

Detection of Unauthorized Transmissions in a Frequency Spectrum Using Wireless Sensor Network

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Abstract

Today, technology interconnects machine and user more than ever before. This newfound technology creates a need for increased security measures to ensure confidentiality of the consumer's information in addition to the protection of device performance. A wireless transmitter could be used to maliciously gain access to sensitive information. In order to prevent this, a wireless detector should be implemented to warn the user of any harmful activity. The detector is comprised of a mesh network of multiple sensors that actively monitor a frequency spectrum.

Introduction

The evolution of technology is increasing exponentially which increases the use of autonomous devices that rely on wireless signals to operate and communicate with other equipment. It is now difficult to locate any modern-day operation that does not incorporate the use of these devices. A disadvantage to the growth of autonomous technology is the unpredictable methods of attack that organizations or individuals can present to various communities. One form of attack may be to tamper with the communication of these devices that can result in overtaking the device or sensitive information becoming compromised. The proposed project is a wireless sensor network designed to alert to any unknown frequency modulated transmissions within a parameter. The purpose of creating the device is to establish a safer and a more reliable environment for the use of autonomous technology.

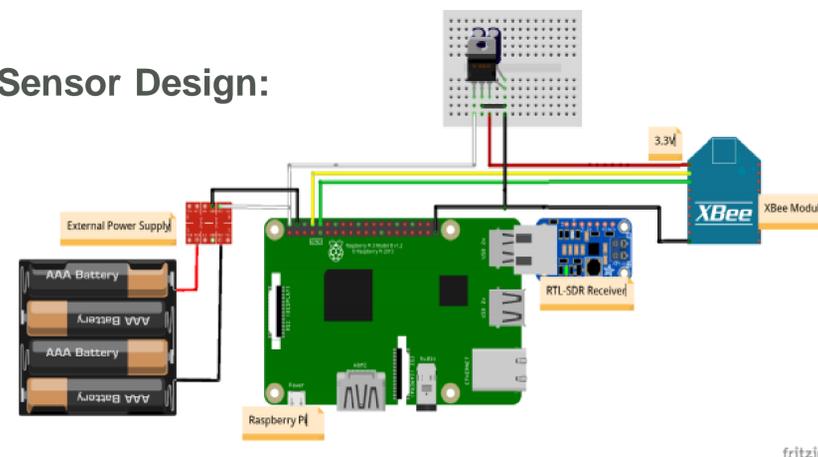
Methods and Materials

Each sensor is comprised of three main components: a software-defined radio, a Raspberry Pi, and an XBee device. The software defined radio is used to scan a given FM spectrum for signals. The Raspberry Pi is used to connect the SDR (software-defined radio) to the XBee device. Once the Raspberry Pi device receives information, it relays that information to the XBee. The XBee's purpose is to wirelessly connect each node to a main fusion center. The fusion center is where data processing and detection takes place. Additionally, the fusion center displays information through a user-interface and alerts the user when an unauthorized transmission is detected.

Results

The current version of this project operates exactly as expected and should operate even better if more sensors were used.

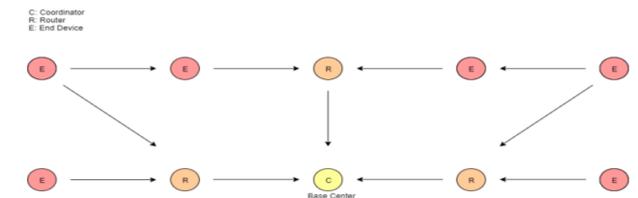
Sensor Design:



Discussion

The wireless sensor network is designed to be modular. This means that the user can expand and improve the network simply by adding more sensors. Additional sensors to the network allow for a higher probability of detection and an increased signal-to-noise ratio allowing for more accurate results.

Network Topology:



Conclusions

Advancements in technology has overcome multiple milestones but has also created new methods of intrusion. Protecting autonomous devices may require a new form of security that could allow for a reliable and secure operation. The report introduces a system that detects unauthorized transmissions in a frequency spectrum using a wireless sensor network. Conducting the research for similar products concluded that there are currently limited implementation methods for that type of security. The main reason for that is due to the high cost of owning a system that functions identically as the project proposed.

Acknowledgements

The process of exploring the functionalities of software defined radio receivers required a general guide on how to approach the project. Guidance from Dr. Fonseca, the projects client, assisted in the understanding of the functionalities of each component. General knowledge about certain functionalities within the project led us to create the bridge required between theory and practice. Feedback from Witenberg Santiago Rodrigues Souza assisted on the development of the documentation for this project.