IMPLEMENTATION OF IOT BASED ENVIRONMENTAL MONITORING SYSTEM

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Abstract: The internet of things (IoT) is one of the major technological trends which is interrelated to computing devices, mechanical and digital machines, humans, objects that are provided with unique identifiers and have the ability to transfer data over a network without requiring human to human or human to computer interaction. This paper presents a novel prototype of wireless environmental monitoring system using IoT. It monitors the environmental conditions in indoor spaces at remote locations by using the information received from an array of sensors and uploads the data in a cloud database that can be visualized and monitored from anywhere in the world with the help of any device connected to the internet. Wireless communication between the system components is performed based on IEEE 802.11 b/g standards. This work provides complete solution for a cyber physical system that consists of microcontroller, sensors, communication protocols, data management and storage using wireless communication at cyber level. The practical results show that the proposed system represents a straightforward solution for environmental monitoring at remote locations.

Keywords: *IoT, Sensors, Microcontroller.*

I. INTRODUCTION

The Importance of environmental monitoring is crucial in many aspects. The weather conditions are required to be monitored to ensure the safety of people living in remote locations and also alerting them from upcoming disasters. Due to the technological growth, the process of reading the environmental parameters became easier compared to the past days because of the wireless sensors.

This system for environmental monitoring uses low-power wireless sensors connected to the internet. Wireless sensor networks (WSNs) are the technology which is a combination of low cost, low power array of sensors and embedded unit which is a microcontroller that provide an ubiquitous computing [1] to detect the environmental conditions and upload them live into a cloud server wirelessly. It also automatically adjusts the environmental conditions according to the needs. They are used in indoor air quality monitoring which affects the health and comfort of the occupants [2]. The primary motivation behind the emergence of cyber physical systems (CPSs) is to improve the energy efficiency and reduce the pollution with decreasing the cost of computation, networking and sensing. These are based on embedded systems that include sensor networks, actuators, coordination and management processes that capture the physical data and acts on the physical environment that are integrated under an intelligent decision system [3]. The information collected by the sensors is further exploited by cyber physical systems. The CPSs

consists of interconnected clusters of processing elements and large-scale wireless networks gathering data and acting upon the environment [4]. These systems are related to internet of things (IoT).

IoT is the advanced technology of connecting the whole world at one place. The objects, things and sensors can be connected to share the data obtained from various locations and analyze the data for coordinating various applications in different fields. IoT offers a wide range of connectivity devices with various protocols for obtaining complete machine to machine interaction [5] .

This paper proposes a system for environmental and ambient parameter monitoring using WSNs connected to the internet which send their measurements to a central server using IEEE 802.11 b/g standards. The data from all over the world is stored in a cloud server and can be visualized from any device connected to the internet. The wireless communication standard chosen in our system was by analyzing the requirements of the application that the environmental conditions should be monitored and updated continuously all the time. There are various other communication technologies like Zigbee, RF link etc., but they can only perform localized communication but here we have to broadcast the information to the whole world so here the Wi-Fi technology is used and GPRS module is used as communication device of the system. The World Wide Web (www) needs to have one client - server configuration for communication. The client needs to be connected to the server with its IP address which can be accessed universally. The GPRS module at certain period of time updates the information to the web page through the server. The system equipped with sensor devices should act as a client to send the data to the web server. For establishing a connection between the sensor network and internet, we used a GPRS module as an additional communication interface controlled by the microcontroller. A GPRS module requires a source of internet connection with the help of SIM card. Once the GPRS module is configured with an internet source, it acts as a client and sends the sensor data retrieved by the microcontroller and we can access it from anywhere using internet. The Wi-Fi technology overcomes the problem of system integration and interoperability by providing a well-defined architecture which simplifies the transmission of data from sensors with different capabilities and increases supervisory efficiency of the system [6]. Because of the evolvement of new power-efficient Wi-Fi devices the drawback of energy consumption is also solved. These also provide advantages like low cost, reduced infrastructure and existence of familiar protocols and management tools [7]. Further the high transmission rates are achievable and no special wireless adapters are required.

This system can also be implemented as an automated irrigation system [8] which keeps track on soil moisture and temperature sensors that helps in water saving compared to the traditional implementations. Sentinella is a smart monitoring solution for the assessment of possible causes of power inefficiency at photovoltaic panel level based on WSNs [9]. In this system temperature, relative humidity, carbon dioxide levels, light intensity are measured through sensors which send the data using the existent wireless infrastructure based on the IEEE 802.11 b/g standards. Through an IP address the data from the sensors can be accessed from every place with an internet connected device. This system can be implemented on a wide variety of applications.

II. PROPOSED SCHEME

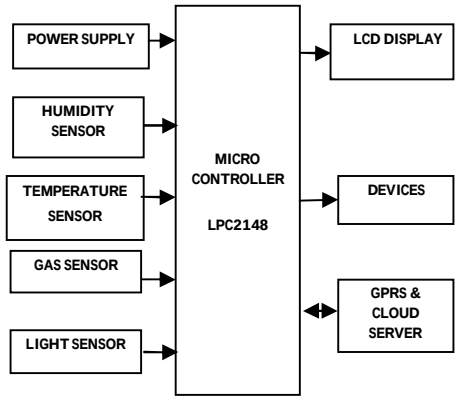

Fig 1: Block Diagram

III. METHODOLOGY:

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7 LPC2148:

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind of technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

Liquid-crystal display (LCD):

LCD is a flat panel, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are used to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically) are self-resetting over current protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.

