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WEATHER FORECASTING TECHNIQUES USING AI TECCHNIQUES

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ABSTRACT: A smart city enables the effective utilization of resources and better quality of services to the citizens. To provide services such as air quality management, weather monitoring and automation of homes and buildings in a smart city, the basic parameters are temperature, humidity and Co and Light intensity, gas leakage. This project presents a customised design of a environment monitoring and controlling system to monitor and control temperature, humidity and CO and Light intensity, gas leakage. In this project two arduino are used as slave and one WeMos D1 Mini as master. The information from the sensors in the environment from two slaves is send to the master WeMos D1 mini using Xbee module. The Wemos board has inbuilt Wi-Fi facility (ESP 8266 controller), so it connect with ThingSpeak server wirelessly and update data sensed by sensors and then plot the data as graphicalstatistics

I. INTRODUCTION

The importance of environment monitoring is existed in many aspects. The conditions environment is required to be monitored to maintain the healthy growth in crops and to ensure the safe working environment in industries, etc. Due to technological growth, the process of reading the environmental parameters became easier compared to the past days. The sensors are the miniaturized electronic devices used to measure the physical and environmental parameters. By using the sensors for monitoring the weather conditions, the results will be accurate and the entire system will be faster and less power consuming.

Environment monitoring is one of the major applications of wireless sensor network. WSN consist of different sensors which are widely distributed to monitor different environment parameters like temperature, humidity, gases, pressure, wind speed etc. The use of wireless ambient sensors can lead to more energy-efficient buildings. WSN consists of sensor nodes which are low cost devices with limited power. This system is used to measure the important parameters of environment such as temperature, humidity, CO and Light Intensity using sensors which are suitable for sensing the environmental parameters. The data collected by environment parameter sensing sensor is send to the master using Xbee.

Wireless Technology:

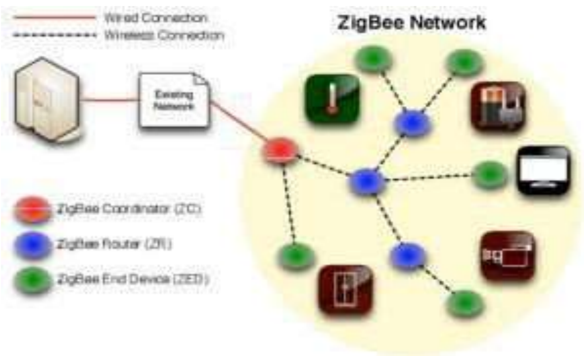

Fig.1. **Wireless Technology**

Zigbee Technology:

Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standarddefines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These Zigbee's WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The date rate of 250 kbps is best suited for periodic as well as intermediate two way transmission of data between sensors andcontrollers.

Zigbee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is less expensive and simpler than the other
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proprietary short-rangem wireless sensor networks as Bluetooth and Wi-Fi.

Zigbee supports different network configurations for master to master or master to slave communications. And also, it can be operated in different modes as a result the battery power is conserved. Zigbee networks are extendable with the use of routers and allow many nodes to interconnect with each other for building a wider area network. **Zigbee Architecture**

Zigbee system structure consists of three different types of devices such as Zigbee coordinator, Router and End device. Every Zigbee network must consist of at least one coordinator which acts as a root and bridge of the network. The coordinator is responsible for handling and storing the information while performing receiving and transmitting data operations. Zigbee routers act as intermediary devices

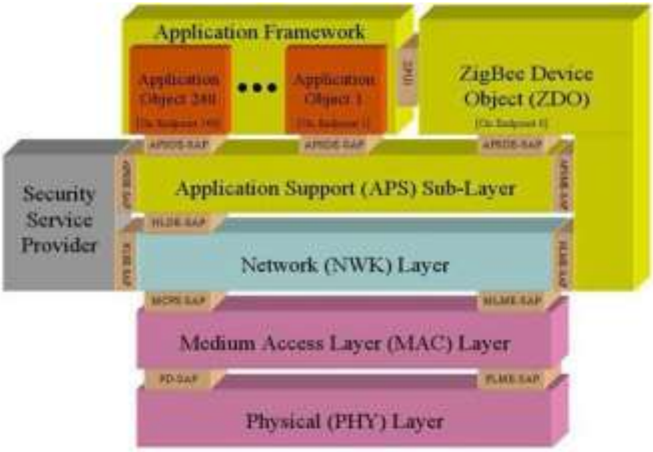

Fig.2. Zigbee system structure

that permit data to pass to and fro through them to other devices. End devices have limited functionality to communicate with the parent nodes such that the battery power is saved as shown in the figure. The number of routers, coordinators and end devices depends on the type of network such as star, tree and mesh networks. Zigbee protocol architectureconsistsofastackofvariouslayers whereIEEE802.15.4isdefinedbyphysicalandMAClayers whilethis protocol is completed by accumulating Zigbee's own network and applicationlayers.
Fig 1.1.1.3 - Zigbee protocol architecture

Physical Layer: This layer does modulation and Demodulation operations up on transmitting and receiving signals respectively. This layer's frequency, date rate and number of channels are given below.

