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IOT-BASED DATA LOGGER FOR WEATHER MONITORING WITH ARDUINO USING SENSOR NETWORKS WITH REMOTE GRAPHICAL APPLICATION

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Abstract: In recent years, the monitoring systems play significant roles in our life. So, in this paper, we propose an automatic weather monitoring system that allows having dynamic and real-time climate data of a given area. The proposed system is based on the internet of things technology and embedded system. The system also includes electronic devices, sensors, and wireless technology. The main objective of this system is sensing the climate parameters, such as temperature, humidity, and existence of some gases, based on the sensors. The captured values can then be sent to remote applications or databases. Afterwards, the stored data can be visualized in graphics and tables form.

Keywords— Arduino; weather station; internet of things; wireless; sensors; smart environment)

I. INTRODUCTION

Internet of Things (IoT) affects all habitual domains[1]. The invented IoT systems are attempted to control, manage, and monitor human usual actions, environmental parameters, or animal movements. So, all these innovations are developed to facilitate human work and make the life easier than before. In this stage, the environmental monitoring systems are invented to measure and control the environment parameters. For many years, humans try to understand their environment. So, humans have invented many objects to measure various parameters. For example, humans have created thermometer, barometer, and pyrometer for measuring temperature, atmospheric pressure, and solar radiation, respectively. However, those traditional tools must be used locally.

The recent environmental monitoring systems are based on the sensors, such as temperature, humidity, and pressure sensors. Some of these sensors can support different environmental conditions. But, others require specific conditions. These sensors can capture the corresponding physical or chemical weather values and convert them to an electric signal. Hence, the captured values are transferred as electric signal to an electronic card. The last one is able to understand the received signals and give its respected value to each one.

II. LITERATURE REVIEW

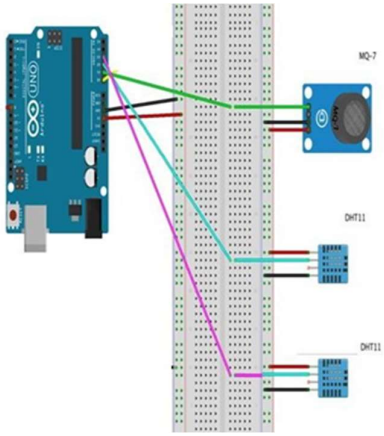
In recent time, the new technology applications allow us to measure various air parameters in distance, thus to monitor airi quality remotely. These applications are developed thanks to the advantage of internet ofi things and the innovation of new devices. The monitoring systems necessitate the application interface that can be web page, software, or mobile application for visualization of the received values or controlling the systems.

In 2016, Rao presented the system fori monitoring weather based on IoT. The systemi measured various parameters such as temperature values, light intensity, and CO level. In the same year, Ram and Gupta developed weather visualization system based on wireless sensor networks. This latter is able to capture temperature, light, and humidity values. The sensed data are then transferred to web page for monitoring. In 2017, Kumar and Jasuja designed a new system based on the internet of things technology by using the Rasberry Pi card. The system aimed to evaluate air quality by measuring its parameters, such as temperature, monoxide and dioxide carbon, andi air pressure and humidity.

In 2019, Durrani proposed a smart weather station for monitoring weather parameters. This system is equipped with various sensors that collect data from their location and then send them to the cloud. In addition, they can predict the future stations of weather by using machine learning algorithms.

