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Harmful UV Rays Detector

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ABSTRACT :A semi-circle monopole printed antenna is designed for Ultra-Wideband (UWB) applications. It consists of two identical antennas placed 3 mm apart and positioned at right angles (90°) to each other on a low-loss substrate. Tests show that the antenna provides very wide bandwidth, high isolation between the two ports (more than 22 dB), and good orthogonal polarization. It also transmits pulses with good accuracy, achieving fidelity factors of 85% and 75% for the two ports. The envelope correlation coefficient is below 0.2, indicating excellent diversity performance. These results show that the proposed antenna is suitable for future UWB wireless communication and diversity applications.

I. INTRODUCTION

The circuit diagram illustrates a Harmful Ultraviolet (UV) Radiation Detection System based on the ESP32 microcontroller. The ML8511 UV sensor detects the intensity of UV radiation and sends an analog signal to the ESP32 for processing. The microcontroller continuously analyzes the sensor data and classifies the UV level as safe, moderate, or dangerous based on predefined threshold values. Three LEDs (green, yellow, and red) provide a simple visual indication of the current UV level. An OLED display, connected through the I²C communication interface, shows the real-time UV intensity for accurate monitoring. The entire system operates on a 3.3 V power supply with a common ground, while 10 kΩ and 220 Ω resistors ensure stable operation and protect the circuit components.

II. EXISTING SYSTEM

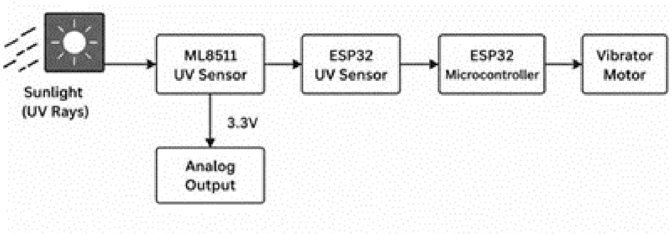

Fig 1: Existing block daigram

The existing block diagram represents the operation of a UV radiation detection system that monitors harmful ultraviolet (UV) rays present in sunlight. The system begins with sunlight, which contains UV radiation. These UV rays fall on the ML8511 UV sensor, a sensor specifically designed to detect UV intensity. The sensor continuously measures the amount of UV radiation in the environment and converts it into an analog voltage output proportional to the detected UV level. The sensor operates using a 3.3 V power supply, making it suitable for low-powerembedded applications.The analog output from the ML8511 sensor is then sent to the ESP32 microcontroller. The ESP32 reads the sensor data through its Analog-to-Digital Converter (ADC), converts the analog signal into digital values, and processes the information using a programmed algorithm. The measured UV intensity is compared with predefined threshold values to determine whether the UV level is safe or harmful.If the detected UV radiation remains within the safe range, the system continues monitoring without any alert. However, when the UV intensity exceeds the preset safe limit, the ESP32 immediately activates the vibrator motor. The vibration acts as a warning signal, informing the user that the surrounding UV radiation has reached a potentially harmful level. This enables the user to take preventive measures, such as moving indoors or using protective equipment like sunscreen, sunglasses, or protective clothing.

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III. PROPOSED METHOD

This project is an IoT-based Harmful Ultraviolet (UV) Radiation Detection and Monitoring System designed to measure the intensity of ultraviolet radiation in real time and alert users when the UV level becomes unsafe. The system uses a GUVA-S12SD UV sensor to detect UV radiation and an LDR (Light Dependent Resistor) to measure ambient light conditions. Both sensor readings are processed by an ESP32 microcontroller, which calculates the UV Index and classifies it into different safety levels. Based on the measured UV Index, the system provides visual alerts using three LEDs: a green LED indicates a safe UV level (UV Index 0–2), a yellow LED indicates a moderate UV level (UV Index 3–5), and a red LED warns of a high and potentially harmful UV level (UV Index 6 and above). A digital display also shows the current UV status, such as "LOW," "MODERATE," or "HIGH," allowing users to easily understand the environmental conditions.

In addition to local indications, the ESP32's built-in Wi-Fi enables the system to upload UV data to the internet for remote monitoring through a smartphone. Users can view the current UV Index, receive instant notifications when harmful UV radiation is detected, and continuously monitor environmental conditions from anywhere. This project is useful in schools, parks, construction sites, agricultural fields, beaches, and other outdoor environments where prolonged exposure to UV radiation can cause health problems such as sunburn, premature skin aging, eye damage, and skin cancer. By providing real-time monitoring and early warning alerts, the system helps people take preventive measures, making it an effective, low-cost, and smart solution for UV safety monitoring.

