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Design of A Monitoring System for Noise, Dust and Co_2 Concentration

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Abstract: Currently, with the strong growth of the economy and the electrical and electronic industries, our country is currently facing many problems with environmental pollution, pollution that affects human health, Therefore, this article has researched and built a system to help people grasp the status of air environment quality in different locations. The system ensures stable operation, suitable for many types of changing environmental conditions, continuous and accurate updates, and a simple and easy-to-use monitoring system that can be accessed by everyone. Data is stored and used for statistical and auditing purposes.

Keywords: air quality; noise; dust; co2 concentration; air pollution.

INTRODUCTION

Pollution is not new and is not a problem specific to any country or organization, it exists every day and is directly affecting us. Currently, the environment is under serious threat because the world's development situation is increasingly high, factories, works, and workshops every day emit into the environment a lot of emissions and hazardous waste, leading to environment is threatened with pollution. The current global environment is full of factors, such as drought, famine, natural disasters, and floods. Below will be an analysis of the serious problems that the earth is struggling with and facing.(Moreno, T. *et al.,* 2014) (Mannucci, P. M. *et al.,* 2015).

Water resources are scarce: Currently on earth, water covers about 70% of the surface, however only about 2% is water suitable for consumption, considered pure water. Water is considered the most used resource in the world. The problem mentioned is that the amount of clean water reaching everyone in the world is not equal. Many areas still depend on stored rainwater, but if the climate changes, natural water supplies will be extremely scarce, leading to scarcity of water for daily use.

Deforestation: Nowadays, natural disasters such as floods and droughts are becoming more and more serious, worthy of warning, the root cause is that the forest is exploited indiscriminately. Deforestation occurs almost all over the world. Green organizations around the world have warned a lot about the destruction of green ecosystems that will affect the global climate. As life develops, the demand for necessities and food increases, leading to people having to destroy many forest areas for cultivation. Society develops, urban areas and large cities grow, causing forests to be replaced by high-rise buildings. Mining, oil and other resources also lead to deforestation. Land erosion, significant climate change and in some cases natural disasters such as landslides and flash floods can be caused, directly or indirectly, by deforestation.

Global climate change: The significant increase in global temperature in recent years is making the world uneasy. Climate change in the world leads to natural disasters, earthquakes, tsunamis, and floods appearing more frequently and more severely.

Hazardous waste management: Hazardous waste management is closely linked to rapid population growth worldwide and its consumption, waste, and management have become a major problem worldwide. world. Waste is generated in many forms, which can be broadly classified in two forms. Some waste is biodegradable and some is not.

Noise pollution: In most countries, the main source of noise pollution is outdoor noise such as vehicles, motor vehicles, airplanes and trains. Outdoor noise is also shortened from environmental noise. Poor urban planning can give rise to noise pollution, as being next to industrial and residential buildings can lead to noise pollution in residential areas.

Equipments Selection

Main components and their characteristics in the system: Arduino Uno R3 uses Atmel's 8-bit mega AVR microprocessor line with the two most popular chips ATmega328 and ATmega2560, PM2.5 dust sensor to measure quality air, MQ5 sensor is capable of detecting LPG gas, natural gas, coal gas. In addition, the system also uses devices: MCUesp8266, DHT11 temperature and humidity sensor, sound sensor, resistor, capacitor (Williams, D. E. *et al.,* 2013).

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Design, Building and Installation

To build the system, it is necessary to have a detailed system model of the blocks and components, analyze each part, from the preliminary diagram of the research system and establish the operating principle for the system so that it is optimal. and ensure full compliance with set requirements. Write algorithm flow charts for microcontrollers and web-based programs, thereby implementing source code execution for the program and system.

