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AIR POLLUTION MONITORING AND MANAGEMENT WITH IOT-BASED WIRELESS SENSORS

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Abstract

Air pollution has become a critical issue, especially in the healthcare and medical sectors. Over time, the level of air pollution has worsened due to factors such as population growth, increased car usage, industrialization, and urbanization, all of which negatively impact human health and overall life satisfaction. The quality of the air directly affects public health, security, and safety. There are various alarming concerns about the deterioration in air quality in some cities of India. Among all of these, particulate matter (PM 2.5) is considered the chief pollutant. The latter causes respiratory disorders and obstructs many metabolic processes, so there is a lot of demand for inexpensive equipment that can be deployed without much hassle in any place under the sun. The objective of this project is to design an IoT-based air quality monitoring system using Arduino UNO for a simple yet effective solution.

Keywords: Air pollution, population growth, industrialization, urbanization, respiratory system

I. INTRODUCTION

The air quality sensors in this gadget use PM2.5, or airborne particles with a width ofaround 2.5 microns. A hydrogen sulphide detecting sensor with a sensitivity limit of 1 to200 ppm is the MQ136. The DHT11 sensor isused to measure moisture in addition to temperature. Wine makes the MQ-2 smoky and flammable sensor. Between 300 and 10,000 ppm, combustible gas can be detected by it. The Arduino UNO is linked with all the sensor and the esp8266 WiFi module. With the esp8266 Wi-Fi module, the Arduino Uno continually collectsdata from sensors and updates it in the Thing speak cloud along with the date and time. Thistask was accomplished via a microcontroller preloaded embedded C application.

The key objectives of the project are:

- Technology for continuously tracking air quality
- Wireless monitoring system poweredby IOT
- Uploading the sensor data to theThing speak cloud using Thing speak
- Completing this challenge with anArduino UNO

II. THEORY

An embedded system combines hardware and software to carry out a specific purpose. Microprocessors and micro-controllers are a couple of the common components found in embedded goods. As they merely receive input, process it, and output, micro-processors are

frequently alluded to as general purpose processor. A micro-controller, on the otherhand it receives the data as inputs and alternates, connects to various devices, manipulates it, ultimately generates output. A unique research that uses an Arduino UNO microcontroller to evaluate air qualityparameter's using sensors and modify them in the Thing speak cloud through an ESP 8266 WI-FI module is called "IoT Based Wireless Sensor Network for Air Pollution Monitoring."

2.1 Embedded systems

An embedded system is prepared tohandle a single or a minute number of tasks, sometimes during real time computational limitations. It is included into a whole machine, frequently with bothelectronic and mechanical components. A general-purpose computer, such as a personal computer (PC), on the other hand,is made to be adaptable and to satisfy a variety of user demands. To days commonplace devices are controlled byembedded systems. One or many more primary processing components, often micro- controllers or digital signal processor, are in charge of handling embedded systems. Having dedicated to completing a work is essential, as it may need an incredibly strong processor. For example, though they establish data centers and specialized nationwide and regional network to connect airports and radars, aviation safetysystems might be considered embedded.

Design engineers may maximize the embedded system performance and reliability while reducing the product size andcost since it is allocated to certain functions. Embedded systems are mainly mass produced to take the scale advantages. Fundamentally embedded systems includes the mobile gadgets like Music player and smartwatches to bulk installation like the traffic signals, industrial control and power plant (nuclear) controller. A micro-controllerchips has a minimum amount of functionality, whereas various unit, accessories, and network built inside a resizable chasis or enclosure have a high degree of complexity's.

