Project Requirements Document

Team: J VANT

Project: ResQ Sensor

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Introduction:

Our goal is to develop an app, ResQ Sensor, using the FLIR Lepton, a thermal imager, that will keep your home, your business, and your family safe and secure without your constant supervision.

The Lepton will essentially be used to detect undesirable temperatures as inputted by the user in order to detect unwanted actions. A user will be given the option to input a temperature range for the Lepton to detect. If the Lepton detects this temperature, an action will then take place depending on the use of our product. For example, we can set our product to detect fire temperatures such as a candle that remained lit while no one was home (approximately 1,400 degrees celsius). In this case, a signal will be sent to the Raspberry Pi causing an extinguisher to set the flame off.

In order to implement these types of actions, we will have to create a user interface allowing the insertion of temperatures, program the lepton to detect these undesirable actions, along with the extinguisher to work as an independent system aimed to only affect the target area.

Our finished product can then serve other purposes such as detection of home intruders with the temperature set to the average human body temperature or even in the military for the same purpose.

Glossary of Terms:

- Raspberry Pi: a single board computer system
- Lepton Thermal Imager: an ultra-compact thermal imaging camera
- GPIO (General-Purpose Input/Output): a pin on an integrated circuit whose behavior(In/Out) is controlled by the user
- UI (User Interface): allows users to communicate with electronics
- Performance FFC: Lepton Thermal Imager shutter that performs a flat-field correction
- servos: motor that will be controlled by Pulse Width Modulation (PWM)
- I2C: serial computer bus that is multi-master, multi-slave, and single ended used to connect lower speed peripherals to processors
- PWM: a digital signal that is used to control a circuit

System Architecture Overview:

The initial setup will be with a Raspberry Pi Model B connected by GPIO to the Lepton module. By analyzing the data reading from the lepton, we control servo to aim the sprinkler to the hottest spot in the image to cool it down.

The Raspberry Pi is a chip computer that contains a strippeddown Linux distribution. It has 4 USB ports, 40 GPIO pins, a Full HDMI port, a Ethernet port, Combined 3.5mm audio jack and composite video, Camera interface (CSI), Display interface (DSI), a Micro SD card slot, and a VideoCore IV 3D graphics core. Because it has an ARMv7 processor, it can run the full range of ARM GNU/Linux distributions, including Snappy Ubuntu Core, as well as Microsoft Windows 10.

The FLIR Lepton™ is the most compact longwave infrared sensor. It packs a resolution of 80 × 60 pixels into a camera body that is smaller than a dime. This revolutionary camera core is poised to equip a new generation of mobile and handheld devices, as well as small fixed-mount camera systems, with thermal imaging capabilities never seen before. Lepton contains a breakthrough lens fabricated in wafer form, along with a microbolometer focal plane array (FPA) and advanced thermal image processing.

A servo is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Requirements:

<u>User Cases:</u>

1. Users can learn how to use ResQ Sensor in the About section of the web page.
2. Users will need to create an account.
3. Users need to log in before they can access their own ResQ sensor cam.
4. Users set an ideal temperature they want the room to be in.
5. Users can go to the web page check on the room through the web camera.
6. Users can take a snapshot of the current image on ResQ sensor cam.
7. The sensor will detect the temperature change once the temperature in anywhere of the room changes (+/- 10F of the desired temperature).
8. The sensor will capture a image of area of temperature change and send to the user through mobile app or web application.
9. Users check the image and send a signal to the sensor if they want the sensor to take actions.

10. If the sensor doesn't get a signal from the users within 5 minutes after the picture sent, it will take actions by default.
11. The sensor will splash water on the area of temperature change or blow it with the fan.
12. Your house is safe and everyone is happy!

Test Cases:

github URL - https://github.com/vivianescalante/Capstone/commit/768c230181fe2a8c51281626e121649ca4adc9bf

1. **bool testMoveServoX():** tests if it returns a valid x-value for the servo to move (you get it from the getter function)
2. **bool testMoveServoY():** tests if it returns a valid y-value for the servo to move (you get it from the getter function)
3. **bool testGetServoX():** tests if it returns a valid x-value for the servo
4. **bool testGetServoY():** tests if it returns a valid y-value for the servo
5. **bool testSceneX():** tests if it returns a valid x-value from the screen (from the temperature array the temperatures can't go above the MAX_INT)
6. **bool testSceneY():** tests if it returns a valid y-value from the screen (from the temperature array the temperatures can't go above the MAX_INT)
7. **bool testLepton():** takes care of when the lepton fails to start or the image is invalid

System Models: N/A

Appendices

- **FLIR Lepton**: LWIR - long-wave infrared imager sensor, resolution of 80x60 pixels into a camera that is smaller than a dime, with thermal capabilities (fits into mobile and handheld devices.
- **Raspberry Pi**: single board computer, does not include a built-in hard disk instead relies on an SD card booting and long term storage.
- **QT (for the GUI)**: a cross-platform that can be written in your choice of language regardless of how many target platforms you will use
- **Github:** used to keep track of the code everyone is doing, update it, and looking back to previous versions
- **Servo:** a device that will have as its input the x and y coordinates of the location where the heat is detected and will move to those coordinates

- **Sprinkler:** After the servo is at the position the sprinkler will shoot water toward the detected object