Supercomputing

The Smart Signal Detection LED Notice Sign

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What is the project about

The project is about addressing the challenge of enforcing no-electronics policies in high-security environments such as government facilities, research laboratories, and date centers. As wireless communication devices like cell phones, Wi-Fi-enabled equipment, and Bluetooth devices become increasingly common, these locations face greater risks of data leakage, signal interference, and security violations. The Smart Signal Detection LED Notice Sign was developed to detect radio frequency (RF) signals emitted by unauthorized electronic devices and provide a clear visual alert when such signals are present. This project defines the problem as the lack of an affordable, automated, and reliable system capable of monitoring wireless activity in real time and reinforcing security policies without relying on manual enforcement.

The plan to solve this Problem

The project is solved computationally and through application-style coding called Python by using a programmed system that continuously processes radio frequency (RF) signal data and controls hardware responses in real time. Python serves as the primary programming language for the application logic because it efficiently handles data input, conditional decision- making, and hardware communication. In this system, Python code reads RF signal values from the detection module, converts the incoming data into usable digital measurements, and compares those values to predefined threshold levels. When the application determines that RF activity exceeds acceptable limits, it automatically triggers LED indicators that turn bright red to alert users that an unauthorized electronic device is present. The application runs continuously, similar to a background security program, enabling real-time monitoring without human intervention. Visually, the system is housed in a shadow box frame with LED lights that remain off under normal conditions and illuminate bright red when RF signals are detected. Adjustable sensitivity is incorporated into the Python application, allowing the system to adapt to different environments and minimize false detection caused by background interference.

Development status

The progress that has been made up to this point includes extensive research, coding development, prototype assembly, and testing. Research focused on understanding RF communication principles, wireless frequency ranges used by cell phones, Wi-Fi, and Bluetooth technologies, and the operating characteristics of RF detectors. Coding progress includes developing the application logic that continuously monitors RF input, processes signal strength values, and controls LED output based on programmed conditions. A functional prototype was constructed using an Arduino micro-controller, an RF signal detection module, LED indicators, antennas, and a power supply, all housed within a shadow box frame. Testing involved introducing various electronic devices within the detector's range to evaluate detection accuracy, response time, and sensitivity adjustments, resulting in refinements to both hardware placement and code logic.

Results

The results that are expected from this project include reliable detection of RF signals emitted by unauthorized electronic devices and immediate LED notifications when such devices are present. The system is expected to accurately identify wireless activity within its designated frequency range while allowing sensitivity adjustments for different security environments.
By automating detection and notification, the project is excepted to reduce human error, improve

compliance with no-electronics policies, and provide a cost-effective alternative to manual inspections and expensive professional RF monitoring systems.

References

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