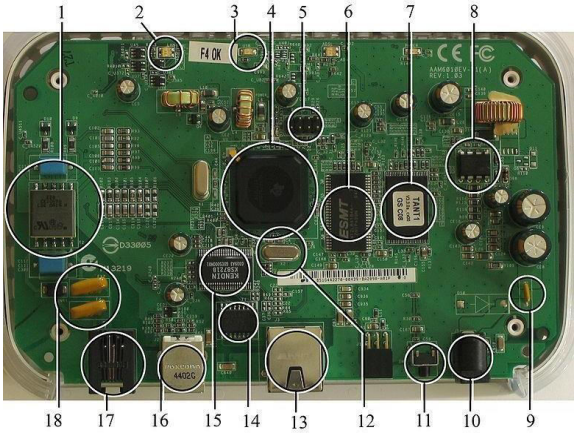

Fig 1. A modern example of embeddedsystem

The different types of Embedded systems:

i. Stand-alone embedded system
ii. Real-time embedded system
iii. Network communicationembedded system

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Applications of embedded system are: Consumer's application, workplace automations, Industry automations, Robot, Computer's networking, and Tele-communications.

2.2 Hardware description

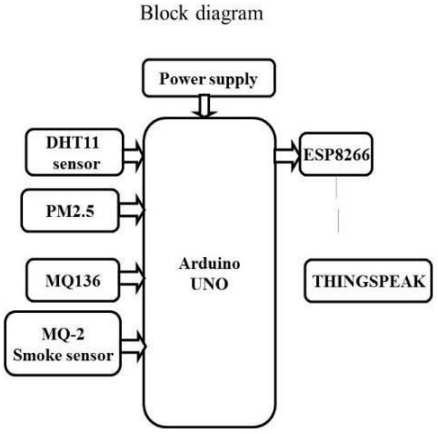

Figure. 2. Block diagram of IoT Based wireless sensor network for Air pollution monitoring

2.3 Arduino UNO

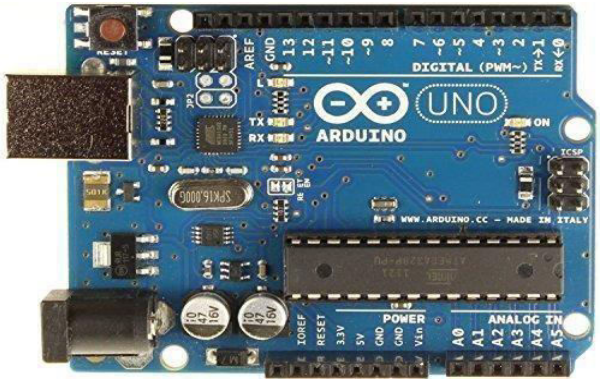

Figure. 3. Arduino UNO

The AT mega 328 from the AVR group isthe micro-controller board on the Arduino UNO. There are 6 Analogs, a 16 MHz resonator (ceramics), and 14 digital multipurpose pins. Restart switch, powerjack, and USB are used. Many modules that accompany it's technology makes coding practical.

2.4 Regulated power supply

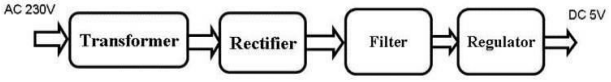

Figure. 4.Block diagram

The energy supply (electrical) is a power source. A machine or system that supplies

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electrical or some other kind of types of energy to a load side or group of loads is that unit. The term is most used in relation tothe sources, less often in relation to computers, and infrequently in relation to other people.

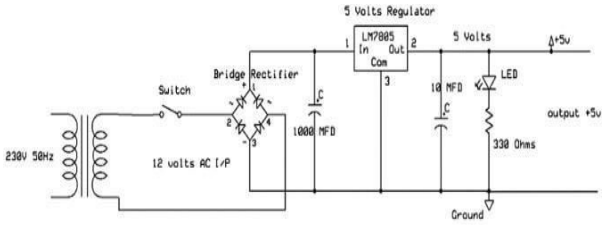

Figure. 5. Circuit diagram of Regulated Power Supply with Led connection

2.5 PROPOSED SYSTEM

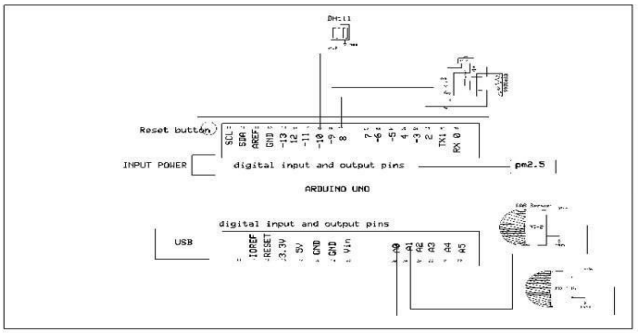

Figure. 6. Schematic diagram of IoT Based wireless sensor network for Air pollution monitoring

The IoT based sensor networks for air- pollution monitoring schematic diagram above demonstrates how each component interfaces with a microcontroller.

