e-ISSN: 2583-553X
Peer Reviewed Journal
https://doi.org/10.31033/abjar.1.3.2

Evaluating the Design and Implementation of an IoT

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Received: 09-10-2022 Revised: 26-10-2022 Accepted: 15-11-2022

ABSTRACT

The world around us is rapidly evolving, and this unrelenting progress will inevitably have some sort of impact on human health. As the world's population rises, the negative health effects of new technologies and infrastructure will inevitably rise alongside it. Invisible pollutants, like smoke, must be tracked down in order to be dealt with effectively. A model that can identify hazardous contaminants and their availability levels is necessary because of the toxic or acute impacts of such invisible pollutants on our entire world or even our possessions. In this work, we present a paradigm based on a hybrid infrastructure consisting of Big Data, the cloud, RESTful APIs, and the Internet of Things (IoT) enabled by the appropriate software and hardware. Air pollution is a major contributor to both the acceleration of global warming and the deterioration of people's health. Our proposed paradigm is crucial in preventing these unfavourable outcomes. The steady increase in the number of cars on the road and the mushrooming of factories are two major sources of pollution. A range of gas sensors and chemical sensors serve as the hardware component of this approach, while the Raspberry platform and its accompanying software architecture are responsible for monitoring and managing pollution data on a web server. Internet of Things (IoT) is a unified framework for enhancing rectification, module efficiency, and monetary gains.

Keywords: gas sensor, internet of things (IoT), air pollution, climate change

I. INTRODUCTION

Increased global industrialization, as well as the wide variety of chemicals and contaminants from everyday human activities, has prompted grave worries about the potential consequences for ecosystem health and human well-being. That's why governments the world over are cracking down harder on polluters and the means by which they can be monitored, controlled, and remedied. The need for suitable, affordable, and trustworthy technology to comply with such requirements was thus brought to the fore. Encounter the effects of pollution.

Over the past decade, concerns over air quality have risen to the forefront, most recently due to the extreme pollution levels being displayed by major Chinese cities. In a typical air quality measurement system, multiple sensors detect the relevant air quality parameters; these sensors are attached to a node that handles data sampling, collection, and communication, and the whole system is linked to a gateway that either forwards the data or stores it locally. Here, we provide a quick summary of the essential history you'll need to know about our air quality system.

The air quality will be tracked in real time by Internet of Things (IoT)-based sensor modules of the Air Pollution Monitoring System via a web server connected to the internet, and an email will be sent to the appropriate authorities. When CO_2, smoke, alcohol, benzene, LPG, NH_3, and NOX are in high enough concentrations to be harmful to humans, In order to make it easier to keep an eye on the air quality, this will display the readings in parts per million (PPM) on both a wall-mounted display and a website. Any location, not just those with power, is suitable for the system's installation. regions where we're interested in analysing air quality using a prototype implementation of sensing devices. These sensors are linked to a wireless computer system in order to track the deviation of parameters from their typical ranges. The goal is to construct a robust system for measuring and tracking environmental factors.

II. REVIEW OF LITERATURE

Significantly affecting the concentration of atmospheric elements, air pollution causes results like global warming. climate change and acid rain. An air pollution monitoring system is crucial for preventing ecological disruptions of this type. This research aims to provide a real-time wireless air pollution monitoring system that can effectively detect pollution using WSN. Discrete gas sensors, available commercially for measuring concentrations of gases like CO and CO_2, are calibrated using suitable calibration technologies and then integrated with wireless sensor mops for use in the field at the university and around the city of Coimbatore. A data aggregation algorithm with several hops is then applied. Other characteristics, such as temperature and humidity, were sensed along with gas concentrations to enable data analysis through data fusion techniques, and a lightweight middleware and web interface were designed to make this information available from anywhere in the world over the internet. The designed wireless air pollution monitoring system was tested in a variety of environments, proving its efficacy as a dependable source of real-time fine-grain pollution data.