Analyze System Models

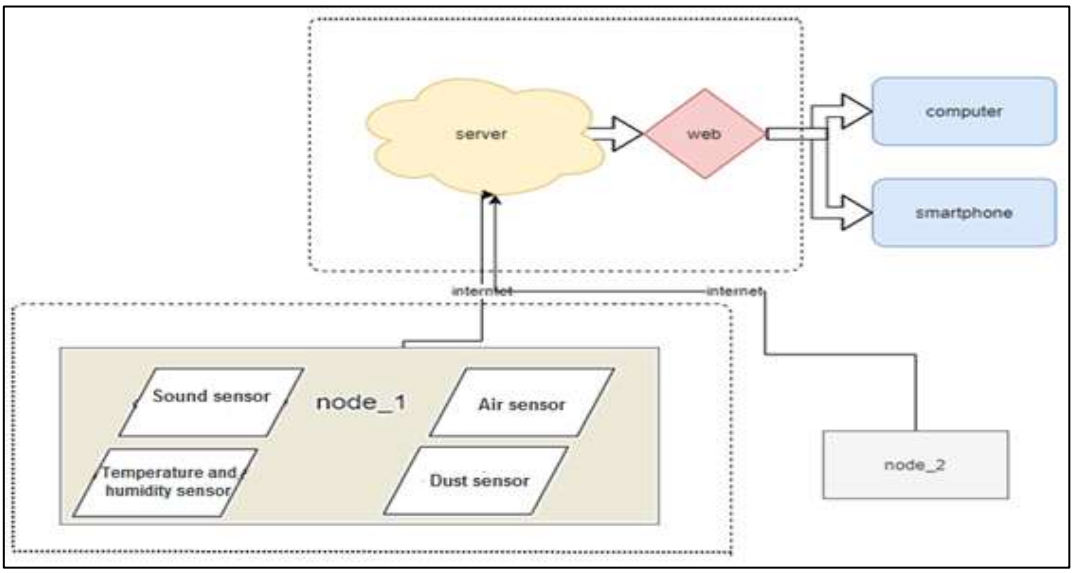

Figure 1. System model diagram

The system includes nodes that use sensors to collect data from the air, which is processed and calculated by a microcontroller and transmits data to the server (Bong, C. K. *et al.,* 2013). The system website will retrieve and use data from the database. Followers can follow directly on the website via a computer or smartphone with an internet connection (Veerabhadraswamy, K. M. 2019).

Block Diagram:

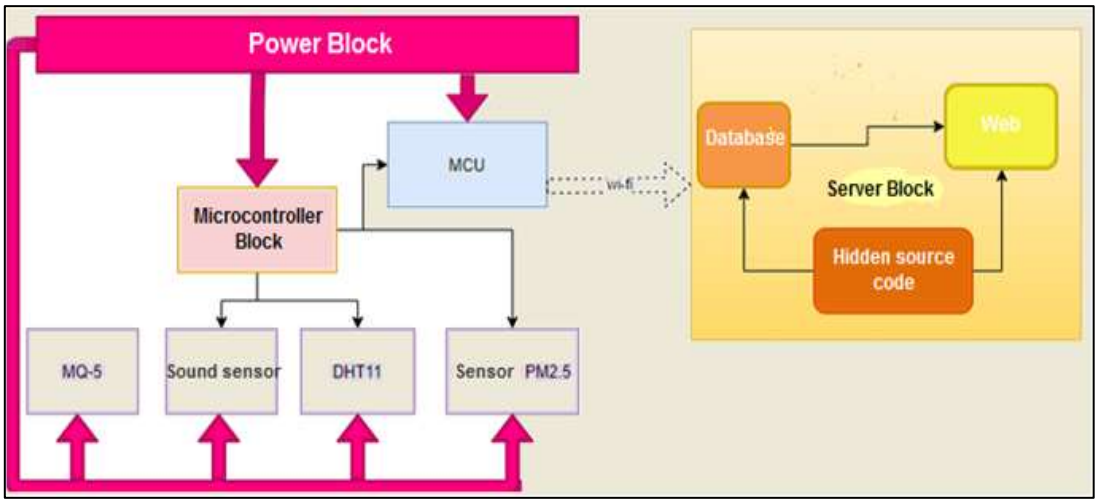

Figure 2. System block diagram

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- Power block: supplies 5v power to the entire circuit.
- VK block: is the central unit that handles all reading, writing, editing, and filtering of data.
- MCU block: connects to the internet to transmit data to the web.
- Block DHT11: measures temperature and humidity.
- MQ-5 block: measures Co2 gas concentration.
- PM2.5 block: measures dust.
- Sound sensor: measures sound signals.
- Server block: stores and displays data

