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Short Communication

Development and Implementation of an Internet of Things for Monitoring System

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ABSTRACT

The Internet of Things (IoT) technology and its applications are transforming objects into smart objects by connecting everything under a common infrastructure to regulate performance *via* a software application and providing timely upgrades with integrated web servers. In order to improve the quality of life, the green economy, and pollution control in society, comprehensive environmental monitoring systems with simple features and maintenance are required. This study proposes building a wireless sensor network with integrated sensor nodes made with Selective Surface Activation Induced by Laser technology. Electrical circuits may be integrated with free-form plastic sensor housing employing this technology. A low-cost asynchronous web server for monitoring temperature and humidity sensors attached to the ESP32 Wi-Fi module was built in this study.

Keywords: Internet of things; Wireless monitoring networks; Technology

DESCRIPTION

Data from sensor nodes across the facility is collected and displayed on a web server in real-time charts. The sensor data can be accessed by several web clients on the same network. Energy might be obtained from nearby sources of electromagnetic radiation to power the sensor nodes. This self-powered and automated system monitors ambient and climatic parameters, aids in prompt response, and enhances sensor design by permitting antenna and rf-circuit construction on various plastics, including the device's body. It also allows for more hardware flexibility and quick large-scale deployment. Wireless Sensor Networks (WSNs) are becoming more widespread in a variety of industries, including manufacturing, transportation, the environment, and healthcare.

Furthermore, the increasing usage of Internet of Things (IoT) technology across practically all industries [1] reinforces this tendency. The major emphasis of this research was on an embedded system of sensor nodes that used Selective Surface Activation Induced by Laser (SSAIL) technology [2,3] to monitor temperature and humidity. Antenna and RF-harvesting circuits may be built on various polymers, including the device's body, using this method. As a result, the gadget can be reduced in size. The communication module that supports energy-harvesting antenna circuits allows for the quick and low-cost construction of three-dimensional circuits on flexible material. Furthermore, long-term functioning of dispersed sensors may be achieved even in severe settings by gathering energy from diverse electromagnetic radiation sources [4].

Furthermore, gathering energy from the environment might minimize the need for sensor network maintenance by ensuring that they have enough energy for a longer life, resulting in several significant environmental and deployment advantages [5]. The fast proliferation of IoT devices has resulted in a plethora of embedded web server options. Current advances in Industrial Wireless Monitoring Networks (IWSNs) are largely concerned with applications from emergency systems, regulatory control systems, supervisory systems, open-loop control systems, alerting systems, and monitoring systems. In contrast, the installation of large-scale IoT devices challenges the use of control systems in production lines due to their enormous size and sensitive construction.

As a result, this study has contributed one of the most economical and ubiquitous answers to society's requirements. The sensor system may be customized utilizing software and hardware technologies, making it simple to deploy for environmental monitoring and giving an option for energy harvesting to power the node in regions where ambient RF signals are abundant for lengthy periods of time. Analyzing the characteristics and properties of sensor network nodes scattered at

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random saves a significant amount of time and money for large-scale real-time deployment of IoT devices. For the monitoring system, an architecture for master and slave sensor nodes has been developed. The communication module as well as the energy-harvesting antennas were developed and tested.

The power consumption of the suggested sensor node has been analyzed to assure its long-term functioning. The results of an examination of one of the most regularly used communication protocols were published. A deterministic operating regime was used to measure the overall power consumption of each sensor node. The monitoring of the sensor nodes was done independently *via* the high-level hosting application.

Solar and wind energy as a source of energy gathering would be the better approach in more remote open areas. After installation, WSNs produced using this method can be used to monitor the forest, including unmapped regions.

CONCLUSION

This primary study focuses on the embedded system of sensor nodes for monitoring temperature and humidity utilizing SSAIL-manufactured electronic circuits and antennas. This method improves sensor design by allowing the construction of antenna and RF-harvesting circuits on diverse polymers, including the device's body. As a result, the gadgets may be miniaturized.

A node's energy generator and communication components were created and tested. The communication module utilized to support the energy-harvesting antenna circuits was built to allow for the quick and cost-effective manufacture of three-dimensional circuits on flexible material.

The fractal antenna's modelling and measured results reveal a perfect match at 2.43 GHz, and it completely covers the lower Wi-Fi frequency spectrum. Future study will include communication between numerous nodes in a network of sensors located in different locations, parameter assessments, radio channel accounting, and real-time data collection *via* web clients. Furthermore, as wireless networking and sensor technologies develop, there is an appealing possibility for data aggregation, modelling, and testing of lifetime-aware routing and geographical coverage.

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