Fig 2: Temperature sensor

Humidity sensor:

Humidity sensor is a device that measures the relative humidity in a given area. A humidity sensor can be used in both indoor and outdoor environment. Humidity sensors are available in both analog and digital forms. An analog humidity sensor gauges the humidity of the air relatively using a capacitor-based system. The sensor is made out of a film usually made of either glass or ceramic. The insulator material which absorbs the water is made out of a polymer which takes in and releases water based on the relative humidity of the given area. This changes the level of charge in the capacitor of the on board electrical circuit. A digital humidity sensor works via

two micro sensors that are calibrated to the relative humidity of the given area. These are then converted into the digital format via an analog to digital conversion process which is done by a chip located in the same circuit. A machine made electrode based system made out of polymer is what makes up the capacitance for the sensor. This protects the sensor from user front panel (interface).

Fig 3: Humidity sensor

Co2 sensor:

They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, i-butane, propane, methane, alcohol, Hydrogen and smoke. The surface resistance of the sensor Rs is obtained through effected voltage signal output of the load resistance RL which is series-wound. The relationship between them is described as:

Rs\RL = (Vc-VRL) / VRL

Fig 4: Co2 sensor

LDR:

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance it drops dramatically. The Fig 5 shows that when the torch is turned on, the resistance of the LDR falls, allowing the current to pass through it. This is an example of a light sensor circuit when the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light. However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. The LED lights on. The preset resistor can be turned up or down to increase or decrease resistance, in this way it can make the circuit more or less sensitive.

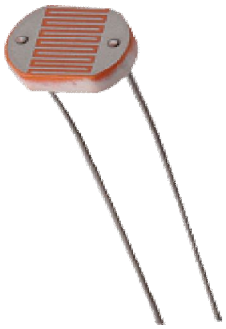

Fig 5: LDR

GPRS module:

GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets

that are transmitted separately and then reassembled at the receiving end. GPRS supports the world's leading packet-based Internet communication protocols, Internet protocol (IP) and X.25, a protocol that is used mainly in Europe. GPRS enables any existing IP or X.25 application to operate over a GSM cellular connection. Cellular networks with GPRS capabilities are wireless extensions of the Internet and X.25 networks.

Fig 6: GPRS module

IV. CONCLUSION

The research and implementation of a system for monitoring the environmental parameters using IoT based on the existent IEEE 802.11 infrastructure, was successfully accomplished. It employs sensors measuring the environmental conditions, which send messages to an IoT platform using UDP. The communication protocol and the design of the nodes help in achieving low power consumption, offering battery lifetime of several years. The system is tested in an indoor environment and it successfully updated the weather conditions from sensor data into the cloud server. This system eliminates bulky solutions and provides the possibility of logging data from any place where Wi-Fi network coverage exists, and it can be used in a wide range of monitoring applications. This is also a less expensive solution due to the usage of low power sensors and SoC contained GPRS module

V. REFERENCES

[1] Stefan poslad, Ubiquitous Computing: Smart Devices, Environments and Interactions, Wiley's hand book, 2009.

[2] L. Zhang and F. Tian, "Performance study of multilayer perceptrons in a low-cost electronic nose," *IEEE Trans. Instrum. Meas.*, vol. 63, no. 7, pp. 1670–1679, Jul. 2014.

[3] J. Wan, M. Chen, F. Xia, D. Li, and K. Zhou, "From machine to machine communications towards cyber-physical systems," *Comput. Sci. Inf. Syst.*, vol. 10, no. 3, pp. 1105–1128, 2013.

[4] F.-J. Wu, Y.-F. Kao, and Y.-C. Tseng, "From wireless sensor networks towards cyber physical systems," *Pervasive Mobile Comput.*, vol. 7, no. 4, pp. 397–413, 2011.

[5] Ashton,K., "Iinternet of things,"RFID Journal. 22, (2009), 97-114.

[6] Sagar J.S.T., M.S.Balamurugan and J.A.Vivek, "A wireless framework for automotive monitoring systems,"in Indian Journal of Science and Technology, Vol 8(19), IPL0146, August 2015.

[7] S. Tozlu, M. Senel, W. Mao, and A.keshavarzian, "Wi-Fi enabled sensors for Internet of Things: A practical approach" *IEEE Commun. Mag.*, vol. 50, no. 6. Pp. 134-143, Jun. 2012.

[8] J.Gutierrez, J. F. Villa-Medina, A. Nieto-Garibay, and M. Porta-Gandara, "Automated irrigation system using a wireless sensor network and GPRS module," *IEEE Trans. Instrum. Meas.*, vol. 63, no. 1, pp. 166-176, Jan. 2014.

[9] B.Ando, S.Baglio, A.Pistorio,G. M. Tina, and C.Ventura, "Sentinella:Smart monitoring of photovoltaic systems at panel level." *IEEE Trans. Instrum. Meas.*, vol. 64, no. 8, pp. 2188-2199, Aug. 2015.