Development of IoT based Environment Monitoring System

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Abstract

In recent years, people have grown aware of the environment in which they currently reside. Because of this consciousness, there is a pressing need to create a reliable system for monitoring the environment. Monitoring and managing the environment has emerged as an essential component of modern life to curb air pollution and provide assistance in various fields, including agriculture, fisheries, shipping, and military operations. Monitoring the environment with conventional, manually operated Weather Monitoring Stations requires the expertise of trained technicians cannot be scaled and requires human intervention. All of these factors contribute to an increase in the cost of the weather monitoring station. It is anticipated that the Internet of Things, or IoT, will play a significant role in our everyday lives through pervasive sensor networks encompassing our surroundings. These systems are intended to monitor critical physical phenomena, which results in the generation of data that can be sent to and stored in the cloud. From there, this data can be accessed through applications, and additional steps can be taken based on the information gleaned from it.

Keywords: Environment, Humidity Sensor, IoT, Temperature Sensor

Introduction

In the most recent few years, environmental protection has emerged as one of the most pressing issues for practically every nation. Even though the rate of industrialization has been steadily growing without any form of regulation over the past few decades, the current scenario is manifestly shifting toward solutions that are friendlier to the environment. The quality of the water and air is absolutely necessary to keep the balance between human progress and preserving a healthy environment. It is essential to keep in mind that lowering pollution levels and cutting down on the use of natural resources are both possible outcomes of pursuing more effective production methods in manufacturing facilities. Nearly every type of modern factory engages in some kind of manufacturing process, whether it is boiling, drying, binding, or something else entirely. These procedures are accountable for a significant amount of the emissions of gases and the discharges of dirty water. It is essential to assess the quality of the wastewater being discharged into the public sewer, even if the bulk of the factories have sewage facilities. This is because the public sewer is a shared

resource [1].One of the most difficult problems to solve today is effective to change management. The government, semi-government organizations, and public organizations are currently making preparations to meet this challenge on both the social and environmental fronts. They are working to make the world a better place for us to live. Household automation is one of the many intelligent systems developed in recent years to adapt to the dynamic nature of an ever-shifting reality [2].

The importance of weather monitoring can be broken down into many categories. It is necessary to keep an eye on the weather to ensure that crops continue to develop normally and that factories, offices, and other types of businesses have risk-free places to work. Compared to times gone by, the process of reading the environmental parameters is now significantly simpler as a direct result of technological advances. The sensors are electronic devices that have been miniaturized and are used to measure various environmental and physical parameters. When the sensors are used to monitor the weather conditions, the results will be accurate, and the system will be faster and use less power than it would without using the sensors. In this day and age, there is no question about the significance of environmental monitoring [3].

Importance of Environmental Monitoring

An environmental monitoring program aims to identify problem areas where potentially harmful microorganisms may be harbouring, becoming a source of contamination, and verify the effectiveness of sanitation programs. Another purpose of an environmental monitoring programme is to ensure that there are no unsanitary environmental conditions. To ensure the long-term preservation of library, archival, and cultural collections, it is essential to provide the appropriate environment [4]. Monitoring the environment is necessary to gather information on and evaluate the environment's efficiency in which collections are stored. The records generated as a result of monitoring the environment will offer a baseline of the circumstances present in the areas where the collections are kept. You can use them to chronicle the daily and seasonal temperature and humidity ranges, or you can use them to locate regions with inadequate climate management. When the ambient light conditions are measured, it will be easier to evaluate the appropriateness of the lighting employed or that naturally occurs in spaces used for storage or display, as well as the possibility for harm caused by exposure to light. The purpose of environmental monitoring, as well as one of its benefits, is to determine whether or not the quality of the surrounding environment is deteriorating [5]. The decisions that governmental and non-governmental organizations make

can benefit greatly from the information that Environmental Consultants gather through Monitoring Environment. The most significant goal or advantage of environmental monitoring is the ability to observe and evaluate trends and patterns in the number of air pollutants in the atmosphere.

