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Soil, Water and Air Quality Monitoring System using IoT

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Abstract – *Water, air, and soil are three natural resources that living beings cannot survive without. Due to extensive increase in industrial output, rural to urban shift and the overuse of land and sea resources, the quality of soil, water and air has worsened greatly. The vast use of fertilizers in farms and also other chemicals in districts such as mining and constructions have given rise to the overall depletion of quality. These days Internet of Things (IoT) techniques are used in different areas of research for observing, fetching and analysis of data from remote locations. It can be implemented in this system where the quality of these three entities (soil, water and air) can be checked to see if it is suitable to crop cultivation.*

Keywords – Soil, water and air quality detection, Raspberry pi3, M2M, GSM module, water, soil, pH, turbidity, NPK, Humidity, MQ135 and Moisture sensors and Embedded IDE

I. INTRODUCTION

Maintaining a healthy soil requires care and effort by the farmers. These years, a decrease in trend of total efficiency and growth rates of major crop and less nutrient use productivity have been observed mostly because of deterioration of soil health. To increase sustainable production, testing of nutrients in soil and prevention and soil deterioration through improved soil health is very important. With increasing population in our nation, Fresh Water Management is essential which demands a rise in agricultural, industrial and others. To ensure the secure supply of the useful water for different purposes like agricultural, the water must be monitored. The system has many sensors used to collect physical and chemical parameters of the water. The parameters such as temperature, pH, turbidity, flow of the water can be measured. Air pollution is a common phenomenon. Especially in Urban areas, air pollution is a real problem. The increased number of vehicles and the presence of industrial areas in the outskirts of major cities are the main causes of air pollution. The issue is seriously increased in metropolitan cities. Also, the climate change is now very real and apparent. The objective of our project is to measure the quality of air and to combine technologies to produce an air quality sensing devices.

II. LITERARURE REVIEW

This paper deals about developing smart agriculture using Iota and given to the farmers Techniques for automatic seeding, weeding, herbicide spraying, harvesting the crops has been proposed and implemented, reduced the dependence on manual labor and increased the yield obtained at the same time. In this paper, the Soil type is checked and later the Soil Quality is to be tested using sensors. The results obtained by the tests are to be considered and according to the results the farmers are suggested as to which type of crop is suitable for that particular soil. Various sensors are deployed in the field like temperature, moisture and PIR sensors and the data collected from these sensors are connected to the microcontroller for analyzing purpose [1]

The content of micronutrient and macronutrient present in the soil and describes the use of wireless sensor network technology to determine the level of soil nutrients. The sensor network technology will help the farmers to know the soil requirements which will help them take better decisions and preventive measures at the right time. The GSM modem is connected to the controller. Soil moisture sensor senses the moisture content of the soil. Two fundamental ways to assess soil quality is to take the measurements periodically over time to monitor changes and to compare measured values to a standard or reference soil conditions [2]

This paper describes how the sensed data will be processed and stored in cloud and that data will be relayed to the registered farm owners through device in user understandable form. In this method, the sensors are connected to a microcontroller. It is of low cost and it consumes low power. The data will be displayed on the LCD screen. The recordings are sent via SMS.

These sensors will measure the Temperature, pH rate, Water level of that particular soil and sends the information about the abnormalities. By sensing the soil frequency it suggests the type pesticides to be used. It is also reliable, easy and provides accurate results [3]

In this paper, water monitoring system using Iota is presented. Sensors like temperature, pH, and turbidity, ultrasonic are used. The collected data from the all the sensors are used for analysis purpose for better solution of water problems. The data is sent to the cloud server via Wi-Fi module ESP8266 which is connected to the Arduino processor. This system helps in providing better results in detecting the quality of the water and for its safe drinking [4]

This paper presents an Intelligent IoT based Water Quality Monitoring system on M2M. The sensor input is transmitted serially to RasberryPi3 where machine learning algorithm is employed for predicting the Water Quality based on trained data set. The trained data set and predicted data are stored in Cloud server for access via their mobile phone. This IoT system is deployed in such a way where the devices communicate among themselves in predicting the Water Quality. This proves that the water quality can be monitored automatically with no human involvement [5]