Hardware Design

Principle of operation of the entire system

Circuit diagram

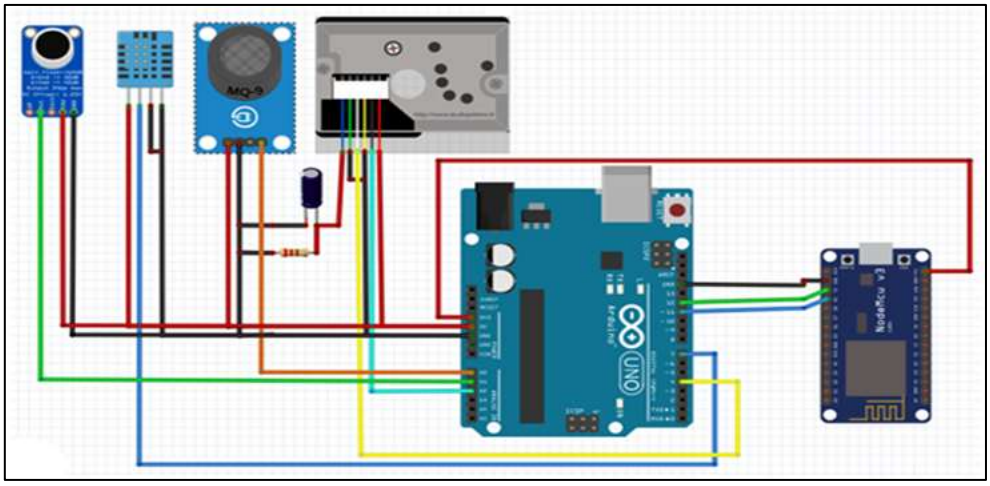

Figure 3. Hardware principle diagram

Place the sensor node at any location with internet coverage, supply power, and set up network connection settings for the circuit.

After the circuit has been connected to the network, VDC will begin sampling from the sensor. When receiving data, it will process, compare, filter noise signals and save, after every 4 seconds the complete data will be received. Converts data type from number to character so it can be transmitted. (Minimum sampling time of the dust sensor) will send data through the MCU block, the MCU block multiplies the data and begins sending it to the server via the pre-installed link and API code (Kelechi, A. H. *et al.*, 2022).

Server side: when detecting access from the client, the server will check the api code to see if it matches.

After checking and finding the correct code, start parsing the sent character string and connect to the database for storage.

Website: the displayed website will run continuously without stopping and continuously update data from the database to draw graphs and print out tables.

*** Pin connection diagram**

Table 1. Pin connections

Equipment	Arduino UNO	MCU	DHT11	PM2.5	MQ5	Sound sensor
Pin connection	GND	GND	GND	2 , 4	GND	GND
	5v	Vin	Vcc	1 Vcc	Vcc	Vcc
	11	RX				
	12	TX				
	7		D0			
	A0				A0	
	A1					DATA
	A2			5		
	4			3		

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Flow chart of microcontroller algorithm

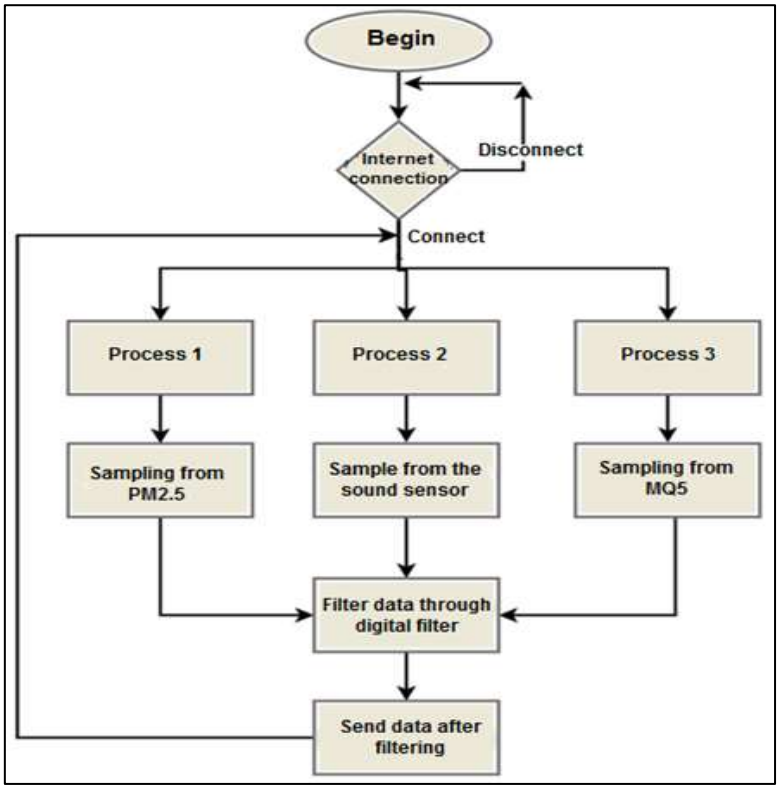

Figure 4. Algorithm flowchart

- When starting the sensor node, the microcontroller will check the connection to the previously installed wifi network address, and will not run other programs without a connection.
- After successful connection, the next step will be to read sample data from the sensors
- This reading is performed in parallel through the microcontroller processes to ensure accurate sampling time

Webserver Design

After sampling, the data will be filtered and processed so it can be transmitted. Next is the server's task, from receiving data to presenting it for display.