- **Air Monitoring:** Pollutants in the air are known to negatively affect both human health and the ecosystems in which they are found. Some of these pollutants are also responsible for eroding cultural monuments and technological infrastructure. The primary contributors to the production of ground-level ozone, which is known to have negative effects on both human health and the health of ecosystems, are emissions of nitrogen oxides and volatile organic compounds that do not contain methane [6].
- **Resource Management**: Farmers, foresters, hunters, and fishermen can plan their work based on the weather, also known as environmental monitoring data. This can help them prepare for things like cyclones, tsunamis, and heavy rainfall. It is possible that the severity of the natural hazard can be reduced if they are informed before a significant amount of time. In addition, farmers can learn about the fertility of their soil so that they can increase their crop yield by applying the necessary fertilizers [7].
- **Scientific Research:** Research in the scientific field is directly connected to monitoring the environment. For example, if the Environmental Monitoring Program identifies a specific contaminant that threatens wildlife or aquatic life, the government may take corrective action. In addition, it can stimulate study on the consequences of that pollution on humans, animals, or aquatic life, which is necessary for developing treatment methods [8].
- **Soil Monitoring:** Grab sampling, which consists of individual samples, and composite sampling, which consists of multiple samples, are both utilised to monitor soil, establish baselines, and identify threats such as acidification, loss of biodiversity, compaction, contamination, erosion, loss of organic material, salinization, and instability of slopes.
- **Waste Monitoring:** Monitoring waste is essential to any comprehensive waste management strategy. Our customers are responsible for ensuring that the emissions produced by their projects or operations follow the regulatory requirements set forth to protect the public's health and safety. We keep an eye on many types of waste to ensure that our customers can rest assured that they are living up to their responsibilities [9].

- **Monitoring Salinity:** People have the misconception that salt is detrimental to the growth of plants because of the common perception that salt is involved in this relationship. However, it is essential to keep in mind that whenever we add fertilizer to the soil, we are also adding salt to it. When the salinity of the soil is measured, the results may indicate either a high or low value. If the salinity is too high, the plant's roots will be unable to absorb any water. The plants risk not receiving enough nutrients if the salinity is too low. This is of utmost importance for indoor operations that use growth media with little or no naturally occurring fertility [10].
- **Water Monitoring:** Monitoring the water quality in the environment is done with the intention of supplying the data necessary for protecting the environment against harmful biological effects caused by multiple chemical contaminations resulting from human-caused diffuse emissions and point sources.
- **Remote Sensing:** In monitoring environmental issues and providing reports on those issues, remote sensing can be an extremely helpful tool, particularly when the goal of the observations being made is to evaluate the effects of pollutants on large spatial scales and for extended periods [11].

Fig. 1: Cloud diagram showcasing variety of environmental monitoring

Need of Collection of Environmental Parameters

Monitoring environmental parameters in their natural contexts can contribute to a better understanding of ecosystems and modeling their responses to pollution stress. In order to

function properly, complex sensor networks must have access to low-cost power sources, and the amount of maintenance work that is performed must be kept to a minimum [12].

The importance of appropriate, accurate measurement and reporting of environmental parameters using IoT is a significant aspect of quality assurance for all researchers and their research. This includes the importance of appropriate, accurate measurement and reporting of environmental parameters. There is an absolute requirement to ensure that research conducted in different parts of the world can be compared, understood, and replicated by other researchers when necessary. It is of the utmost importance to have a standard set of guidelines that can instruct, help, and stimulate comparative thinking [13].

Proposed System

All of the sensors and other devices that make up the system can be connected to an Arduino, a component of the proposed system. These sensors gather data for the processing unit that controls the entire system. The GSM Module can operate the sensors to retrieve the data from them, and it processes the analysis using the data retrieved from the sensors and updates it to the internet via the Wi-Fi module that is connected to it.