As stated in 9 and 14, WSN is now recognised as a vital resource for the IoT thanks to its incorporation into the IoT. In conclusion, the developed Air Quality Monitoring System provides an efficient integration between WSN and IoT, achieving the central goal of remote monitoring the air quality in the targeted area of interest and making the same more user-friendly. In this study, we employ the widely-used application protocol HTTP to transmit and receive data. The maximum number of nodes is 4. Developing a module to compute the air quality index using data collected from a network of sensors will be the primary focus of future efforts. Also, increasing the number of node deployments to ensure widespread coverage and creating connectivity with IoT-specific protocols like MQTT or COAP

This study presents an Internet of Things (IoT) central server and a gas sensor-based Wireless Sensor Network (WSN) air quality monitoring system. This method pales in comparison to the complex infrastructures that are now in place to track air quality. Cities can use this project to keep an eye on their pollution levels. This prototype can be refined for use in future real-world city implementations.

The concentration of atmospheric elements, such as greenhouse gases and acid rain, is significantly impacted by air pollution. A polluted air automatic monitoring system using empirical analysis has high precision but is bulky and expensive. This system can be laid out in a large number in the monitoring area to form a monitoring sensor network, and it can also exhibit the following: along with the functions of a polluted air automatic monitoring system, it also demonstrates the following:

- Function of controlling IoT is the "infrastructure of the information society; it includes efficiency, accuracy, and economic benefits" that enable physical devices like cars and other items to collect and exchange data via the internet.
- These systems combine air quality information from sensors connected to an ATMEGA328 microcontroller.

The suggested system consists of a wireless sensor network for gathering climatic data locally. Gas sensors (such as CO, SO2, and NO2), temperature sensors, particle matter 2.5 and 10 (PM2.5) sensors, and humidity sensors are only some of the many types of environmental sensors used in WSN in the field. Environment monitoring parameters are then calculated at the control system's distant location and displayed wirelessly on the user's Android mobile device at the remote station. This unit includes a Wi-Fi module, sensors, and abattery, power supply, and microcontroller. For a more precise environmental monitoring system, a network of WSUs can be set up in the field to act as sensors. Aside from air temperature, gas information can be gathered with the help of an infrared sensor, and an electrochemical sensor can be added to the setup. Each device relies on a Raspberry Pi LPC2148 microprocessor to manage the Wi-Fi module and analyse data from the various sensors.

The environmental monitoring system has the ability to provide a number of advantages; for example, it offers monitoring services in inaccessible locations. In order to create IoT-based solutions for environmental monitoring, three distinct wireless sensors were conceived of, built, and evaluated. Taking a look at how these three implementations fared against one another, it became clear that Wi-Fi technologies are well suited for monitoring applications that can stand up to the MQTT protocol. Although Wi-Fi uses more power, it paves the way for low-cost solutions to be created by making better use of existing networks. Its ability to detect earthquakes has the potential to save millions of lives. With such low overall life-cycle costs, the system could conceivably function for months without any input from a human operator. Given its ability to upload data to the internet automatically, a single, strategically located system can make local meteorological information readily available to everyone. Using indicators like rising temperatures and shifting humidity levels, it can forecast the arrival of stormy weather. The analysis presented in this paper is a starting point for the selection of a direction in the deployment of IoT-based environmental monitoring applications, with an overview of the potential and challenges of each of the three developed wireless sensors.

Pollution, climate change, and infrastructure failure are only some of the environmental issues brought on by the rapid expansion of industrial and societal infrastructure. As pollution becomes an increasingly pressing concern, a robust system that addresses existing challenges and keeps tabs on variables contributing to pollution is essential. The Internet of Things (IOT), a connection between computing and electronics, is integral to the solution. Air, noise, temperature, humidity, and lighting are just a few of the environmental elements that may be tracked with its help. A wireless embedded computing system is proposed to monitor pollution levels in an industrial setting or other region of interest. To create the working prototype, we used sensors, an Arduino Uno board, and an ESP8266 wireless module. These sensors are connected to a wireless embedded computing system, which tracks how far the values of various parameters deviate from their norms. To reach this goal, a strong system must be built to measure and keep track of environmental factors.