Database

The online database is responsible for storing all information updated from the node, the database will be divided into 2 parts including information and data.

- The information section will contain sensor node information such as installation location, location name, sensor types, and operating status.
- The data part is the data received from the sensor.

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TESTING AND RESULTS

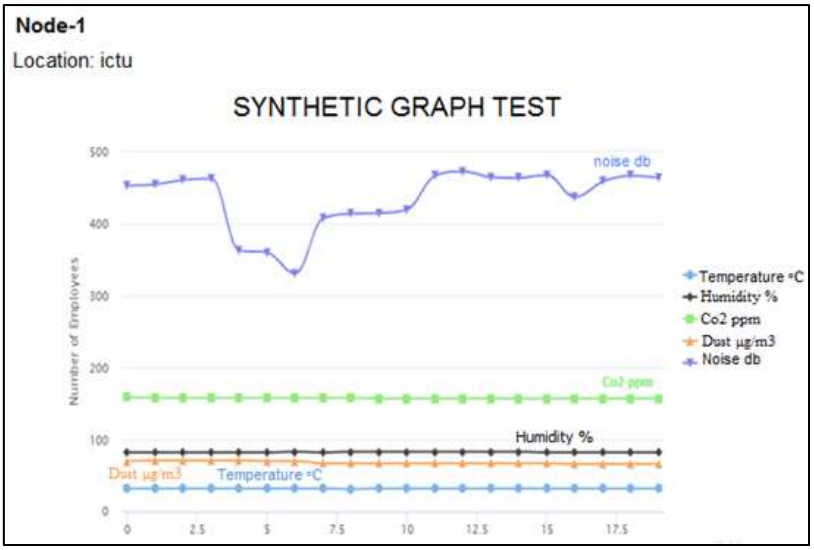

Figure 5. Synthetic graph

Graph showing the results of different measurements of temperature, humidity, noise level, dust and co2 concentration; The monitoring system operates stably (Yang, C. T. *et al.*, 2014).

Hardware products after research and design are as follows:

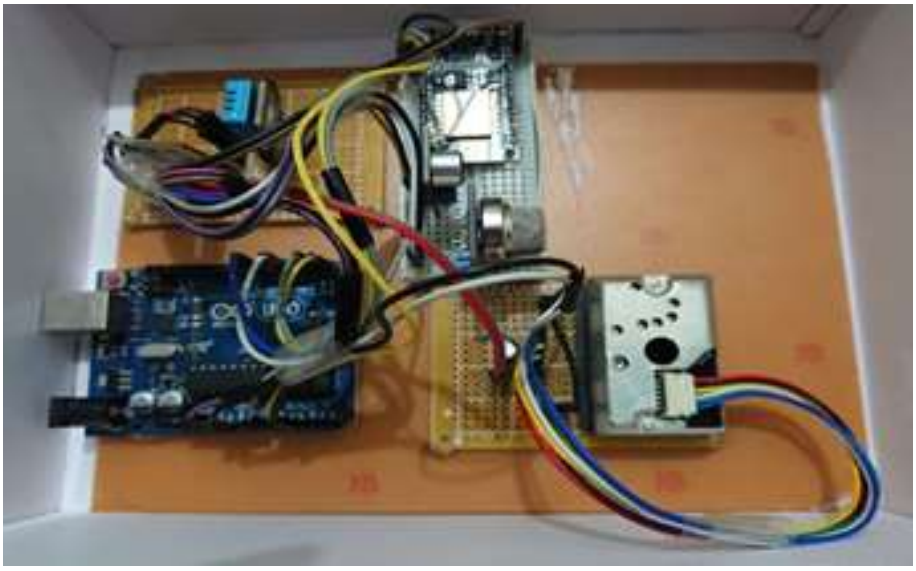

Figure 6. Hardware demo

The product is a combination of information technology and electronic technology into engineering to monitor environmental parameters. Specifically, the system has the following features:

- The system is capable of collecting environmental parameters such as temperature, humidity, dust, gas, and sound.
- The system has the ability to send and store collected values directly on the server through communication via WiFi network.
- Suitable for use in many areas such as living or production areas.

There is great potential for practical application to improve the quality of life while making a significant contribution to the prevention of harmful agents.

CONCLUSION

Through this article, a system has been built to monitor and observe the levels of noise, dust and co2 concentration, with indicators placed at different locations in the area, ensuring stable and appropriate operation. With a variety of changing environmental conditions, continuous and accurate updates, a simple and easy-to-use monitoring system that can be accessed by everyone. Data is

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stored and used for statistical and auditing purposes.

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