Fig.2: The outcome of the project developed to collect various parameters

Algorithm

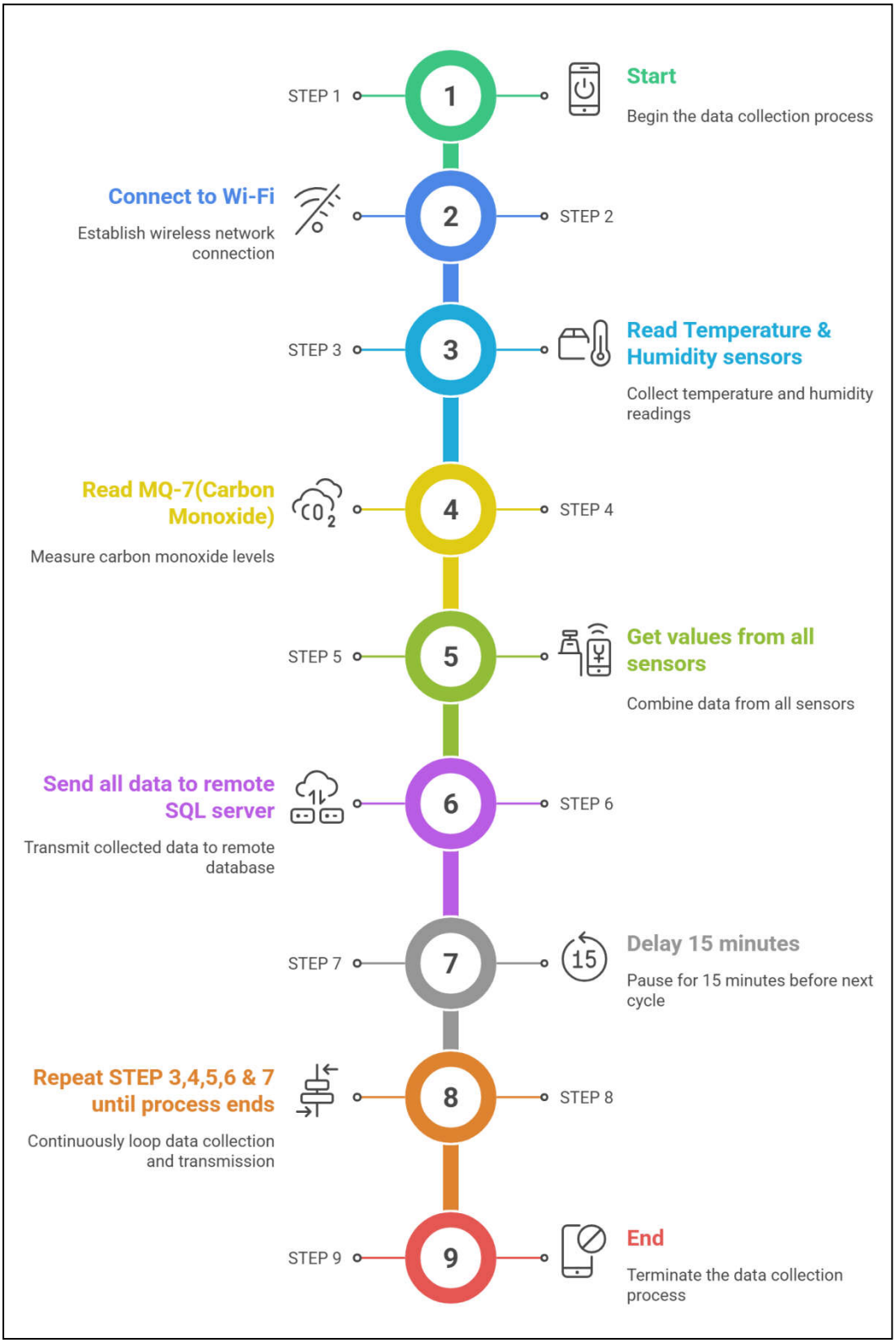

Fig. 2: IoT based data collection method in step by step

Components and Modules

- **Node MCU ESP8266:** The ESP8266 is a low-cost System-on-a-Chip (SoC), and the NodeMCU (Node Micro Controller Unit) is an open-source software and hardware

development environment that was created around it. Espress if Systems is responsible for the design and production of the ESP8266, which includes all of the essential components of a computer, including a central processing unit (CPU), random access memory (RAM), networking capabilities (WiFi), and even a modern operating system and software development kit (SDK). Because of this, it is a fantastic option for Internet of Things (IoT) applications of any kind [14].

- **DHT-11:** The DHT11 is a fundamental digital temperature and humidity sensor available at a very low cost. It employs a capacitive humidity sensor and a thermistor to determine the temperature and humidity of the air around it. Then it emits a digital signal on the data pin (no analogue input pins needed). It is quite easy to operate, however precise timing is required to obtain the data [15].
- **MQ-7:** The MQ-7 is a Carbon Monoxide (CO) sensor that can detect the amount of carbon monoxide present in the air as measured in parts per million (PPM). The range of CO concentrations the MQ-7 sensor can measure is 20 to 2000 ppm. This sensor has a very quick response time and a high level of sensitivity. The output of the sensor is presented as an analog resistance.

Conclusion

The device is designed to detect the present humidity, temperature, and pollution levels within the university campus, which will enable people living on campus to enhance their quality of life on a day-to-day basis. Through the web portal that was built, the collected data was made available to anybody and everyone. Users are also able to make use of this data when they are working on a variety of experiments. It will also assist users in promptly making proper decisions on the organisation of any programme or event dependent on the weather.

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