Monitoring And Alerting System Based On Air, Water And Garbage Levels Using Esp8266

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ABSTRACT

The paper is about informing the garbage levels, water quality and air purity to the nearby authority station in that area. We have used the Ultrasonic sensor, VOC Sensor , PH Sensor and ESP8266 module which is used to connect the above 3 sensors individually and send the data to firebase to store the data and an mobile application is provided for all the users to monitor the data. This process alerts the people and authorities by sending a push notifications to the user and text message to the main authority persons.

Keywords: Firebase, Automation, ESP8266, Android Studio.

I. Introduction

The increased speed of the internet has offered humans all over the world additional opportunities to connect. In terms of the control module, the Internet of things (IoT) methodology electronically communicates both humans and devices [1]. The low cost of Wi-Fi has increased the dependence on (IoT) trends. The Internet of Things (IoT) intends to connect multiple devices and sensors through a specific network and restore the actual data from sensors placed in various locations through a webpage server where the data can be reconstructed and evaluated to generate the appropriate information. The Internet of Things (IoT) allows things to be sensed or controlled remotely using existing network infrastructure, however developing an IoT application requires the selection and integration of numerous components, including sensors, communications difficulties, and networks. Cloud computing, analytics, interaction with core systems, and process modifications are all common ways to turn the data you acquire into something useful [2]. Integration of other technologies with IoT projects allows the project to grow and expand in terms of the services offered, and what has been done in this paper demonstrates the importance of using cloud technology such as Firebase to provide system protection, which is used as a notification medium between an ESP8266 device and a smart phone.

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II. Hardware

A. ESP8266 MODULE

The ESP8266 is a WiFi module that has a full TCP/IP protocol stack and can connect any microcontroller to a WiFi network. The ESP8266 is a complete and self-contained Wi-Fi network solution that can carry software applications or remove all Wi-Fi networking features via another application processor. The flash memory can be started straight from an external Move when the device is mounted and as the only application of the application processor. Built-in cache memory improves system performance while lowering memory needs [4]. Another example is when wireless Internet access takes over the role of a Wi-Fi adaptor and may be integrated into any microcontroller-based device.
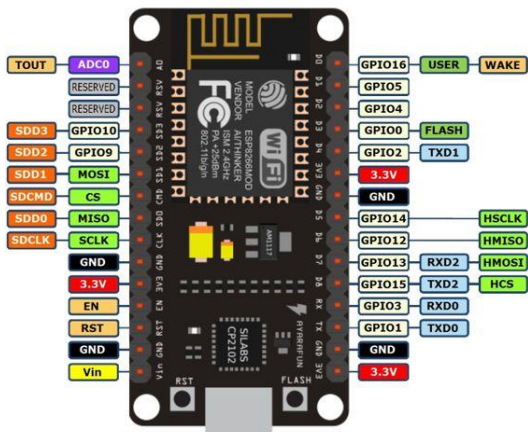
Fig.1: Esp8266 Pin Configuration

B. Gas Sensor

The gas sensor is an equipment that, as part of a support programme, measures the presence of gases in the environment. This type of equipment is frequently used to detect gas leaks or other contaminants, and it can communicate with the control unit to shut down the operation instantly. Workers in the area where the leak occurs may hear a warning from the gas sensor, giving them the opportunity to leave. This type of mechanism is necessary because many chemicals, such as those produced by humans or animals, can be harmful to biological life. The approach of identifying potentially dangerous gas leaks with sensors is known as identification of gas leakage..

Fig.2: Gas Sensor

The majority of these detectors use a visible signal to alert individuals when a dangerous chemical has been detected. Hazardous gas exposure can also occur during tasks such as lighting, decontamination, fuel loading, construction, drainage of dirty soils, land filling, and entry into enclosed places, among others.

C. Ultra Sonic Sensor

The HC-SR04 is an ultrasonic range module intended for use in embedded systems. The HC-SR04 ultrasonic ranging module has a non-contact measurement range of 2cm to 400cm with a ranging precision of 3mm. Ultrasonic transmitters, receivers, and control circuits are included in the modules [3]. Basics of Ultrasonic Sensing and Manipulation Ultrasonic warnings are similar to audible sound waves, but with much higher frequencies. Our ultrasonic transducers use piezoelectric crystals that vibrate at a specific frequency and transfer electric power to acoustic power and back.