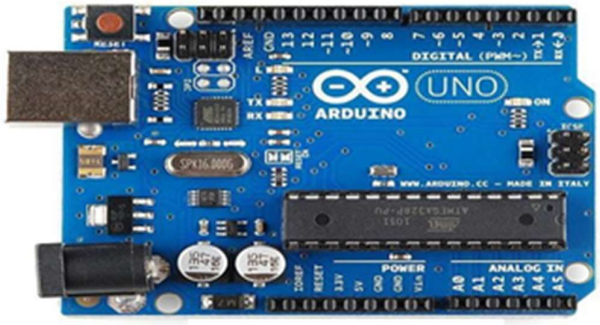
III. SYSTEM ARCHITECTURE

In order to monitor the air and weather conditions, we have implemented a new application that is illustrated in Fig. 1. Our application can capture both weather and air parameters. The realized framework includes an Arduino card as a central management unit. Then, all sensor and devices can be connected with it directly or indirectly.
The connected sensors are able to measure weather and air information from their environment. The captured values are transmitted to Arduino card for local processing. After a simple treatment, the Arduino card transmits the processed values to computer that includes database. The stored information can be accessed remotely via page web, where it is represented graphically. The main components of the proposed system are depicted in Fig. 1 and they are detailed in the following.



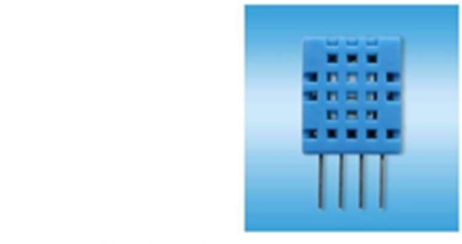
(1) Arduino UNO R3 card

In our system, we have used the Arduino UNO card illustrated in Fig. 2a. As we can see, it is a small electronic card that integrates microcontroller. Arduino UNO card is given the ability to be programmed for receiving the sensed values by sensors and control the actuators. On the other hand, the sensors and actuator can be connected to Arduino via the digital and analog pin. Besides, the Arduino is powered via USB connector or via Direct Current (DC) jack connector. Arduino UNO card is linked with an integrated voltage regulator. Hence, the power source for connecting has to be between 5 and 12 V.



A gas sensor is a device which detects the presence or concentration ofi gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance ofi the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

In our experiment gas sensor MQ-135 was used to detect if the there was presence of smoke in the surrounding area.The LED light on the sensor turns on in presence of smoke, and the reading will be shown as “SMOKE DETECTED” in case there is presence of carbon dioxide or methane composition in the air.

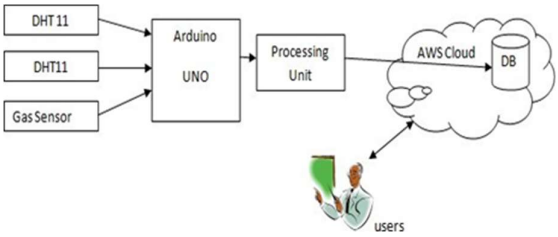


DHT11

MQ-2

IV. TESTING

With aims to evaluate our proposed system, we have done some experimental tests. Hence, after compiling the program code source and downloading it in Arduino board, we have tested each parameter separately.



(1) Humidity and temperature sensor experiment

In our system, the sensor used for sensing the humidity and temperature is DHT22 sensor. In order to monitor the humidity in given zone, we have performed this basic test: The DHT22 sensor was placed in an extremely humid location, then we had noticed that the system began to register various values ofi humidity. The received values are exposed graphically and in cards . The result ofi this experiment is considered as a demonstration that confirms the reaction of the sensor to the humidity levels. Consequently, it also shows that our system is efficient for monitoring the humidity remotely. On the other hand, we have done another simple test for surveying the temperature values. During this examination, we used a small flame to change the air temperature. Then, the sensor DHT22 was positioned near the flame to perceive the variation of the air temperature. The obtained temperature measurement is illustrated in form of graph and displayed in our user interface or our webpage.

