ECE 4220 Project Proposal

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The Problem

With my project I plan to provide a device that will allow you to automate the lights within your home. Today you more than likely left an unnecessary light on within your home and wasted energy, costing your money. My device will be able to detect when anyone is within the room and turn the light on, hands-free, and turn the light off when everyone leaves the room. Not only will it automate your light switches, it will allow you to monitor the number of people within a room from your home PC. This will allow you to monitor your power usage at any given time by knowing each specific light that is on within your home.

Materials

In order to complete this project, I will be writing the software on a Raspberry Pi Model B+. The reason I have chosen this microcontroller is to enable multitasking to monitor multiple doors within a room and to also enable network communication with a PC. The sensors I will be using are two of the Infrared Proximity Sensors - GP2Y0A21YK. This sensor is manufactured by Sharp. This sensor will allow me to measure the distance of an object or person from the door. The final material required would be the essentials: power cord, Ethernet cable, and wires to connect the components.

Implementation

To start, the sensors will be placed on either side of the doorway. An assumption will be made that when a person moves through the doorway they will linger there (opening or closing the door) for a small amount of time before moving on. The raspberry pi will be the brains of the project. It will continuously monitor the state of the sensors and track the distances being recorded from the object. After observing the distance of the ceiling , the sensors will be calibrated to recognize when a person is standing above them. Below is a diagram to give a visual sense of the build.

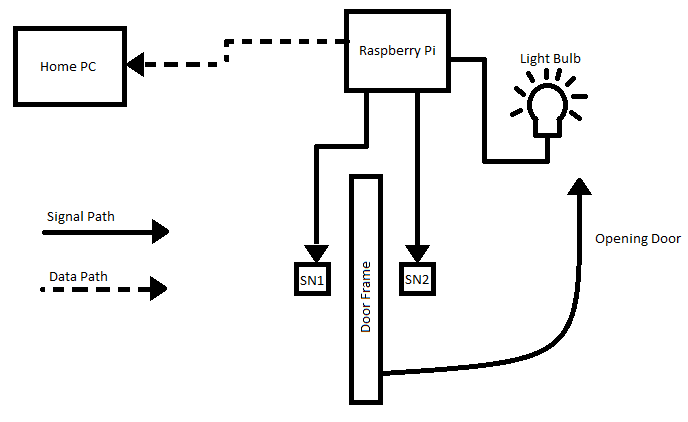


Figure 1. Project Visual Diagram

This diagram better shows the placement of the sensors and an extremely high level view of the overall project. With the Home PC being sent data from the Raspberry Pi you can monitor the count of occupants in the room, and the state of the light build.

In order to count the when a person enters or leaves the room, the sensors will read a distance that is below a certain threshold (that has yet to be determined) for a small amount of time (roughly 2-3 seconds; this correlates to the assumption of the person taking a few seconds to open and close the door) it will increment the count in the room depending on which sensor is triggered first. For instance if going from SN2 to SN1 is going from outside to inside, the counter will increment to show that someone has entered the room. Vice versa, if sensor SN1 is then triggered and then SN2 is triggered, the count will be decremented and if that count reaches zero, it will turn off the light since there is no occupant within the room.

Along with counting the occupants in the room, it will be communication through sockets with the Home PC. Every time the count is incremented or decremented, signaling a possible change in the state of the room, a message will be sent from the raspberry pi to the home PC. This message will include the new count, a time-stamp of when this count was changed, and the state of the light (whether it is on or off).

Timeline

My goal to is to have the project completely done on or before May 1st. This leaves me four weeks total to complete the project. For the first week I plan on getting the sensors to communicate with the raspberry pi and read in the signals sent from them. The second week I plan on wiring the circuit that will control the light using the raspberry pi. The third week I plan on getting the communication between the raspberry pi and my Home PC established. The final week I will integrate all three of the previous week’s work, and have test the system as a whole for completion.