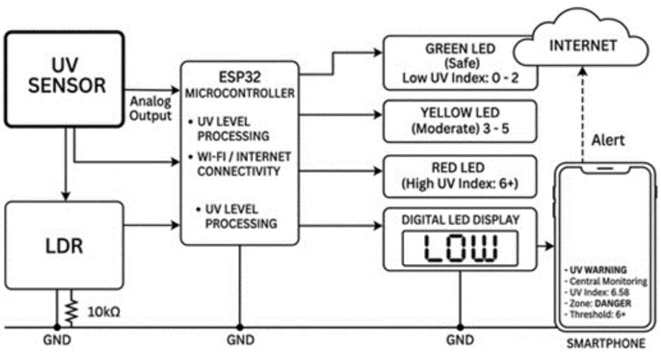

Fig 2: PROPOSED METHOD BLOCK DIAGRAM

IV. DESIGN AND WORKING

A. CIRCUIT DIAGRAM

The circuit diagram represents the Harmful Ultraviolet (UV) Radiation Detection System, which is designed to monitor the intensity of ultraviolet (UV) radiation in the surrounding environment. The main component of the system is the ESP32 microcontroller, which acts as the brain of the project by receiving, processing, and controlling all the connected devices.The ML8511 UV sensor is used to detect UV radiation. It converts the intensity of UV rays into an analog voltage signal, which is sent to one of the analog input pins of the ESP32. The ESP32 continuously reads this signal, calculates the corresponding UV level, and compares it with predefined threshold values to determine whether the radiation is safe, moderate, or dangerous.To provide a clear visual indication of the UV level, three LEDs are connected to different GPIO pins of the ESP32 through 220 Ω current-limiting resistors. The green LED glows when the UV radiation is at a safe level, indicating that there is minimal risk of UV exposure. When the UV intensity increases to a moderate level, the yellow LED turns on as a caution signal. If the UV radiation exceeds the dangerous threshold, the red LED lights up to warn users about the harmful level of exposure.The system also includes an OLED display, which is connected to the ESP32 using the I²C communication protocol through the SDA and SCL pins. The OLED screen displays the measured UV value in real time, allowing users to monitor the exact UV intensity instead of relying only on the LED indicators.The entire circuit operates on a

3.3 V power supply, which is suitable for both the ESP32 and the ML8511 UV sensor. All components share a common ground (GND) connection to ensure proper electrical operation. The 10 kΩ resistors used in the circuit help maintain stable input signals and improve the reliability of the system.

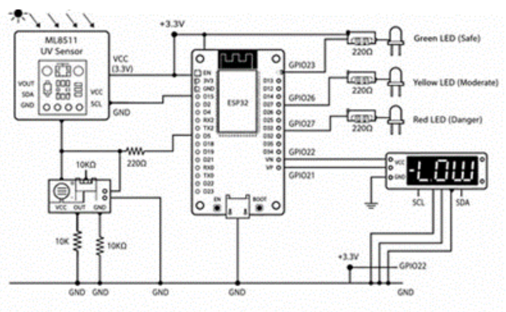

Fig 3: CIRCUIT DIAGRAM

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B. WORKING

The UV Radiation Monitoring System continuously detects ultraviolet (UV) radiation using the ML8511 UV sensor. The sensor converts UV intensity into an analog signal, which is processed by the ESP32 microcontroller. An LDR (Light Dependent Resistor) measures ambient light to improve the accuracy and reliability of UV readings. Based on predefined threshold values, the ESP32 classifies the UV level as Safe, Moderate, or Dangerous. The corresponding green, yellow, or red LED lights up to indicate the current UV condition, while an OLED display shows the real-time UV intensity. This system provides continuous monitoring and instant visual alerts, helping users reduce exposure to harmful UV radiation. The ESP32 also allows future expansion with IoT features such as cloud data logging, mobile notifications, and remote monitoring.