	BAND	COVERAGE	DATA RATE	CHANNEL NUMBERS
2.4 GHz	ISM	Worldwide	250 kbps	11-26
868 MHz		Europe	20 kbps	0
915 MHz	ISM	Americas	40 kbps	1-10

Fig.3. Physical Layer of ZigBee Protocol

MAC Layer: This layer is responsible for reliable transmission of data by accessing different networks with the carrier sense multiple access collision avoidance (CSMA). This also transmits the beacon frames for synchronizing communication.
Network Layer: This layer takes care of all network related operations such as network setup, end device connection and disconnection to network, routing, device configurations, etc.
Application Support Sub-Layer: This layer enables the services necessary for ZigBee device object and application objects to interface with the network layers for data managing services. This layer is responsible for matching two devices according to their services and needs.
Application Framework: It provides two types of data services as key value pair and generic message services. Generic message is a developer defined structure, whereas the key value pair is used for getting attributes within the application objects. ZDO provides an interface between application objects and APS layer in Zigbee devices. It is responsible for detecting, initiating and binding other devices to the network.

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- **Internet of Things(IoT)**

The Internet of Things (IoT) is a system of 'connected things'. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighbouring things. But the real power of IoT is harnessed when the things connect to a 'service' either directly or via other 'things'. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex dataanalytics.

One such IoT application platform that offers a wide variety of analysis, monitoring and counter action capabilities is 'thingSpeak'.

- **ThingSpeak**

ThingSpeak is an open source Internet of Things (iot) application and APIto store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates".

ThingSpeak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plugins and apps for collaborating with web services, social network and other APIS.

II. LITERATURE SURVEY

Internet of Things (IOT) Based Weather Monitoringsystem

Present innovations in technology mainly focus on controlling and monitoring of different activities. These are increasingly emerging to reach the human needs. Most of this technology is focused on efficient monitoring and controlling different activities. An efficient environmental monitoring system is required to monitor and assess the conditions in case of exceeding the prescribed level of parameters (e.g., noise, CO and radiation levels). When the objects like environment equipped with sensor devices, microcontroller and various software applications becomes a self-protecting and self-monitoring environment and it is also called as smart environment. In such environment when some event occurs the alarm or LED alerts automatically. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by smart environmental monitoring system.

By using embedded intelligence into the environment makes the environment interactive with other objectives, this is one of the application that smart environment targets. Human needs demands different types of monitoring systems these are depends on the type of data gathered by the sensor devices. Event Detection based and Spatial Process Estimation are the two categories to which applications are classified. Initially the sensor devices are deployed in environment to detect the parameters (e.g., Temperature, Humidity, Pressure, LDR, noise, CO and radiation levels etc.) while the data acquisition, computation and controlling action (e.g., the variations in the noise and CO levels with respect to the specified levels). Sensor devices are placed at different locations to collect the data to predict the behaviour of a particular area of interest. The main aim of the this paper is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the webbrowse[1]r.

Real Time Remote Temperature & Humidity Monitoring Using Arduino and Xbee S2

A monitoring system generally refers to an automated system that simultaneously and continuously records one or more physical parameters such as temperature, relative humidity, wind flow, light intensity, soil moisture etc. at one or more predefined places. Continuous monitoring of any sensitive environment helps to meet security and regulatory compliance needs. Monitoring temperature and/or humidity conditions is an essential ingredient of a wide range of quality assurance applications. Monitoring deterioration would provide an early warning of incipient problems enabling the planning and scheduling of maintenance programs, hence minimizing relevant costs. Furthermore, the use of data from monitoring systems together with improved service-life prediction models leads to additional savings in life cycle costs. Temperature and humidity are key issues to be taken care of in manufacturing plants and particularly that of electronic assemblies. Lack of control over any of them will not only affect the component and equipment but also the process and the operators' comfort, all ultimately leading to loss in production. Temperature and relative humidity affects the airborne survival of viruses, bacteria and fungi. Thus environmental control in hospitals is important because of infectious disease transmission from the aerosol or airborne infection. Temperature and relative humidity plays an important role in the lifecycle of the plants. When plants have the right humidity they thrive, because they open their pores completely and so breathe deeply without threat of excessive water loss. Wireless sensor network (WSN) has revolutionized the field of monitoring and remote sensing. Wireless sensor network or wireless sensor & actuator network (WSAN) are spatially distributed sensors to monitor physical or environmental conditions such as temperature, humidity, fire etc. and to cooperatively pass their data through the network to the main location. The aim of this paper is to design and develop a system which fulfils all above requirements. In this paper digital humidity temperature composite (DHT11) sensor is used to sense the environmental temperature and relative

