



Concept Generation (JST/Team 7)

Matteo Guerrini <matteo20@ru.is>

Giacomo Menchi <giacomo20@ru.is>

William Paciaroni <william20@ru.is>

T-411-MECH Mechatronics 1

RU Science and Engineering

October 20, 2020

1 Home SecuriPi

The main concept of this project is the home security: we are trying to solve the problem of thieves and intruders entering your house when you are not inside by implementing a layer of security which alerts you if a presence is detected when the system is active.

We plan on using a Raspberry Pi which controls a camera, a PIR sensor and a microphone.

- The PIR sensor detects movements[1] inside the house and turns on the camera when one is registered, which then recognizes the presence of an intruder (a human figure).
- The microphone is used to check for loud noises (i.e. those which are above a certain threshold) which would further confirm the presence of an intruder.
- A notification is sent to the user (via email or telegram bot) whenever the camera detects a person or the microphone hears a loud noise.
- The system can be turned on and off with a physical button or wireless via Adafruit.io dashboard (API calls), and its status is reflected on a LED.

Additional features may be developed, but we didn't study their feasibility yet, so we are leaving them as uncertain for now:

- A speaker may reproduce a recorder sound when an intruder is detected.
- The microphone could record audio and send it using the means mentioned before (email or telegram bot).
- A light sensor could be used to check if lights are on when nobody is supposed to be in the house, triggering a message that alerts the user.

1.1 Components list

The preliminary components list would be:

- Raspberry Pi Zero
- Raspberry Pi Camera module
- PIR sensor
- Microphone
- Relay
- Switch
- One led RGB or two LEDs red and green
- Jumpers, Resistors and Breadboard
- Box (3d printed) [Figure 1 and 2]

1.2 Related Works

A similar commercial alternative to our project is the all-in-one "Blink indoor"[4] which is sold by Amazon: the main difference between the two is that our sensors network is low cost and homemade, so it could allow more customizable features and flexibility.

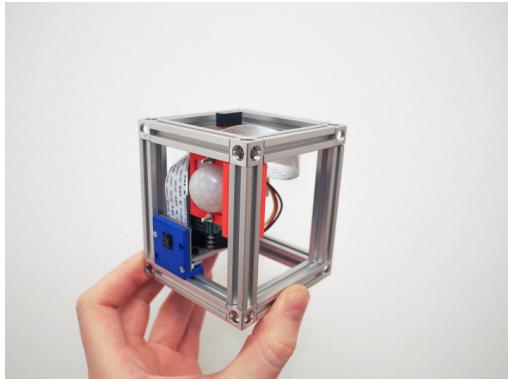


Figure 1: Picture of Home SecuriPi concept [6]

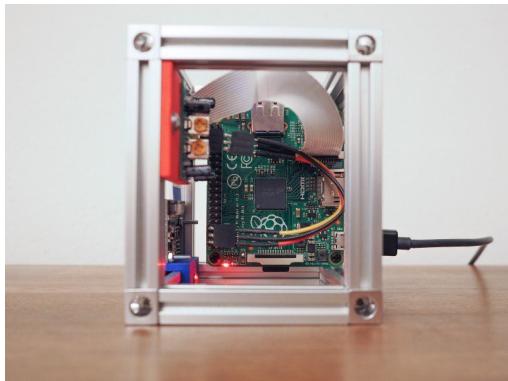


Figure 2: Same picture from another angle [6]

2 Weather Echo Pi

The main concept of this project is based in 2 components, a weather station and a speaker station (echo). The weather station [Figure 4], that is a sort of 'Home Server' (for example placed in the balcony), is able to read temperature, humidity, light and pressure of air.

The second station , that could be classified like a little Alexa Echo, is able to speak and tells all the information read from weather station (local information) when the alarm rings (previously set up).

We plan on using two Raspberry Pi, the first one (weather station) which controls light sensor, temperature sensor, barometric sensor and humidity sensor, and the second one (Echo) controls a speaker.

The problem we are trying to solve is that before getting out in the morning we usually don't have any info about the weather, while with this system we could always have updated temperature, humidity, and other data available for us to check before leaving home.

- The weather station is placed outside like in a balcony and is able to read all the information about humidity, temperature...
- In order to set the alarm, APIs are used.
- When the alarm rings, the weather station reads these data and sends it to the Echo station[3], that receives and reproduces them using the speaker.
- The system can be turned on and off with a physical button or without setting the alarm.