Figure 3: Ultrasonic Sensor

To execute any sort of indicating or manipulating function, an output signal is generated. To provide a temporal delay so that the "echoes" can be interpreted, a minimum distance from the sensor is necessary. Goal floor attitude, reflective surface roughness, and temperature or humidity changes are all variables that can affect the operation of ultrasonic

sensors. The targets could have any kind of reflective shape – even round objects.

D. Ph Sensor

A Ph metre is a scientific tool that determines the acidity or alkalinity of water-based solutions by measuring hydrogen-ion activity. The Ph metre is frequently referred to as a "potentiometric Ph metre" since it detects the difference in electrical potential between a Ph electrode and a reference electrode. The difference in electrical potential relates to the acidity or Ph of the solution.

Fig.4: Ph Sensor

The electronic pH metre V2 is meant to determine the pH of a solution and reflect its acidity or alkalinity. The sensor, which is an improved version of the pH metre V1, considerably enhances precision and user experience. The on-board voltage regulator chip can handle a wide range of voltages from 3.3 to 5.5V. The hardware-filtered output signal has a minimal jitter. You may rapidly construct a pH metre using this Ph Sensor to test the Ph value of various aqueous solutions.

III. Software

This is a crucial aspect that controls the work of the hardware components and data streaming between them. It consists of three major software: Arduino IDE, Firebase console, and Android Studio.

A. Arduino IDE

The Arduino Integrated Development Environment is a piece of software that runs on our PC and allows us to develop Arduino sketches. (See Fig. 5.) Then we'll upload the sketch to the board; the code we've written is compiled into a low-level language that the microcontroller can understand[5].

Fig.5: Arduino IDE Interface

Here we should add firebase and ESP8266 Wi-Fi libraries to enable device to connect to internet and firebase.

B. Firebase Console

Firebase provide power to application backend, including data storage, user authentication, static hosting, notification
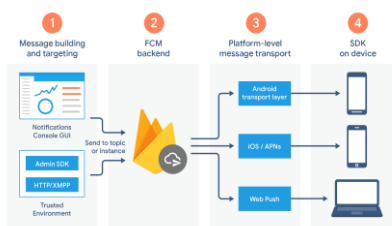

Fig.6: Firebase Architecture

and more (see figure 6) Focus on creating extraordinary user experiences, It's provide tools to develop high-quality web and smart phone applications. Firebase used to send notify to the mobile device application after receive it from Arduino in addition it will store user name and password.

C. Firebase Notification Sending

This was achieved through the use of Firebase Cloud Messaging (FCM), which is a cross-platform messaging system that allows us to send messages to applications consistently. We can notify the client application that new email or other data is available to synchronize by using FCM. A message can deliver

a payload of up to 4KB to a client programmer for use cases like instant messaging [6].

D. Android Studio

To get alerts from Firebase, the solution presented in this paper uses an Android operating system application (but it is feasible to utilize cross platform for other OS's), hence an IDE is required to construct the application. The best environment to utilize for this purpose is android studio in general because it is backed by Google and contains a big number of libraries and tools that assist programmers in coding and design. I can also quickly integrate the firebase API into the project. (SeeFigure.7)
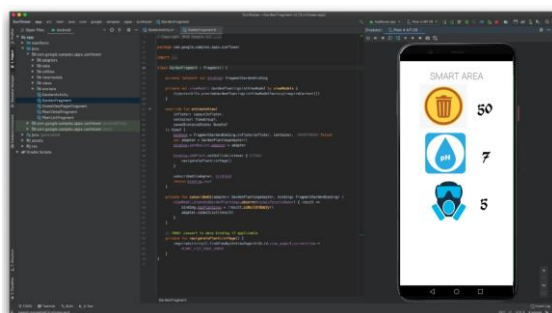

Fig.7: Android Studio Interface

Android Studio is designed specifically for Android development. It is provided on Windows, Mac OS X and Linux, and replaced Eclipse Android Development Tools (ADT) as Google's primary IDE for native Android application development [7].

IV. Design

The three sensors (Ultrasonic, Ph, and Voc sensors) are independently connected to different ESP8266 modules and placed at different positions to collect data, as illustrated in Figure 8. These readings are also saved in the firebase.
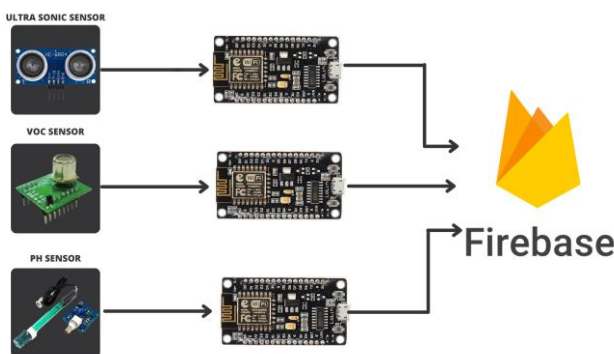

