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Arduino Nano based Dust and Humidity Quality Monitoring using Web of Thing

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***Abstract*: In this context where combination of many challenges of computer science, wireless communication and electronics; the Smart Sensor Networks are an emerging field of research. In this paper a solution to monitor the air and noise pollution levels in industrial environment or by using wireless embedded computing system a particular area of interest is proposed. The technology like Internet of Things (IoT) is included in the form of solution which is outcome of merged field of computer science and electronics. For monitoring the fluctuation of parameters like air pollution levels from their normal levels in this case the sensing devices are connected to the embedded computing system. For the requirement of continuous monitoring, controlling and behavior analysis this model is adaptable and distributive for any infrastructural environment. The working appearance of the proposed model is evaluated using prototype implementation, consisting of Arduino Nano board, sensor devices for two or three parameters like humidity, temperature, dust levels the implementation is tested with respect to the normal behavior levels or given specifications which provide a monitoring over the pollution control to make the environment smart and ecofriendly.**

***Keywords*: Arduino Nano, Dust Sensor, Humidity Sensor.**

1. Introduction

The Nowadays, the Wireless Sensor Network (WSN) is considered to be an essential technology that is used in many fields and projects such as monitoring the water quality, engine emissions and air pollution and metrological. It is made of nodes, every node or more than one node is connected to one sensor. The WSN had many advantages which are sufficient data, temporal accuracy, flexibility, low power consumption, less implantation cost and so on [1]. The wireless sensor network can be an excellent device to observe air quality. It gathers air quality data automatically.

Due to depending on industrial and fossil fuel in over the world, toxins and unhealthy gases and radiation that in many cases cannot be detected by smell or sight surround by humans. These gases and radiations have many potential dangers such as lung damage, skin damage, and even cancer and death, not to mention the possibility of explosive gas damage [2].

This paper presented an approach to prevent such dangers in a reliable and affordable way. Many hardware can be used to implement this work such as the Arduino, PandaBoard ES, Cubieboard, Hackberry, Arduino nano and so on. This project aims to prevent such dangers by using the Arduino nano because of its features and characteristics, which are:

1. Relatively low-cost.
2. Easy to program and understand.
3. Portable computer and pocket size device.
4. Many sensor nodes can be hooked up to it.

2. Methodology

Many The model was designed using Node MCU, formaldehyde sensor, dust sensor, DHT22 sensor and Organic Light emitting diode (OLED) display. Fig. 1 shows the functional block diagram. Node MCU is the major node controlling our system. The sensors are being used for detecting different environmental parameters like particulate matter, carbon monoxide, carbon dioxide, temperature, humidity and pressure. The sensors are connected to Node MCU board. The data sensed by the sensors are continuously transmitted through Wi-Fi module to the cloud over the internet because of its good network connectivity. Formaldehyde concentration measurement sensor and dust sensors are used for measuring the particulate matter i.e. Smoke and dust present in our Environment these two sensors having the digital serial communication outputs. The sensors detect either gases or dust particles present in the air and displays the output in OLED display.

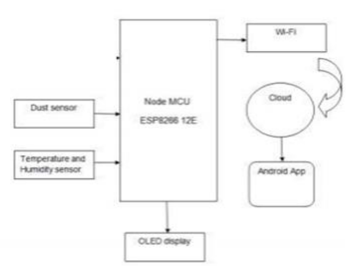

Fig. 1. Block diagram of proposed system

Node MCU is a low-cost microcontroller board based on atmega-328p which can be easily interfaced with Wi-Fi module. This Wi-Fi module provides the internet to the complete system. The light weight protocol MQTT (message queuing telemetry transport). MQTT plays an important role in establishing communication between the sensors and the clients. The client can access the data that is being displayed on the android app by using the device id but the client will be not able to do any modification to the data received

These gasses are possible threats facing every household, but protection from these gases (through companies that offer devices and sensors for protection) are costly and are out of the reach of many people. That leads to present this project to find a solution for this problem by protecting against these dangerous gases and making sure houses are safe, while at the same time keeping costs low and affordable,

3. Related work

The [1], [2] Hussein in his research has explained that the goal of the project is to use common and available sensors to create engine emission detecting computer and give a judgment on whether an area is above or below the required emission levels. The main method of measurement is using a Carbon Monoxide sensor [2].

Arizaga, Calleja, Hernandez, and Benitez presented a project, which is built around an automated control system that is used to ensure sterilization of biological material. This system is separated into four modules that are flame detection, pressure sensor, gas control and PU modules. The system is controlled centrally by an Arduino board using the C++ language. The system was tested to ensure that it is able to maintain the different environmental variables needed for proper sterilization [3].