Using the internet and a web server, we'll keep tabs on air pollution levels and sound an alarm if we detect dangerous concentrations of pollutants like carbon monoxide, cigarette smoke, ethanol, benzene, or ammonia (NH3). Both the LCD and the web interface will display the air quality in parts per million, allowing for easy monitoring. Air pollution has a significant effect on human health, the environment, and the global economy, and it is therefore rapidly becoming one of the world's most pressing environmental concerns. Since they are not scalable and only have access to so much data, traditional air pollution systems cannot supply high-resolution air pollution data in terms of both space and time. Thanks to improvements in microelectromechanical sensors (MEMS) and wireless sensor networks (WSN), researchers have come up with a number of cutting-edge methods. superior air pollution monitoring devices for measuring carbon monoxide, carbon dioxide, oxygen, sulphur dioxide, volatile organic compounds, and particulate matter (PM). Here, we give a thorough analysis of how WSN can be used to keep tabs on both indoor and outdoor air quality in real time. Methods and algorithms used in the development of WSN-based air quality monitoring systems are detailed. The current approaches to WSN-based Air Quality Monitoring Systems are reviewed in depth, and comparisons are made between them.

In this paper, we introduce an Internet of Things (IoT) crowd sensing platform that uses a bicycle network as IoT probes to provide a variety of useful services to the local populace. A total of 288 regular bicycle commuters were surveyed to determine their preferences for bike-enabled services. It was determined that there is a need for services such as: (a) real-time remote geo-location detection of users' bicycles; (b) an anti-theft service; (c) details about the route taken (distance, duration, and ascent); and (d) air pollution monitoring. The Smart Bike platform's architecture and service definitions were then developed in response to an enabling scenario. It consists of three primary parts: the Smart Bike devices, which collect data; the end-user devices, which serve as user interfaces for real-time bike geolocation detection and the anti-theft service; and the Smart Bike central servers, which store revealed data and provide a web interface for data visualization. To an early prototype of the presented platform was implemented, and the platform was tested by a volunteer in order to assess the viability of the approach and the suitability of the platform.

We present current home IoT technology and present research on its many forms and applications in the real world. We also detail IoT marketing strategies and specific modelling techniques for enhancing air quality, a crucial home IoT service. We do this by reviewing the most recent findings from studies on sensor-based home IoT, indoor air quality, and technical studies on random data generation. In addition, we acquire primary analytical data via spectrum and density analysis and construct the requisite infrastructure using the natural cubic spline method in order to create a marketable model for improving air quality. As a result, we produce contextual information by assigning values to user actions. To facilitate easy Web and mobile app access, we incorporate the logic into the preexisting home IoT system. We anticipate the recent introduction of a usable marketing application strategy will aid in the development of the home IoT market.

Together, IoT architectures and AAL technologies will not only continue to reduce the price of ubiquitous solutions but also contribute scientific advancements to improved living environments. While there have been many technological advancements, there are still certain obstacles to building IoT solutions. These difficulties are primarily linked to the privacy, confidentiality, and security of such systems. Despite the many benefits of IoT-based healthcare systems, many questions remain unanswered. These include concerns about the systems' accessibility, reliability, mobility, performance, scalability, and interoperability. Solutions to these issues should be built into any viable system proposal. It cannot be stressed enough that this type of healthcare system should be used to supplement medical treatments as an important addition to medical supervision.

III. INTRODUCTION TO THE ENVISIONED SYSTEM

Our proposed system model aims to design and develop pollution monitoring that will be installed at a specific location and increase the availability of relevant web-based data to the general public. Figure 1 shows how the proposed system is supposed to work, and Figure 2 shows how the proposed research implementation is supposed to work.