(2) Gas Detection experiment

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration ofi the gas the sensor produces a corresponding potential difference by changing the resistance ofi the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

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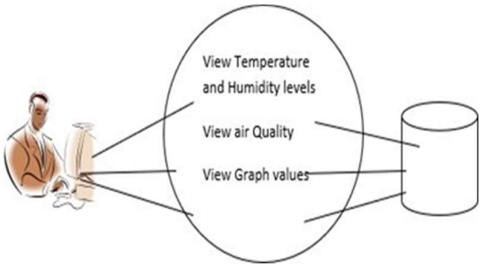
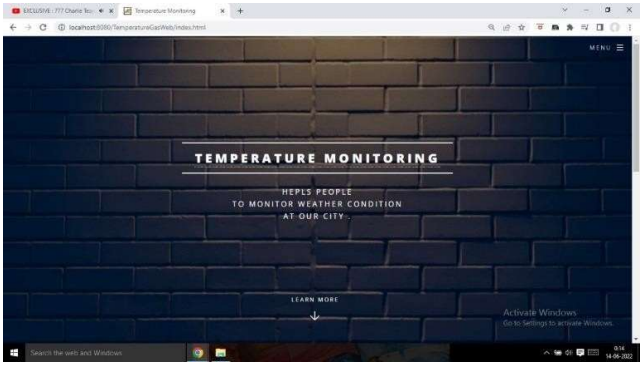


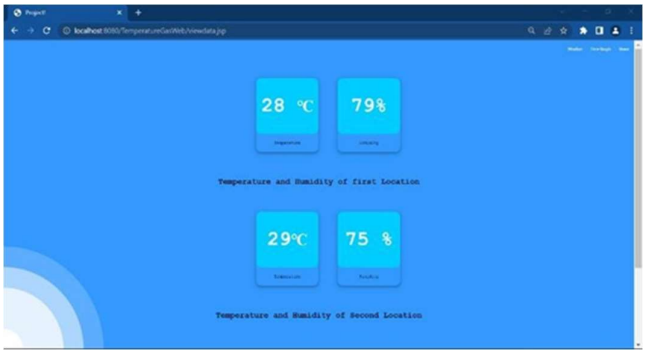
V. EXPERIMENTAL TEST



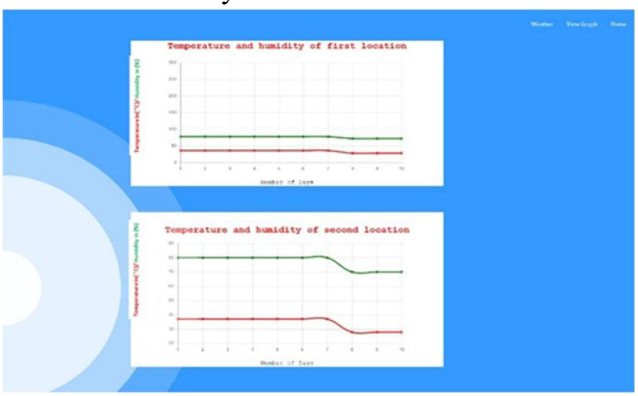
This is the first page in the user interface that contains side menus in the menus option for displaying, viewing temperature humidity and presence of gas in cards and in graphical form.

Main page with side menus to view current status and in graphical form.

Forecast page that shows the temperature and humidity of two different location and the presence of gas. It will be shown 'gas present' in presence of methane or carbon monoxide in the air.



Temperature and Humidity of two different locations in card form.



Temperature and humidty of two different locations in graphical form.

VI. CONCLUSION AND FUTURE SCOPE

The implementation of a system for monitoring environmental parameters using the IoT has been tentatively tested to verify air and weather parameters. The system provides a low energy consumption solution for the establishment of a station weather system. The system is tested in an indoor environment and it successfully updated the environment and weather conditions from sensor data. It is also a less expensive solution thanks to the use of low power consumption sensors and arduino board. This information will be useful for future review and tend to be shared effectively with various users. This model can also be extended to the observation of contamination in new and modern urban areas. To protect the general well-

being from contamination, this model provides an effective and minimal effort response for continuous observation. In future we can enhance the project by using more and more sensors for various locations and collect the temperature and humidity data for the study of environment. By that we can have prediction of data about the rain, summer and winters.

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