



INSTITUTE *of*
TECHNOLOGY

CARLOW

Institiúid Teicneolaíochta Cheatharlach

Secure SCADA/IoT System to track live data

Functional Specification

Student: Neil Kane

Student Number: C00242418

Supervisor: James Egan

Abstract

The purpose of this project is to create a secure SCADA/IOT system to monitor data from IoT devices and sensors. A front end web application will be implemented to monitor the readings from the sensors. The sensors will be connected using a Raspberry Pi, which will then be used on the dashboard. We can monitor the systems. I will also have a second raspberry Pi using a camera and facial recognition. Although these systems work on separate Pi's, they could be seen working together as the facial recognition could open a door to allow the user access to the monitors hosting the dashboard. SCADA systems are used in many industries and this project could be used for a range of monitoring.

Table of Contents

Abstract.....	1
Table of Contents.....	2
Introduction.....	3
Purpose	3
Features	3
Core Feature	3
Non-Core Feature	4
SCADA.....	4
Security.....	5
Data.....	5
Sensors.....	5
Users	5
Inspiration	5
Project Plan.....	6

Introduction

The purpose of this function specification is to document the features and functions of this project. I will outline what the secure SCADA system's purpose is. I will create a detailed list of what I want to achieve and any potential issues that may arise in the development process.

Purpose

The purpose and function of this project is to create a device, which reads in data. It will be a mix of SCADA and IoT systems to produce the best result. I will use readings from sensors like temperature and humidity. It will use Sunfounder sensors and the main device is the Raspberry Pi. I will also use a Raspberry Pi camera for security features on a second Pi. The SCADA system will be used to monitor data like temperature. At the core of this project is security.

Features

There is many features to this project. Some features have a higher priority than others for a range of reasons. I will arrange what I currently see as core features, meaning they need to be in the project against non-core features. These are features that will improve the project but not necessary as important as the core features. As my project is a running system, it is hard to see at the moment the type of things that I would consider a non-core feature.

Core Feature

Security – This will be seen throughout the project, there is many areas to be secured and this is the pushing point for my project to create a secure system. I am hoping that showing the security implemented will give reasons to use SCADA/IOT systems. This will also show me where security is lacking regarding these kind of systems.

Login and Logout page – This is important as I don't want anybody to be able to just go to the webpage see the readings.

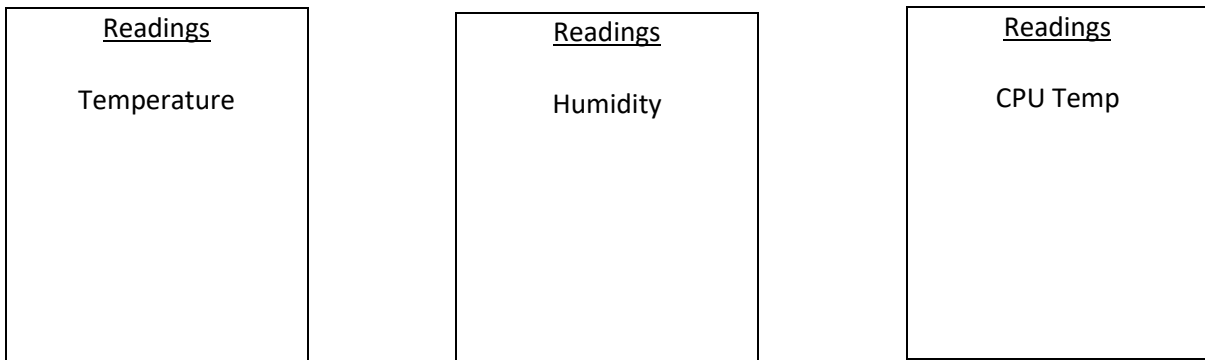
Data – The type that I read in from the devices is important as this is what I want the project to do.