With this proposed system, we may collect information from strategically placed sensors. All sensor data and data from external libraries will be gathered by the ESP8266 Wi-Fi module. A remote database will receive the data after it has been collected. Through a web interface, the data stores will be linked to the user interface. Anyone with access to the internet can use this app to get real-time data on pollution levels in the areas that matter to them. Simply put, this web app will be able to present information graphically, such as in a report or chart.

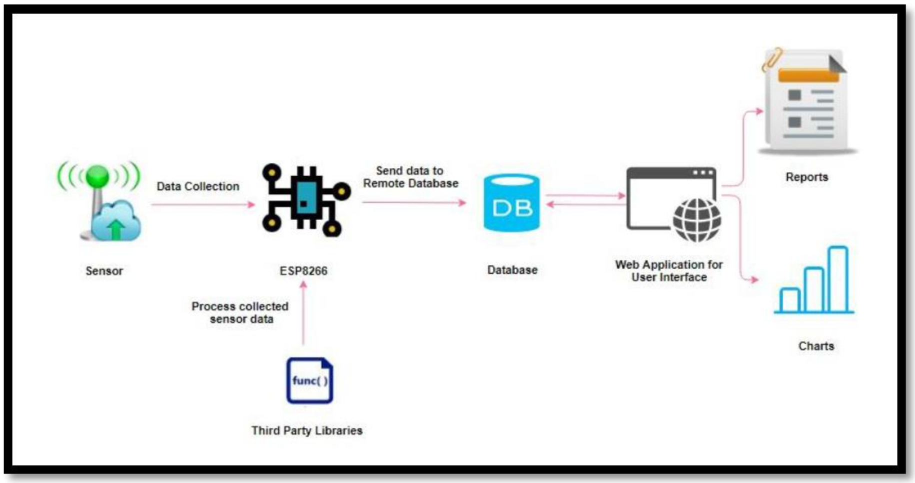

Figure 1: Research Flowchart Implementation

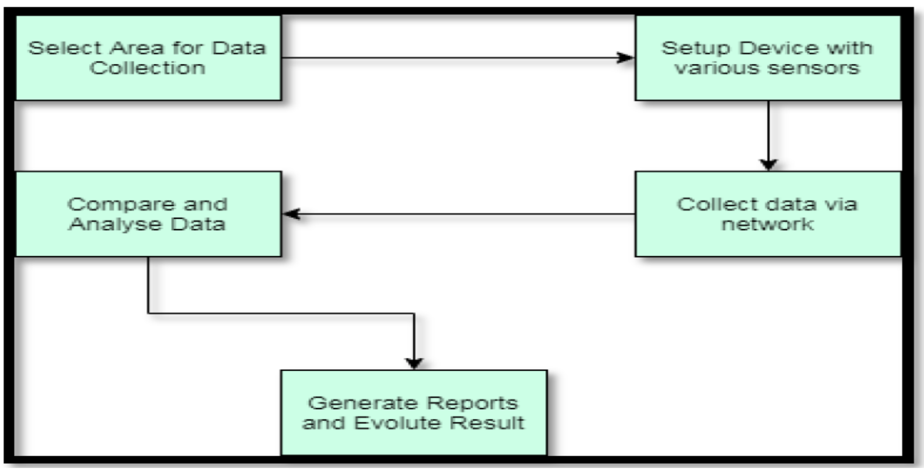

Figure 2: Flowchart of the Suggested System

IV. CONCLUSION

Air pollution can be seen and measured from specific areas with the help of our suggested system, "Design and Development of Air Quality Visualization System Using IoT." This review paper's proposals of the aforesaid philosophy will provide useful functionality in the design of smart city infrastructure. As a result of reading our review paper, you'll be better equipped to identify the wide range of smart air pollution visualisation approaches that can be used to make your city cleaner. Future iterations of our proposed system will include a GPS component that may be utilised in real-time to map pollution hotspots.

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