Intrusion Detection Using Passive Infrared Sensors for Home Security

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1. Abstract

Home security systems offer protection against break-ins and prevent costly property damage. They are designed to protect property from theft, fires, and other environmental disasters. Although there are many home security systems available on the market, they vary in effectiveness and some might even invade the privacy of individuals living in the house, such as a camera surveillance system. Therefore, it is important to develop systems that are effective and do not invade any privacies. Our proposal will discuss use of Passive Infrared Sensors (PIR) in home security systems.

2. Problem Statement

Trespassing on private property is a common problem. Latest technology with CCTVs and alarms has made it easier to monitor the property, however it still requires a security guard to sit in front of screens monitoring individual cameras. This is a tedious task and allows for mistakes. The guard could easily miss an unauthorized individual trespassing. There is also the problem of invading the privacy of individuals inside the house, who might not be comfortable with being always watched by security guards. It is also very cost effective to build such a system and pay for the salaries of the guards. A smart system network is needed to help with such a tedious task and to detect any unauthorized personnel.

3. Solution and Approach

To solve this problem, we will be constructing a smart sensor network using passive infra-red sensors (PIR), Which are also known as pyroelectric sensors and Arduino. A passive infra-red sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. A PIR consists of a pyroelectric sensor which generates energy when exposed to heat, so when a human comes in its range, the human emits heat energy in the form of infra-red radiation which is picked up by the sensor. The sensor also consists of a lens called the Fresnel lens which focuses the infrared radiation onto the pyroelectric sensor. Passive infrared sensors are not equipped with any type of light emitting diode, which allows them to work in complete darkness as well as during the day.

Pyroelectric infrared (PIR) sensors are well known presence detectors. Due to their low cost and low power consumption, small size and discreet and privacy protective interaction, they have been widely used in human tracking systems. A dense PIR sensor array with digital output and Fresnel lens modulation visibility can provide the ability to track human movement, identify walking objects, and count the number of people entering or leaving a room entrance. PIR sensors could address the invasion of privacy issues raised using camera-based surveillance systems.

The most important aspect of using passive infrared sensors to detect human movement is that they are completely silent, making them an excellent choice for areas where people are sensitive to noise. They will not only determine whether a person exists in a certain area, but also how the person moves within a given area.

To develop a robust human tracking system, we will need to focus on three important aspects

1. Identifying the object being detected (human or not)
2. What is the location of the object relative to the sensor?
3. Which direction is the object moving?

This smart sensor network could detect the presence of unauthorized individual(s) with greater accuracy and pinpoint the location of the individual to a single room. The sensors could also work out the path of the intruder, as the intruder moves through the property activating sensors. A sensor network with several motion detection sensors connected to a central processor. The processors continuously check the sensors for feedback and if any sensor picks up movement, the processor reports back to the user. The system also checks which sensor was activated and use the information to pinpoint the location of the intruder.

4. Plan of Action

Our first phase of the plan of action would be to buy all the sensors and devices we need such as PIR sensors and an Arduino board for configuration and programming. After verifying that the components work properly, we will begin to develop the network by placing the sensors at distinct locations in the house and configuring them with an Arduino.

Our second phase would be to integrate all the sensors and program them in such a way that they work together and send accurate signals back to the central processor. The sensors should work simultaneously and not interrupt each other.

Our third and final phase of action would be to check its working for demo presentation and start writing the final report.