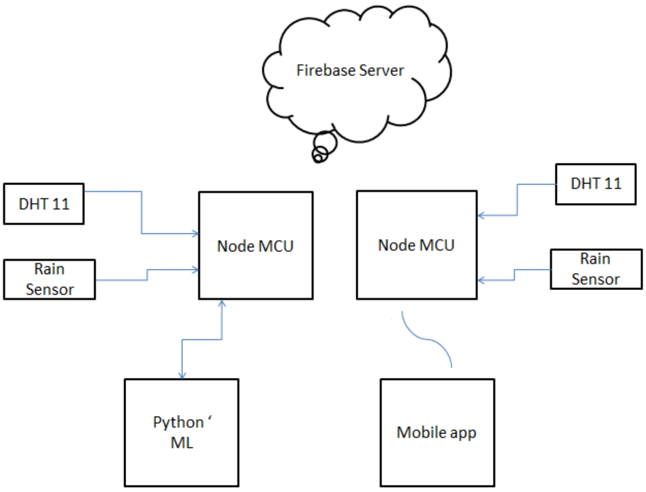

Fig 1 proposed system

IV. RESULT

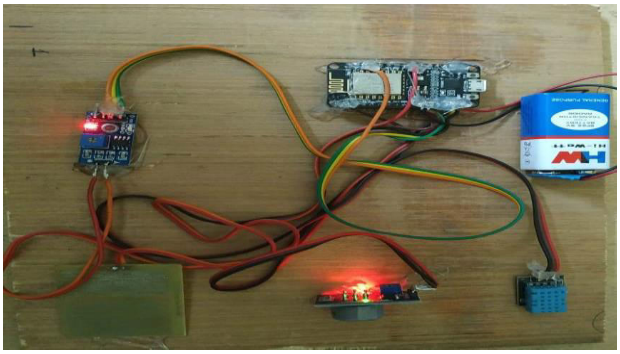

Fig 2. Hardware module

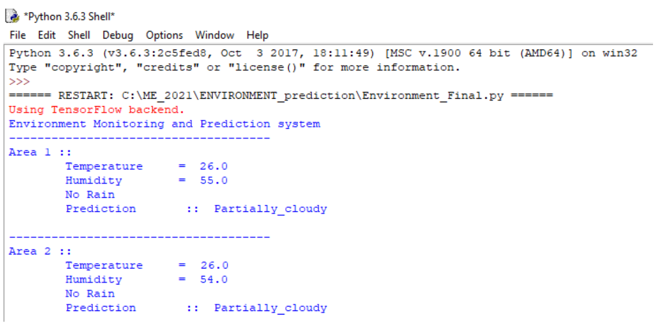

Fig 3. Python predication Results

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Fig 3. Mobile App Login

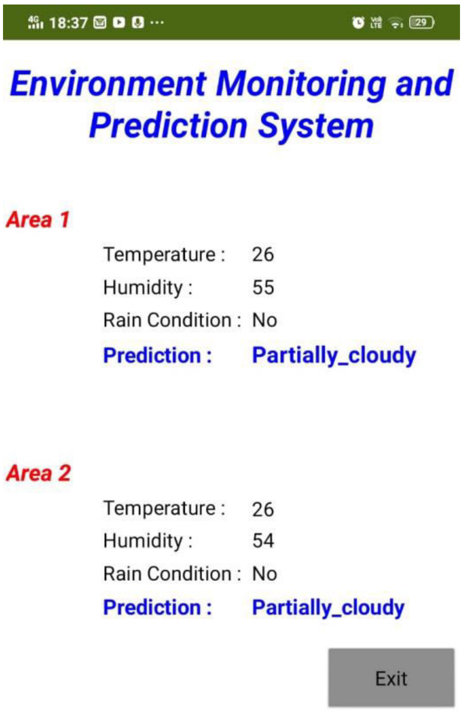

Fig 4.Final Results Showing In Mobile App

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Table1. Sensor Data Recorded On Different Days And Their Predicted Value

Temp (°C)	**Relative Hum (%)**	**Conc. of CO**	**Rain status**	**Prediction**	**Accuracy**
32	54	115	0	Sunny weather	Correct
32	57	116	0	Sunny weather	Correct
33	43	109	0	Sunny weather	Incorrect
33	43	108	0	Sunny weather	Incorrect
27	95	115	1	It's raining	Correct
32	65	116	0	Clouded	Correct
33	70	135	0	Clouded	Incorrect
32	42	112	0	Sunny weather	Correct
31	43	109	0	Sunny weather	Correct
31	78	108	0	Clouded	Correct
30	43	105	0	Sunny weather	Correct
32	54	115	0	Sunny weather	Correct
32	57	116	0	Sunny weather	Correct
33	43	109	0	Sunny weather	Incorrect

	Correctly classified	Mis-classified	Accuracy
DNN	346	13	96.37883008
SVM	325	34	90.52924791

V. CONCLUSION

This paper presents three different wireless sensors for implementing IoT-based solutions for environmental monitoring and prediction: one employing User Datagram Protocol (UDP)-based Wi-Fi communication, second employing communicating through Wi-Fi and Hypertext Transfer Protocol (HTTP), and a third one using Bluetooth Smart were designed, developed, and analyzed. All of them are fabricated with discrete components and provide facile access to the Internet using a minimum of additional hardware and software resources.The analysis of the three implementations

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revealed the fact that all three technologies are suited for successfully environmental monitoring applications. The prediction done on the basis of sensor data collected, which experiments are done at Viman Nagar area in Pune on different weather conditions. The result showed in mobile application in form of data value and prediction. Employing this technology has been proved efficient and promising results which encourage for development of systems.

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