Non-Core Feature

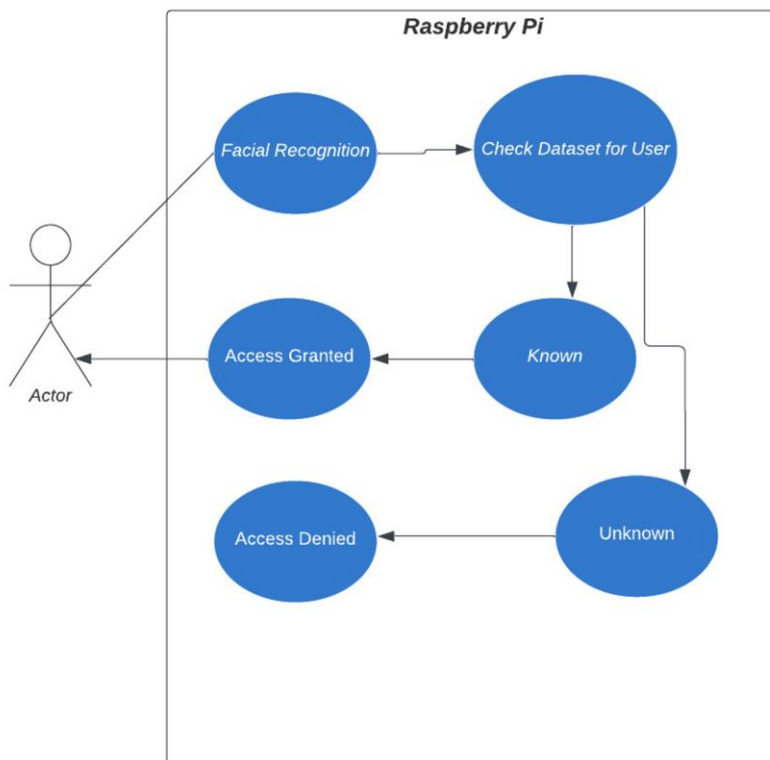
Sensors – Although this seems contradictory, I believe the type of sensors I use, is not as important as securing the device and reading in the data. I know there will be sensors regardless of the type of system I make.

SCADA

A front end web application will act as the SCADA systems, to monitor data and gather information from all the devices. It will have a login and logout page. Once logged in, the user will be able to see the dashboard. This will show the data in graphs. The below is an example of the home page.



The camera function will authenticate a user if they are recognised. A user will approach the camera. A database of images is created of known users. If the user is known to the database, they are granted access., if unknown they are refused.



Security

There is many areas which need to be secured regarding this project. I need to secure the web based application. A secure login and logout page is needed to stop anybody gaining access. I also need to secure the raspberry pi itself and any sensors connected to it. I need to make sure nobody can gain access to the network through this device. As a whole by individual assigning security protocols to each area, I can see what is secure and what potentially needs more security features added.

Data

I have created a shared drive, which I can access from my windows machine. This was set up to share the readings from the Pi and convert them in data charts.

Sensors

The type of sensors to be used are temperature and humidity acting as the features of the weather station. I will use a camera for security. There is other sensors that could be included. This is why I stated that the type of sensors used is not as important as other aspects of the project. I can add sensors as needed or take some away if they are not serving the purpose of my project.

Users

This project is aimed at any type of SCADA system. It is to try flush out potential security concerns and fix them. There is many Raspberry Pi projects online, this project will hopefully be able to be used as a guide of securing it regarding certain aspects. Although this project was not created with a certain department or company in mind, I think the findings of this project could be important and helpful to many systems. As we know SCADA systems are used in many industries. Some people consider these systems as a dying system and that IoT, is taking over. Others believe that incorporating the two is the way forward. I am hoping my project can showcase the two working together is possible and also that it makes all systems involved more secure. If I could show this I believe it would be a great push forward for SCADA. These systems have always been considered to be design with poor security and I think incorporating IoT with SCADA will improve many features of the systems

Inspiration

Although I was given the title of the project, with the research it quickly took on a mind of its own. Once I started to look into SCADA systems and different types of projects, I realised that the option are endless. I quickly grew to appreciate papers and studies published and became interested in other projects that students and like-

minded people have created. This is when I decided rather than just creating a weather station. I wanted to create a multifunction application.

There are so many projects created and papers published, that we are nearly always taking inspiration or getting ideas from them. Sometimes within even realising, we may stumble across something that just suits our ideas perfectly. One of these was a paper published on energy monitoring within a University.

Project Plan

Project Plan Description	Due Date
Research Document	26/11/2021
Presentation 1	16/12/2021
Functional Specification	17/12/2021
Presentation 2	28/01/2022
Project Report	25/04/2022
Final Product	25/04/2022
Website	25/04/2022
Demo	28/04/2022

Below is a list of hardware and software to be used or implemented in this project.

Hardware
2 x Raspberry Pi
Breadboard
T-Cobbler
40-Pin Ribbon Cable for T-Cobbler
Jumper Wires
2,3,4,5 Pin Anti Reverse Cables
DHT11 Humiture Sensor
Ultrasonic Range Sensor
Rain Detection Sensor
Camera
PCF8591

Software
Python
Putty
Win32DiskImage
Flask
NOOBS OS
Visual Studio Code
Thonny
Windows 10 OS
Remote Desktop Connection

The Raspberry Pi is configured as seen below.

We connect the Ribbon Cable to the GIO pins on the raspberry PI.

The other end of the cable is connected to the T-Cobbler, this is labelled with the names of the pins in use like 3V, Ground and the GPIO number.

The T-Cobbler is connected to the breadboard.

Once this is connected we are free to start using the system to setup our sensors. Most sensors have text on them, to tell us which cables are power and ground. If we follow this we can then input the other cables to a specific pin number, which can later be used in our code by referencing the pin number.

