Security Alarm System

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Introduction

a. Purpose

With our arduino-based security system, we plan to enhance the idea of sounding an alarm based on an intruder, while also tackling the issue of cost and the ability to mass-produce a product. Our goals and objectives are as follows:

    i.   Enhance the intelligence behind sounding an alarm if there is an intruder present

    ii.   Produce a cheap security system that is able to be mass-produced and easily implemented

By enhancing the intelligence of a general alarm, the alarm can differentiate between whether or not a true intruder is present or a harmless animal or object. Also, making this product able to be mass-produced will allow more families and prospective business owners to take advantage of the decreased cost of the product. Consequently, once they receive their product, making it easily implementable will save time and reduce frustration.

b. Features and benefits

The security system will be implemented using the Arduino and logic gate components. The implementation of a photocell will allow us to detect shadows of considerable size and indicate whether or not a human shadow was made. A proximity sensor will detect general movement. Finally, a thermal sensor will detect human movement specifically. These sensors were made with the idea of cost-efficiency behind them, which contributes to the

ability to mass-produce and be affordable. Also, with logic gate implementation, we deemed

the shadow sensor the most important, followed by the thermal and proximity sensor, which

were equally important. When the shadow sensor and either the thermal or the proximity

sensor turns on, the alarm will sound. This logic will specifically detect humans and disregard

animals and other objects all within a cost-efficient budget.

Design

c. System Overview

The shadow sensor takes precedence over the other sensors. If two out of the three, which must

include the shadow sensor, go off, then an intrusion is detected.
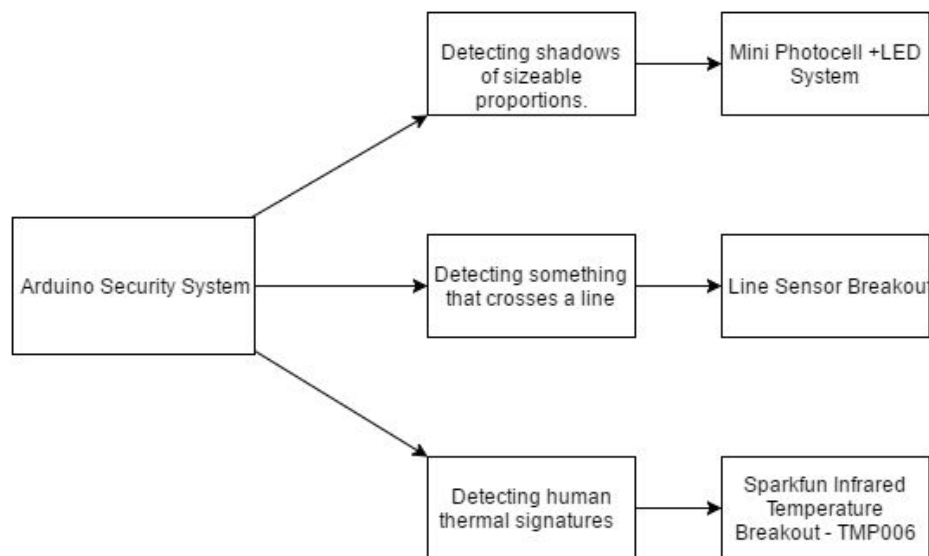
d. Design Details

The system was created using three different types of sensors. We used the mini photocell as our

shadow sensor, the Line Sensor Breakout as our infrared sensor, and the Sparkfun Temperature

Breakout sensor to detect temperature. We had the power and grounds running through all the

chips with resistors to ground to make sure the voltage regulator on the arduino wasn't overheating.

We used the arduino to power the system with 5V. The sensors were used as analog inputs to the arduino and we coded digital outputs based on their signals. Those digital outputs were coded and they sent out signals that were connected to logic gates.

We used the NAND chips for our logic gates. The output of these gates was hooked to a LED and a resistor. When the LED was off, there was no intrusion. When it was on, there was an intrusion.