C. ALGORITHM

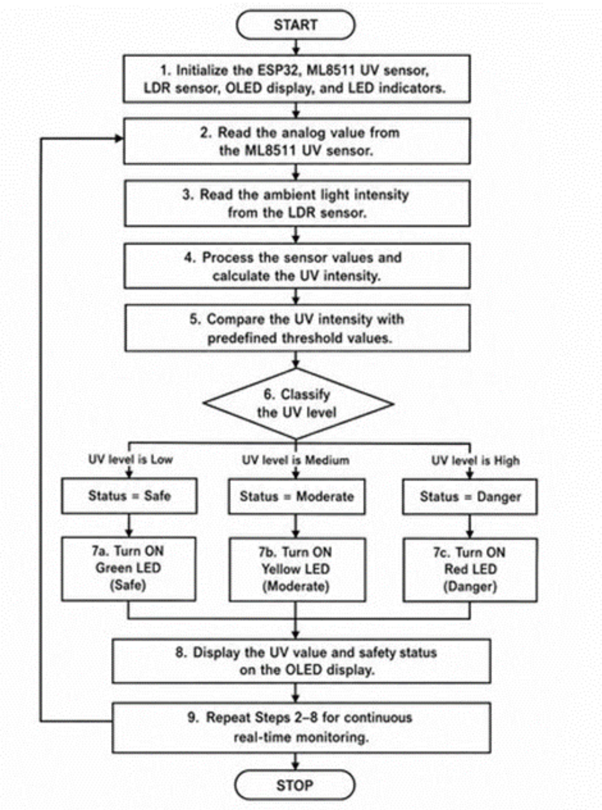

Fig 4: ALGORITHM

Step 1: Start the system.

Step 2: Initialize the ESP32 microcontroller, ML8511 UV sensor, LDR sensor, OLED display, and LED indicators.

Step 3: Read the analog value from the ML8511 UV sensor.

Step 4: Read the ambient light intensity from the LDR sensor.

Step 5: Process the sensor values and calculate the UV intensity.

Step 6: Compare the calculated UV intensity with predefined threshold values.

Step 7: Classify the UV level:

If the UV level is Low, set the status to Safe.

If the UV level is Medium, set the status to Moderate.

If the UV level is High, set the status to Danger. Step 8: Turn ON the corresponding LED indicator:

Green LED → Safe Yellow LED → Moderate Red LED → Danger

Step 9: Display the UV value and the corresponding safety status on the OLED display.

Step 10: Repeat Steps 3–9 continuously for real-time UV radiation monitoring.

V. EXPERIMENTAL RESULT

The developed IoT-Based UV Index Monitoring and Reporting System successfully achieved its intended objectives by providing accurate and continuous monitoring of ultraviolet (UV) radiation and ambient light intensity. The GUVA-S12SD UV sensor effectively detected changes in UV radiation, while the LDR accurately measured ambient light conditions, ensuring reliable environmental data collection. The ESP32 microcontroller processed the sensor readings in real time, calculated the UV Index, and displayed the results clearly on the digital display. The LED indicators responded correctly according to predefined UV thresholds, allowing users to easily identify whether the UV exposure was low, moderate, or high. Furthermore, the ESP32's built-in Wi-Fi successfully transmitted the collected data to the cloud, enabling remote monitoring and data analysis. The system demonstrated stable performance, low power consumption, and cost-effective operation throughout testing. Therefore, the project proves to be a practical and efficient solution for real-time UV monitoring, helping to increase public awareness and support health and environmental safety.

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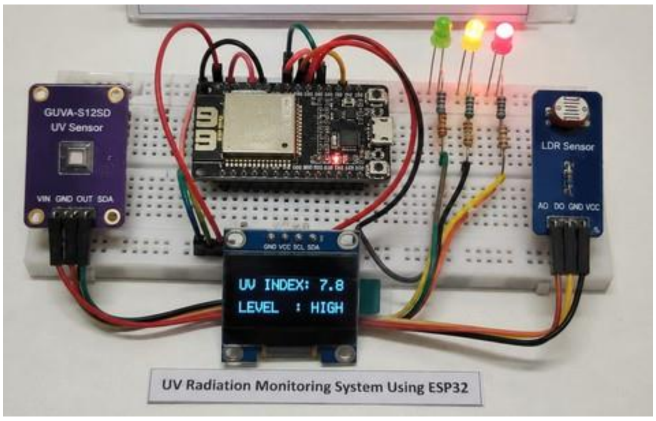

Fig 5: RESULT

VI. ACKNOWLEGEMENT

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VII. CONCLUSION

The IoT-Based UV Index Monitoring and Reporting System was successfully designed and developed to monitor ultraviolet (UV) radiation and ambient light intensity in real time. The system uses an ESP32 microcontroller, GUVA-S12SD UV sensor, and LDR sensor to collect and process environmental data. The calculated UV Index is displayed on the digital display, while green, yellow, and red LEDs indicate low, moderate, and high UV levels. Using the ESP32's built-in Wi-Fi, the data can be uploaded to the cloud for remote monitoring. This project provides a reliable, low-cost, and energy-efficient solution for UV monitoring and helps raise awareness about the harmful effects of excessive UV exposure. It is suitable for applications such as smart cities, weather monitoring, public parks, and health protection systems.

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