Humidity. Arduino microcontroller is used to make complex computation of the parameters and then to transmit the data wirelessly by using Xbee S2 module to the receiver. At receiver section Xbee S2 module is used to capture the serial data, which is transmitted, by transmitter and using Digi's XCTU software the data is logged ontoPC.[2]

Agriculture Environment Monitoring System Using Wireless Network

The agricultural practices such as irrigation, crop rotation, fertilizers, pesticides and animals were developed long ago, but have made great strides in the past century. The history of agriculture has played a major role in human history, as agricultural progress has been a crucial factor in worldwide socio-economic change. The concern of better quality agricultural products from the consumers made the farmers adapt to latest agricultural techniques by implementing modern technologies for producing better agricultural products. Among the important things which are taken into consideration by the farmers are the qualities of agricultural land, weather conditions etc. Traditional farming involves a human labour. With proper data the farmer will be able to deliver the quality product to the consumer. In this paper we have discussed about monitoring of agriculture parameter using soil moisture level sensor, Wireless technology. We update the parameter result from the sensor node data is transferred to the wireless transceiver to another end server PC. From the PC, then after that values are analysed and some predicate are applied on it. If they gives positive response then there will continuous monitoring but if it shows negative then it will provide total farming solution and cultivation plan. It also send these all solution to farmers or user via SMS to them in their regionallanguages[5].

Environment Monitoring using Wireless Sensor Network for Agricultural Application

Environment monitoring system, in general, is used to monitor various environment parameters with the help of sensor. Some communication media, like Wireless Communication, is needed to transfer sensor data. An environment parameter can be temperature, pressure, humidity, GPS location, or an Image. We can design a system to monitor all or any of these parameters as and when required. For monitoring purpose we need to install some sensors on each node. A node will interact with sensor and will transfer that data to controlling unit. A controller will receive data from each node and can take action depending on programming done. User can use Graphical user Interface (GUI) to manage all activities or to check data at any time. GUI can be designed using python, HTML, CSS or any other language. Depending on sensor types, various monitoring services can be designed. To monitor and control services or action we can use Internet. Data acquired by sensors can be transferred over network by using web server or by using some SMS service. To provide energy, battery cell can beused[6].

Present Scenario:

Variation in the environmental conditions checked with different sensor such as temperature/humidity sensor i.e DHT11, Co sensor i.e MQ7, and light intensity i.e LDR, Gas leakage detection sensor will help to monitor environment parameter.

All these sensors are connected to two slave Ardunio. Arduino send the sensors data to the master ZigBee module.

III. PROPOSED SYSTEM

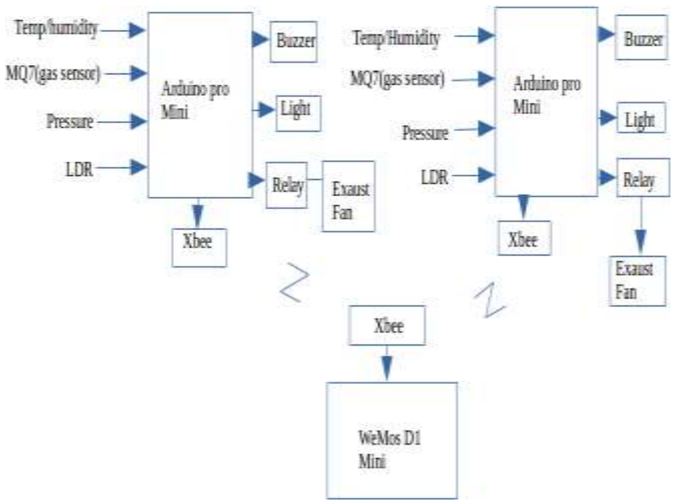

Fig.4. System Block Diagram

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Detailed explanation:
The above fig shows the block diagram for Smart Environment node. In this project we design the system which is useful for the Weather forecast centre. This system has two slaves and one master module. Two slaves has different sensors and send the data to the master module.