Results

Our proximity sensors were line sensors that used infrared to detect whether movement was present. This was done by outputting a boolean 0 if something was blocking its sensor, while a 1 was output if no object was there. The thermal sensor would output the object and the sensor's temperature on the console, so we could debug and see if the sensor itself was working. The shadow sensor used a photocell and was coded to detect light sensitivity, and its value increased as more light was present and decreased with less light (which simulated the appearance of a shadow). This result was also output to the console, so we could debug the circuit if it did not work. We verified our logic component by reversing our NAND gate to get the correct OR gate and AND gate (Appendix a). We tested the system by simulating all scenarios, such as thermal and shadow sensor turning on (LED/Alarm turns on) and thermal and line sensor turning on (LED/Alarm does not turn on). We would cast shadows by placing our hands over the shadow sensor, and we would place our hands near the line sensor and the thermal sensor to simulate movement and thermal activity. These tests successfully passed and we were able to confirm the correct implementation of our security system.

Problems and Challenges

One major obstacle we faced was the compatibility of our purchased sensors with the breadboard. While we were fortunate to have our thermal and shadow sensor work on our breadboard, our first proximity sensor did not work easily, as many of the cables had four connectors compared to its unique design of using 3 connectors. After attempting to solder it onto the breadboard manually instead of using pre-made cables, we found the proximity sensor did not work with our breadboard. Consequently we were set back by two weeks in our design. Thankfully, with the help of our TAs, we were able to substitute the proximity sensor function with infrared line sensors. Along with the benefit of being cheap, these line sensors were easy to implement.

Besides that major issue, we did not face any other major challenges or obstacles, and the prototype of our security system went along smoothly.
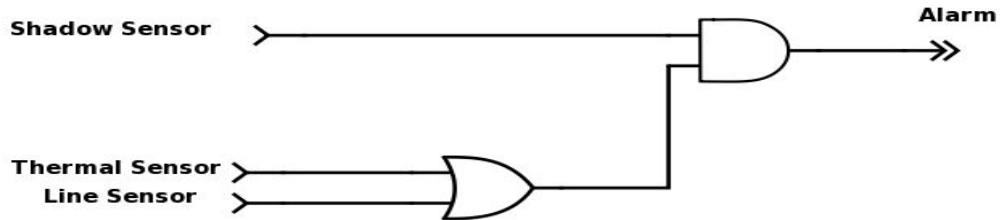
Future Plans

If we were to continue our project through the next semester, we would redesign this project onto a PCB board for ease of use. ? We would also incorporate and optimize more sensors in our security system, and we could implement more intelligent logic for detecting intruders. We are also planning to implement a way for the arduino to send a text message if an intruder triggers the alarm.
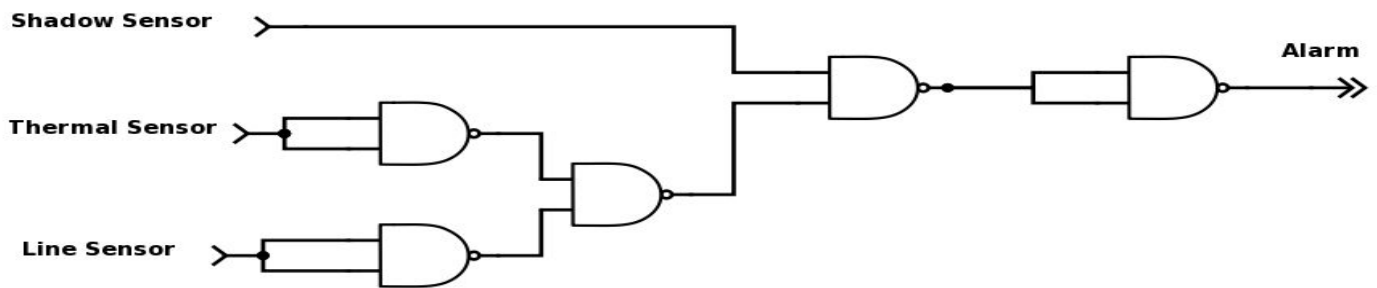
Appendix

a.

Theory Circuit Schematic

Shadow Sensor

Alarm

Thermal Sensor
Line Sensor

Final Circuit Schematic

Shadow Sensor

Alarm

Thermal Sensor

Line Sensor

References

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