2.5.1 Procedure for Compilation, Simulation, and Dumping

Step 1: Parts

1 - Arduino on a Bread-board1 - Arduino UNO Connecting Wire
Arduino IDE (installed on PC)

Step 2: Approach

AT mega 328 on the Arduino on a Bread board is loaded using the Arduino UNO. AnAT mega 328P-PU can do this very easily, while an AT mega 328-PU requires an additional step.

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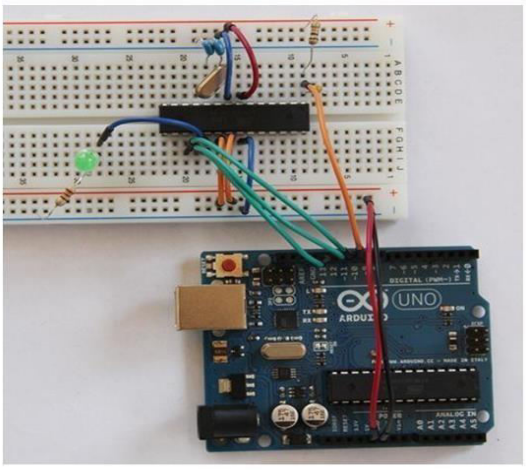

Figure. 7. Arduino UNO

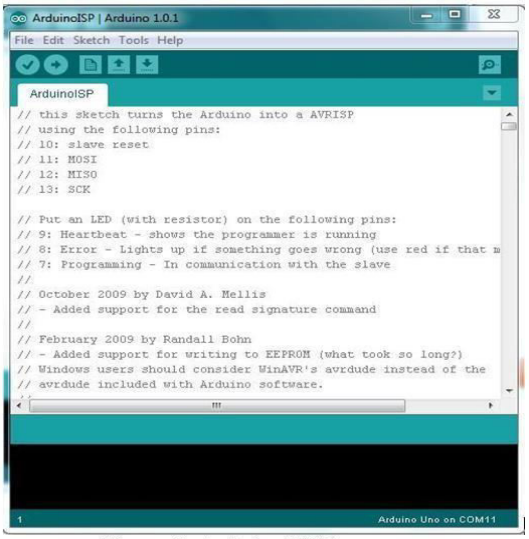

Figure. 8. Arduino UNO program

Step 3: Programming of Arduino UNO as anISP

The Arduino UNO will burn the boot loaderon to the Bread board chips, it is to be program to function as an ISP.

- Start the ArduinoIDE first
- Launch the Arduino ISP projectdesign
- If you are using the IDE version 1.0

Step 4: Connect your AT mega 328

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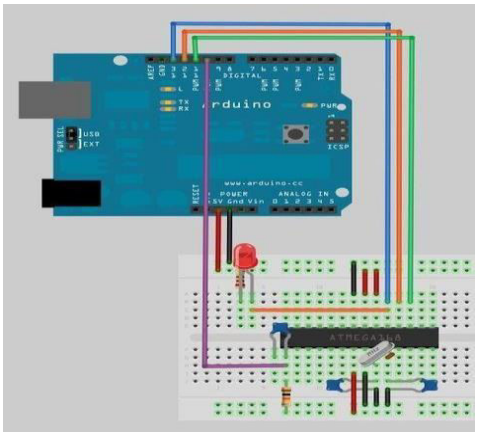

Figure. 9. AT mega 328

Step 5: Which ATmega328 are you using?