Slave 1: Slave 1 is the Arduino Pro mini atmega328 have different sensors such as DHT11 (Humidity and temperature sensor) for detecting temperature and humidity present in environment, Gas sensor (MQ7) which is able to detect Carbon Monoxide (CO) gas used for cooking with high accuracy and LDR (Light detecting Resistor) is used to detect light intensity since resistance of LDR changes with change in light intensity. When slave detects leakage of gas then it will automatically ON buzzer. Relay is connected to Arduino.

Relay act as switch to on or off fan when temperature increases from certain value. Slave 1 send measured data to master by ZigBee Transmitter.

Slave 2: Slave 2 is also Arduino Uno atmega328 have different sensors interfaced to it such as DHT11 (Humidity and temperature sensor) for detecting temperature and humidity present in environment, Gas sensor (MQ7) which is able to detect Carbon Monoxide (CO) gas used for cooking with high accuracy and LDR (Light detecting Resistor) is used to detect light intensity since resistance of LDR changes with change in light intensity. When slave detects leakage of gas then it will automatically ON buzzer. Relay is connected to Arduino. Relay act as switch to on or off fan when temperature increases from certain value. Slave 2 send measured data to master by Zigbee Transmitter.

Master: Master is We MOS D1 mini gets measured data by slave1 and slave2 by ZigBee Rx. Master Acts as main controller unit which get the environment parameters of two different locations with slave 1 and slave 2. Master first sends identifier to both the slaves to identify the identities of the two slaves. Then wemos receives data from them via ZigBee. The Wemos board has inbuilt Wi-Fi facility (ESP 8266 controller), so it connect with ThingSpeak server wirelessly and update data sensed by sensors.

Algorithm:

Step 1: Initialize the system.

Step 2: Slave 1 get the environment parameterbyusing different sensors such astemperature /humidity sensor i.e DHT11, Co sensor i.e MQ7, and light intensity i.e LDR

Step 3: Slave 1 control the light, exhaust fan based on monitored environment parameter.

Step 4: Slave 2 get the environment parameter by using different sensors such as temperature /humidity sensor i.e DHT11, Co sensor i.e MQ7, and light intensity i.e LDR

Step 5: Slave 2 control the light, exhaust fan based on monitored environment parameter.

Step 6: slave 1 send the monitored data to master using zigbeeTx

Step 7: slave 2 send the monitored data to master using zigbeeTx

Step 8: Master get monitored data by slave1 and slave2 using Zigbee Rx.

Step9: TheWemosboardhasinbuiltWi-Fifacility(ESP8266controller),soitconnectswith ThingSpeak server wirelessly and update data sensed bysensors.

Step 10: we get the data collected in graphical format on webpage.

IV. EXPERIMENTAL RESULT

Figure shows the actual hardware model of the proposed system which consist of 2 slaves (Arduino pro mini) and a master (Wemos D1 mini). Two slaves are interfaced with different types of environmental monitoring sensor such as DHT11, MQ7, LDR etc whereas the devices are DC fan, light and Buzzer.

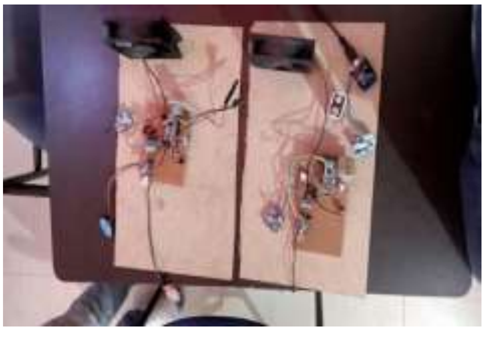

Fig. 5. Hardware

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Node 1 Graph

Fig 6. Shows the node 1 graph of the IoT based environment monitoring system

- **Node 2Graph**

Fig.7. shows the node 2 graph of the IoT based environment monitoring system

V. CONCLUSION

By keeping the embedded devices in the environment for monitoring enables self-protection (i.e., smart environment) to the environment. To implement this need, deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through thenetwork.

The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The important parameters of the environment such as temperature, humidity, CO are checked by the respective sensors. The measured parameters are transmitted to the thingSpeak cloud through the ESP8266 Wi-Fi Module.

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