Additional features may be developed, but we didn't study their feasibility yet, so we are leaving them as uncertain for now:

- An application to handle all these data and set up the alarm for the speaker.



Figure 3: Example of weather data collection station [5]



Figure 4: Example of station content (sensors) [2]

- A log of previous days weather.
- OLED screen for the speaker station to see the data.

2.1 Components list

The preliminary components list would be:

- 2 Raspberry Pi Zero
- Speaker
- Light sensor
- Temperature sensor
- Barometrical sensor
- Humidity sensor
- Button
- One led RGB or two LEDs red and green
- Jumpers, Resistors and Breadboard
- Box (3d printed) [Figure 3]

2.2 Related Works

There are a lot of similar commercial alternative to this project, from Alexa that uses generic APIs, to all-in-one "Smart Weather Station" which is sold by Amazon and is available at [THIS LINK](#): the main difference between the two is that our weather station is low cost and homemade, so it could allow more customizable features and flexibility.

3 Smart Home

Smart Home is a lighting management system.

It solves the problem of entering a dark house or building and having to look for the light switches: when movements in rooms are detected, lights will be turned on automatically.

This is once again obtained using PIR sensors which check for movement and coupling them with light bulbs to make them turn on.

We thought about also using light sensors to check if the room is already lit (for example, due to the sun entering from a window), which would avoid the light bulbs from turning on.

To avoid wasting energy and prevent lights from turning on when not needed or not requested, we will also develop an application which will allow to see the currently on lights, turn them on and off and prevent them from switching on or off.

3.1 Components list

The preliminary components list would be:

- Raspberry Pi Zero (one for each system)
- Light bulb
- Light sensor
- Relay
- Power supply
- PIR sensor
- Button
- One led RGB or two LEDs red and green
- Jumpers, Resistors and Breadboard

3.2 Related Works

There is similar alternative to this project, but not at all the same, which is a Smart Light with an integrated PIR sensor [9]: the main difference from our project is basically that our application has a website integrated.

Other related works could be Alexa with smart light bulb, but it doesn't use any PIR sensor, but only a speech recognition to turn it on.

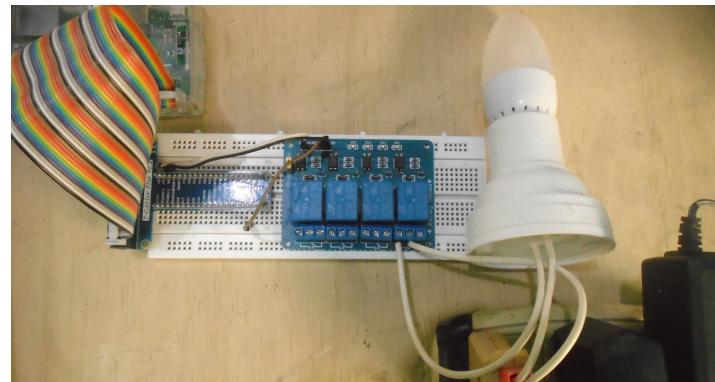


Figure 5: Example of smart light bulb using relays [7]

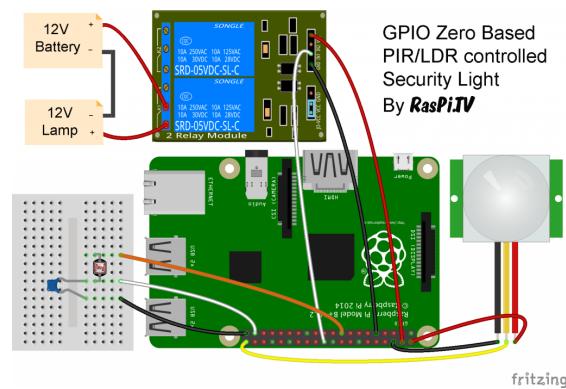


Figure 6: Example of schematic [8]

References

- [1] Raspberry Pi Home Security System with Camera and PIR Sensor
- [2] Make a Weather Station With a Raspberry Pi 2
- [3] Alexa Assistant With a \$10 Raspberry Pi Zero W and Lights
- [4] All-new Blink Indoor
- [5] Complete Raspberry Pi Weather Station
- [6] Raspberry Pi Security System in Python
- [7] Raspberry Pi Smart Home Light
- [8] Circuit for GPIO Zero PIR/LDR 12V Security Light
- [9] PIR Intelligent Detection Light Bulb