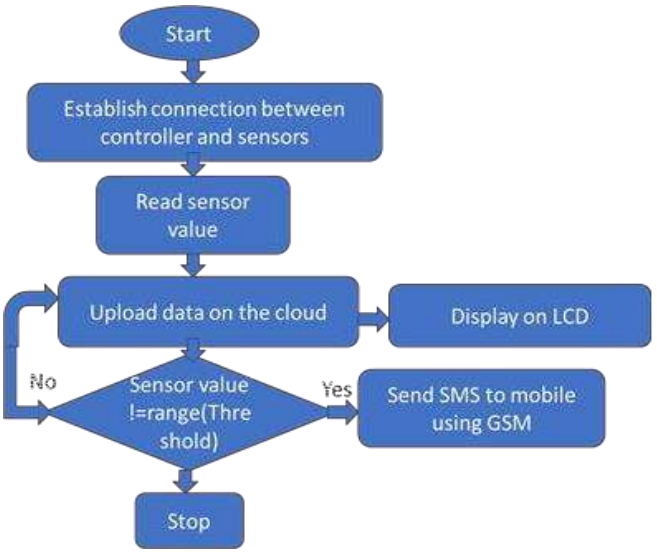
This paper demonstrates a Smart Water Quality Monitoring system. According to the research, the results obtained matched with the expected results. The sensor readings are measured for all the parameters. GSM technology is been implemented to send alarm based on reference parameter to the ultimate user for immediate action to ensure the water quality. The sensor readings obtained from all the different water sources will be used to perform automated water analysis in the form of Neural Network Analysis [6]

In this paper, with the help of the module Nodemcuesp8266, the air pollution is monitored remotely. Nodemcu ESP8266, is used as a micro controller. This board has a WiFi module which plays as the information accessing for the air quality. It facilitates humans to find out which content of the air is polluted and can be monitored at any given point of time. Nodemcu ESP8266, MQ2 gas sensor, MQ9 gas sensor, Analog Multiplexer 4051 (CD4051BE), OLED monitor SSD1306, 80ohm resistor x2 and 330 ohm resistor x2, Adapter 5v 8, ZH03A Laser Dust Sensor tools are employed in this project for air quality monitoring. The mail goal of this project is to integrate MQ2 gas sensor, MQ9 gas sensor and ZH03A laser Dust Sensors. Air quality can be monitored using this model [7]

In this paper, a low cost air quality system for monitoring the concentrations of major air pollutant gases has been developed. An air-quality monitoring nodes comprises of semiconductor gas sensor with Wi- Fi modules are used. The developed system uses semiconductor sensors and measures concentrations of gases such as CO, CO2, SO2 and NO2. The data of various parameters are sensed and the recorded data will be sent to raspberry pi, which acts as a base station. The gathered data taken by sensors is shown on Raspberry pi based Web server .Using Node.js in javascript, TCP server is implemented over raspberry. MQ7 and MQ135 gas sensors with a Wi-Fi Module interfaced with Nucleo F401RE to form two client nodes. Sensor data is sent wirelessly from sensor node to Gateway in the form of packets through the Client nodes. Data packets contains id of the node data and the time when the packet was created. A NoSql database (Mongo DB) in raspberry pi has been installed. To save and analyze the data, we have designed a webpage using MEAN stack for data visualization [8]

III. METHODOLOGY

The soil, water and air samples are collected and a connection is established between the controller and the sensors. Considering several factors like pH, moisture, temperature, turbidity, nutrients, air pollutants the sensor values are being read and recorded accordingly. The obtained results are then uploaded on the cloud and displayed the same on LCD screen. If the sensor readings are not in the normal threshold range then an alert message is sent to the concerned board about the uneven measurements of the element via a GSM module. If all the values are confined in the range then the readings are uploaded on the cloud and stored.



IV. FUTURE ENHANCEMENTS

In the future, with the help of Machine Learning, we can compare the present readings with the readings of the past data log and record the level of variations in the quality of soil, water and air. Based on the sensor readings, a recommendation system can be developed which sends a suggestion message to the farmers about which type of crops can be grown for that particular condition of soil, water and weather. A mechanism can be brought up where the farmers can manipulate and control the sensor readings of the elements from a distant place and avoid the work of manually doing it.

V. CONCLUSION

This paper mainly focuses on checking the quality of soil, water and air so that each of those entities are used effectively and maintain their health. This is relatively a modern research field and is expected to expand in the near future. There is a lot to be improved in this area. The sensor technology will help the user in making better decisions and acts as a preventive measure at the right time. Here the system gets the basic knowledge about how the soil, air and water quality can be tested and works based on that.

VI. REFERENCES

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