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Automatic System to Detect Radiation Exposure in Day-To-Day Life

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Abstract **- The existence of air pollutants and the unconstrained emission of non-ionization radiation such as RF and UV radiation in the environment due to various human activities eventually leads us to consider how necessary it is to monitor the surrounding parameters to ensure the safety of the general public. The basis of a monitoring system contains three prime subsystems namely the detection sensor, wireless communication, and monitoring interface. This paper describes an IoT-based system that consists of a set of interconnected components that can detect, monitor, collect and store the data of parameters such as UV radiation, RF radiation, gas leakage, and air quality from the vicinity, in real-time. The system consists of 1) four distinct sensing modules for measuring entities like air quality, gas leakage, UV, and RF radiation. 2) a base station or a central unit mainly comprising of microcontroller ATMEGA328 and Wi-Fi module ESP8266 for the processing of data from the respective sensors, to notify using buzzer alarm if the values cross the threshold limit, and display of the values on LCD. 3) a cloud such as BLYNK and an android application for real-time data collection and its visualization along with the provision of remote access to the user. The complete description of the system architecture is shown and the work ability is proved.**

Keywords: Internet of Things, ATMEGA, Non-ionization radiation monitoring, Real-time monitoring, Environment.

I. INTRODUCTION

Non-ionization Radiation (NIR) is naturally originated from sunlight, lightning discharges, etc., and also from man-made sources such as wireless communications, industrial, scientific and medical applications. The UV light is mainly emitted by the sun and to some extent from electronic devices etc. Human beings are surrounded by numerous hazardous radiations. The hazards rely on the potential to penetrate the human body and the amount absorbed by various tissues. Due to the increase in ozone depletion, detection of UV light in the environment is very important. It affects the skin as well as the eyes and also weakens the immune system to a great extent if continued exposure persists. With the growth in industrialization, the number of toxic gases in the air is increasing. The indoor air quality is a matter of human health as a large portion of time is spent indoors. Breathing polluted air puts you at a high risk of respiratory diseases. Gas leaks can cause oxygen deficiencies and an explosive atmosphere. It is necessary to detect flammable, toxic, or combustible gases in your houses or workplace.

The number of devices to detect all of them efficiently is less in number. But the development in technology has helped to integrate various components to detect and observe these parameters reliably. Atmega328 microcontroller, esp8266 Wi-Fi module, physical sensors form a powerful wireless sensor network. It collects, pre-processes, and sends the data to the web server. The web server after receiving the signals centralizes them and then processes them as well as stores them in the database for remote access. Android applications can be used for displaying real-time information. BLYNK platform is used in the proposed system for displaying the recorded data.

II. PROPOSED SYSTEM

A) Wireless Sensor Network

The monitoring system is based on a wireless sensor network consisting of conceptually distributed self-sufficient sensor nodes. The sensor node consists of an esp8266 compatible microcontroller along with four environmental sensors. The esp8266 was programmed to record, initialize and transmit the data from its environment to the distant web server through a Wi-Fi network using MQTT (Message Queuing Telemetry Transport) protocol. MQTT is a messaging protocol that is designed for high latency, low bandwidth, or unreliable networks which is also simple and lightweight.

B) Physical sensors

1) RF Sensor

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This RF locator will detect the presence of an actuated cell phone from a scope of 20-25 cm. When it identifies an RF signal from an initiated gadget, the light-discharging diode begins squinting and keeps on flickering till the sign stops. IC LM358 is used in the circuit chart of the RF indicator. It is designed around LM358 (IC1) and NPN electronic semiconductor BC548 (T1) at the point when a gadget is dynamic, it transmits an RF signal that goes through the close by space. The frequency of signs in cell phones goes from 3.3 to 10 cm and the recurrence of transmission from 0.9 to 3 GHz.

2) UV Sensor

GYML8511 is a Ultra-Violet Light Sensor Module producing an Analog Output. The GYML8511 Sensor works by recording an analog signal to the amount of detected UV light. This sensor detects 270-390nm light most effectively with the operating voltage 3-5V and the operating current 120µA (average) and 190µA (max).

3) Gas Detection Sensor

MQ-6 Gas Sensor is the type of gas the sensor would detect depending on the sensing material present inside the sensor. These sensors are available as modules with comparators. A particular threshold value of gas concentration can be set for these comparators. The digital pin goes high when the gas concentration exceeds the threshold level. The analog pin measures the concentration of the gas. Chemiresistor is responsible for the detection of gases in a gas sensor for conducting current.