Sayantani, Sridevi, and Pitchiah explained in their paper that the project's stated aim was to develop a wireless solution for indoor air quality monitoring using Java. The proposed system is to integrate environmental parameters like temperature, humidity, gaseous pollutants and aerosol/particulate matter into a controlling HVAC (Heating, Ventilation, and Air Conditioning) system in a smart building [4].

In 2013, Preethichandra has demonstrated that the research objective is the development of an ultra-low power microcontroller for sensor nodes to gather information on indoor air quality. The system measures Carbon Dioxide, Carbon Monoxide, Propane and methane using industrial grade gas sensors. The research was verified with actual measurements under real-life situations [5].

In 2014, Ferdoush and Xinrong designed an environmental monitoring system based on Arduino and Raspberry Pi. It is an inexpensive and scalable wireless sensor network system that can be used in many environmental monitoring applications [6].

In 2016, Sonali and Venkatasubramanian presented a Raspberry-pi based on IOT system that is able to monitor the environmental parameters, such as carbon dioxide, temperature, humidity, and carbon monoxide. The system uploads the recorded parameters to the cloud for the user, who can track the condition of the environment [7]. As for Balasubramaniyan and Manivannan, they described a monitoring system for Air quality that uses IoT and Raspberry Pi. The system goal is to remotely monitor the air quality in a specific area of interest, and it is a user-oriented system [8]. In addition, Jadhav et al. built a Raspberry-pi based environment monitoring system. It is a universal and scalable system that can monitor the environmental parameters such as humidity CO2 concentration in air, temperature, and more [9].

By 2017, Rohani et al. used Arduino microcontroller with Open Platform Communications (OPC) in designing a monitoring system to control and monitor the CO2 emission in the industrial environment. System testing was performed in a lab under real-time CO2 emissions measurement, and system implementation indicated a successful application [10]. A real-time monitoring system for agriculture's weather was proposed by Susanto et al., which used parallel processing, Arduino, and Raspberry Pi. The system was faster and 50% efficient than the systems with single processor [11]. Furthermore, Mekki and Abdallah implemented a monitoring system for greenhouse controlling using Wireless Sensor Networks (WSN). Temperature, humidity, and soil parameters were controlled by the proposed system [12].

Abd Allah et al. presented a data logger system that can be used in applications of environmental monitoring. The system is universal, it is built using Arduino and LabView software, and can be used as a standalone device. It can monitor and record a massive amount of data [13].

Baharun et al. used the SICK sensor in conducting a study on measuring and analyzing the air quality inside the Meru Menora Tunnel. The study helped in controlling the ventilation fan system, which operates efficiently depending on the gases concentration level in the tunnel and thus eliminates the power consumption [14]. Montanaro et al. presented an air pollution monitoring system for the city, called SmartBike. The system exploited a network of bicycles to provide several services to citizens, such as bikes location detection, antitheft, traveled distance, and monitoring of air pollution [15].

4. Result

S. no.	Sensors	Test	Result
1	Dust	Vary the dust particle in environment and observe the changes in dust density.	Dust density is increased or decreased and output is shown in figure (2).
3	Temperat ure	Vary the temperature in environment by using heat and observe the increased temperature.	Temperature is increased and output is shown in figure (3).
4	Humidity	Vary the humidity in environment and observe the increased or decreased humidity.	Humidity is increased and output is shown in figure (4).

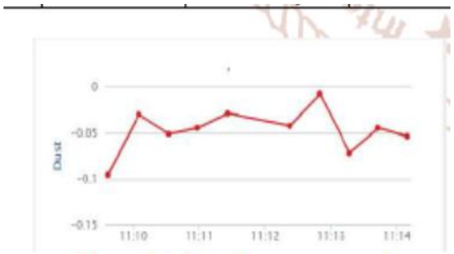

Fig. 2. Test result of dust sensor

Fig. 3. Test result of temperature sensor

Fig. 4. Test result of humidity sensor

A. System testing

IoT cloud server is created to get the updated data in the server. We get the data into the IoT thing speak server from the hardware module. By varying all sensors data behavior we get different values of data and the data is checked in different places. All sensors real data is updated in real time in thing speak server.

5. Conclusion

Here we are going to conclude that fine dust monitoring system is designed using different sensors for indoor and outdoor air quality monitoring. Two sensors are designated in the system for monitoring different parameter from environment. We got the temperature and humidity parameter, and dust density from Environment by using temperature sensor, Gas sensor and dust senor respectively. The real data from sensors in IOT server and hence human society will be taken precaution for their better life. With the help of this system People can get all real time environment data from different area and they can schedule their life according to it. Here each module is tested and got the proper result from all modules according to environmental change.

We have taken the record data and all data are available in IOT server. Hence the system is very useful for better life of human being and helpful for society precaution.

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