Fig. 8: Hardware interface with Firebase

And the data in the firebase is processed and compared with the threshold values when the data in the firebase is changed and if values ranges in the threshold value then there will be no changes, if the

values are beyond the threshold value then alerting system activates and send the push notifications and SMS alerts.
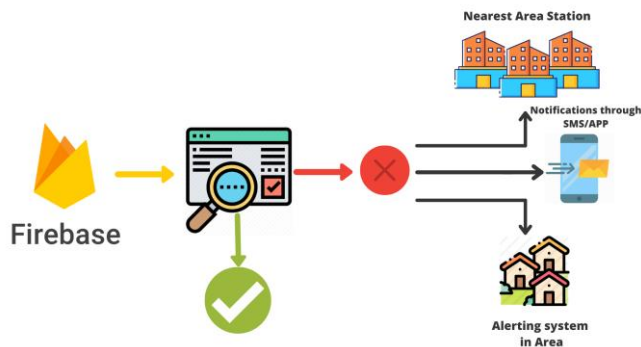
Fig.9: Implementation of comparing the data with threshold values

V. Results

The readings from the sensor are stored in the Google cloud. The data is stored in the Real-time Database. Where GasMax, WasteMax, WaterMax, WaterMin are threshold values of gas, waste, water respectively.

The readings from Ph sensor, Ultrasonic sensor and Gas sensor are stored in name of Water, Waste, Gas and their corresponding reading is stored in the value place respectively.

Fig.10: Real-time DataBase

Fig 11 Shows the interface of the mobile application which is developed in the Android Studio. It collects the information from firebase and displays on the user interface. The screenshot of various conditions are as shown below
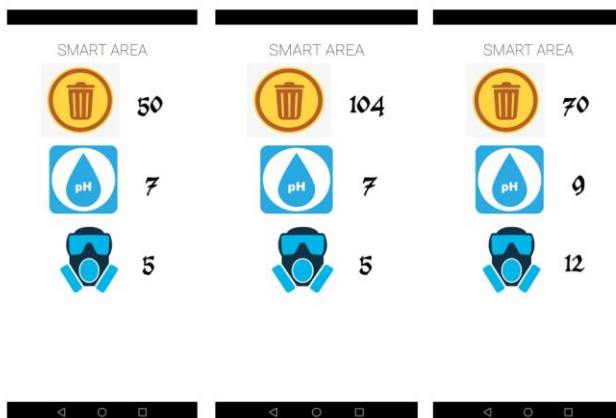

Fig.11: Mobile Application Results

Push Notifications are sent to mobile when the value of the reading is greater than the threshold values to indicate the change in the parameters.
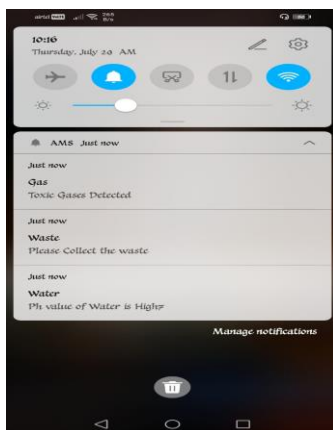
Fig.12: Push Notifications on Mobile

SMS Alerts are send to the Authority persons for better performance of the system because the push notifications are sent on when the mobile data or Wi-Fi Connection is available to avoid this situations SMS Alerts are sent.
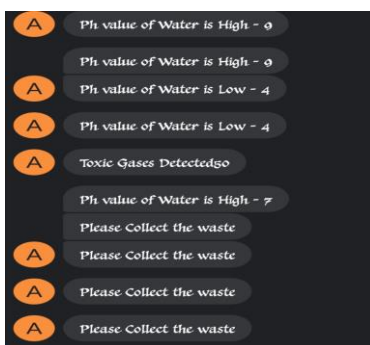

Fig.13: SMS Alerts to Mobile

VI. Conclusion

By using this project we can reduce the Human loss due to the Gas Leakages & we can also save the water eco system as well as the human drinking water by monitoring the acidic and base values. And also the garbage which is increasing can be monitored and collected if it is full, So that we reduce the disease which are caused by the decay of waste materials. This project helps the humans for the future advancements of living nature by continuous monitoring of the readings and an comparison algorithm which detects change in the values if beyond the threshold and sends a notifications and SMS Alerts.

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