4) Air Quality Sensor

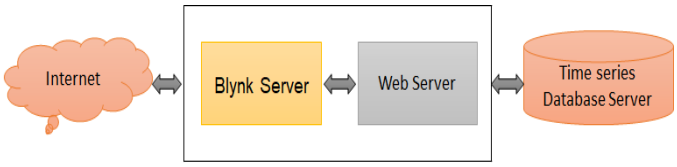
Air quality sensor detects a wide range of gases, benzene, including NH3, alcohol, NOx, smoke, and CO2. The sensor has a detection range of 10 - 300 ppm for NH3, 10 - 1000 ppm for Benzene, 10 - 300 for Alcohol. The Heater Voltage is 5.0V. The Ideal use of air quality sensor is in office or factory. MQ135 gas sensor has a high sensitivity to Sulfide, Ammonia, smoke, and other harmful gases.

C) Web Server

The web server is used to incorporate all the signals from the system. It collects data from the respective sensor nodes analyses them and stores them into a database. The processed data available to remote users through the internet. Blynk application is used to store the data and to make it available to the end-user. The Node MCU (Node Microcontroller Unit) used in the Blynk application is an open-source software and hardware development environment based on ESP8266.

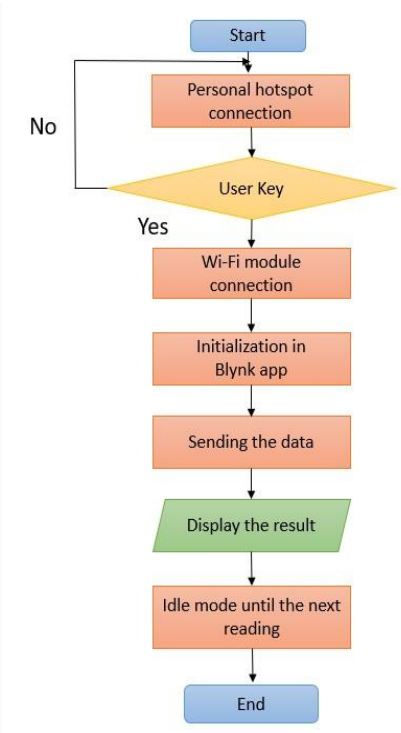
D) Web and Android Application

An android application that gives the user access to the specific real-time information which is recorded by the sensors. The application is designed based on Node MCU and it will simultaneously display all the instantaneous environment parameters collected from the sensor node.



E) Interfacing between Wi-Fi module and Blynk Application

The process of interfacing between the Wi-Fi module and the Blynk application begins with setting up the personal hotspot connection where the hardware is paired to the Wi-Fi module using a User Key which is embedded in the source code. Along with the User Key, the other credential parameters like the Wi-Fi hotspot user name and password needs to be set the same as in the source code to pair the Wi-Fi module with the user's device. If the pairing is successful then a connection between the hardware and the user's device is established. A new project is created on the Blynk application by the user where the user has to set the value display, pin, and push. Once the value display for all the sensor nodes is created the user will be able to access the data recorded by the sensors. The data can be accessed by the user in real-time even from a wider range.



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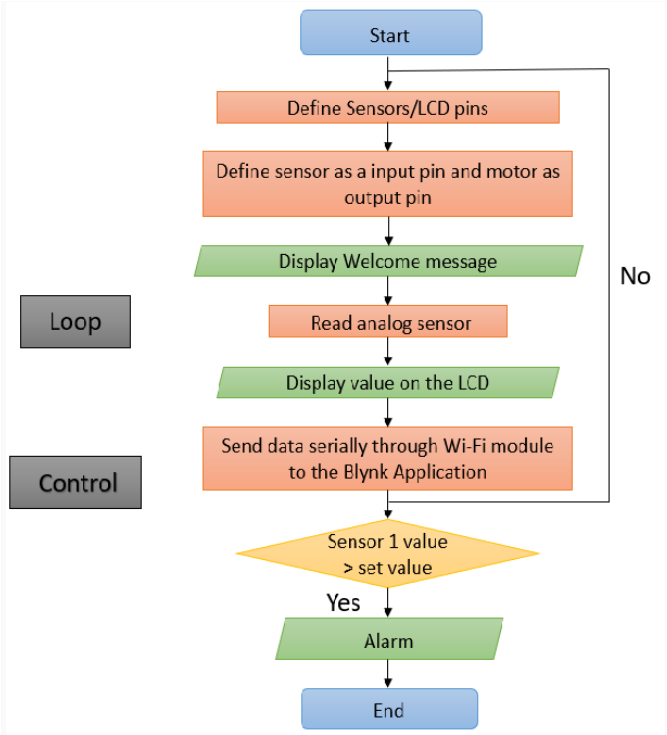
F) Coding