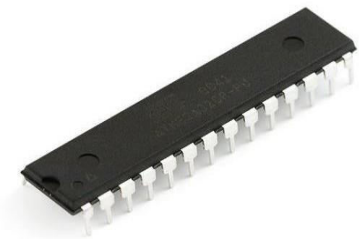

Fig 10. AT mega 328

There are many AT mega 328 models, as I had to figure out on my own. The different versions that fascinate us are the AT mega 328 PU and theAT mega 328P PU. Our bread board requires a PDIP installation, which is indicated by the PU designation.
The pico-Power 328P Processor, which is designed for minimal power consumption, is used in the Arduino board. Because to its low energy consumption, this is the ideal choice.

III. COMPONENTS DESCRIPTION

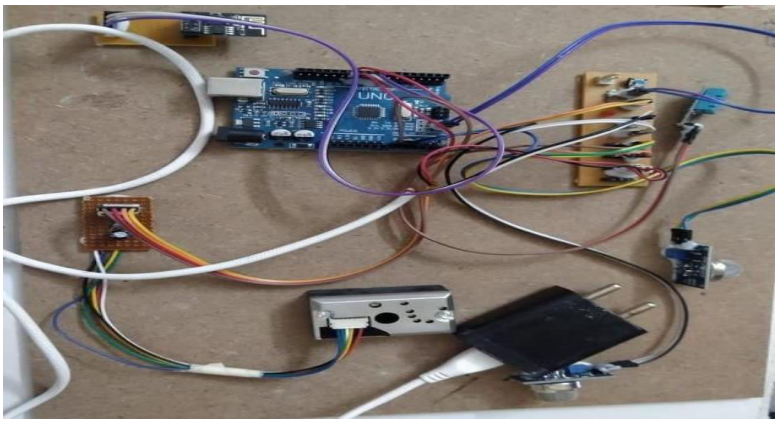

Fig 11. Entire setup model

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A. HARDWARE COMPONENTS

MQ135 Sensor

Fig 12. MQ135

The MQ135 sensor can sense NH3, NOx,alcohol, Benzene, smoke, CO2 and someother gases.It gives the output in form of voltage levels.

LPG Sensor

Fig 13. MQ6

MQ-6 sensor is a simple-to-use liquefiedpetroleum gas (LPG) sensor, suitable forsensing LPG (composed of mostly propane and butane) concentrations inthe air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm.

P.M 2.5

Fig 14. P.M 2.5

This PM2.5 GP2Y1010AU0F Dust Smoke Particle Sensor is an infrared emitting diode (IRED) and a phototransistor are diagonallyarranged into this device. It detects the reflected light of dust in the air. Especially,it is effective to detect very fine particle likethe cigarette smoke.

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DHT11 Sensor

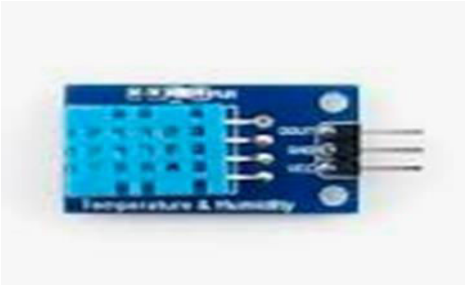


Fig 15 . DHT11 sensor

The DHT11 is **a basic, ultra low-cost digital temperature and humidity sensor**. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pinsneeded). Its fairly simple to use, but requires careful timing to grab data.

IV. RESULTS AND CONCLUSION

RESULTS

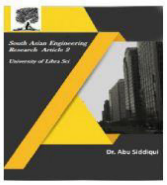
Technology for tracking quality of air was developed as part of the "IoT Based wirelesssensor network for monitoring of air pollution project. The arduino microcontroller serves as the project's primary controlling mechanism. The Arduino uno is connected to all the air quality sensors. The time and date are also updated into the Thing speak cloud by Arduino as it constantly reads data from sensors. This task is accomplished via a microcontroller loaded embedded C program.

CONCLUSION

It has been created with integrating characteristics for all the embedded system utilized. Every component's existence has been thoughtfully considered and arranged, which helps the unit function as best it can. Second, employing cutting-edge ICs, the project has been effectively carried out withthe aid of developing technology. As a result,the proposal's concept and testing were effective.

FUTURE SCOPE

- We can upgrade this project withsolar panels.
- If the sensor data goes beyond the predetermined range, we may addGSM to send an alarm notification.



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