The coding logic starts with defining the sensors and the LCD pins. The sensor is defined as the input pin and the motor as the output pin. A welcome message will be displayed. A loop will come into the picture here, where the analog sensors will record the signal and convert it into digital with the help of a 10-bit A to D converter and display the value on the LCD. The data is then serially sent through the Wi-Fi module. If the loop is not completed then the flow will start again from defining the sensors and LCD pins. Once the loop is successful the sensor will check if the data is above the set value or threshold value if yes, the buzzer will buzz and a notification will be sent to the user on the Blynk application recorded by the sensor.



III. QUANTITATIVE EVALUATION

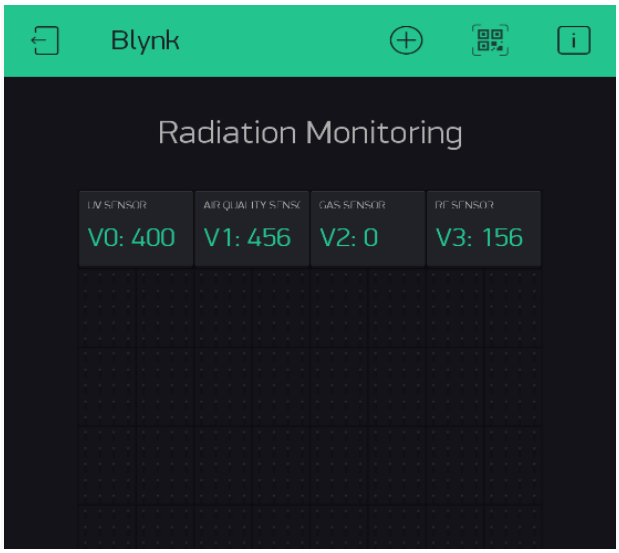
RF Sensor: Electromagnetic signals detected due to the active devices present during testing were displayed on the application and the LCD. The detection range is 25-30 cms.

Gas leakage Sensor: During the testing, there was no gas leakage detected by the gas sensor.

UV Sensor: For the testing, the hardware was kept in sunlight and we could observe an increasing value of the sensor.

Further, we also tested the hardware at night and we could see a lower value of UV rays detected by the sensor.

Air Quality: The sensor displayed the Air Quality as 456 ppm after we brought the sensor in the proximity of an alcohol-based deodorant.



IV. ADVANTAGES AND APPLICATIONS

- A radiation detector can be utilized effectively in the electromagnetic radiation climate for perceiving the sum discharged by the gadgets nearby.
- It likewise gauges the measure of bright light in the environment to restrict our weakness to it.
- It aids in establishing a more secure and solid climate to live in by assisting us with deciding the combustible and poisonous components around us.
- A climate with lower levels of radiation and destructive gases can be accomplished with the assistance of the framework.
- It provides fast and reliable outputs which can be accessed by safe and secure methods included in the system.

V. FUTURE SCOPE

- The size of the model can be minimized to an extent.
- Customization of the sensors should be possible as per the client's need.
- The accuracy of the sensors can be expanded.
- A notice alert for every one of the sensors can be added to this model.
- The scope of the RF sensor can be expanded.

VI. CONCLUSIONS

Non-ionizing radiation is a growing area of concern that involves a vast region that still needs to be traversed and when explored properly will give many useful and reliable results accordingly. In a scenario where most of us are indoors, a concept like radiation and air quality detector comes in handy

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for developing a safe residing environment. Though to date, it has been implemented several times, a small effort is made with some improvements such as visualizing the sensor data, setting alarms and notifications, and also real-time automated data analysis. It is also open-source and has an easy connection over the Wi-Fi/cellular data. The user will have to create an account, connect, and then the data will be eventually stored with the help of a Wi-Fi network in some simple steps. In recent times where there is a lot of electromagnetic pollution and harmful gases in the surroundings, the proposed methodology can be used to minimize the concerned issue.

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