Final Project: End-to-End IoT System

"Smart HVAC System" created by Issac Magallanes

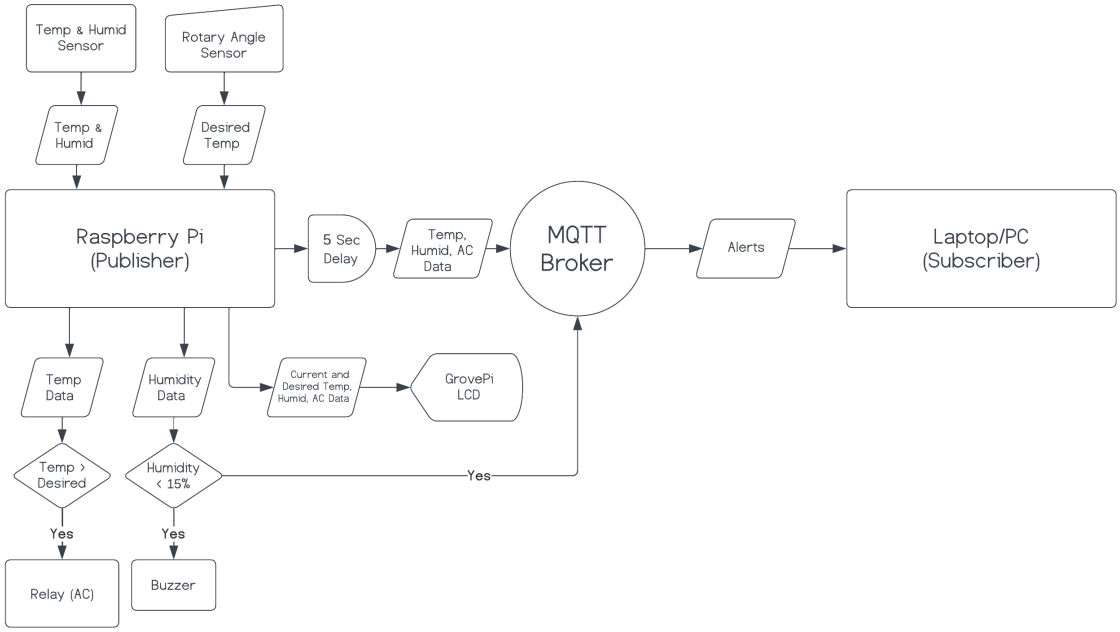
The "Smart HVAC System" collects data on temperature and humidity, controlling the AC unit based on a desired temperature chosen by the user. It publishes this data to an MQTT broker for any subscribers. In the case of a fire, the system will send an emergency alert.

The main.py file will utilize the Raspberry Pi as an MQTT broker and collect data from the Temperature & Humidity Sensor, converting the temperature from ºC to ºF and displaying it on the LCD. The Rotary Angle Sensor, set to a range between 40ºF to 90ºF, acts as an AC dial and displays this desired temperature on the LCD. Based on the desired temperature, the program will control the AC unit (Relay) and display on the LCD whether or not the AC is running. Every five (5) seconds, the program will publish the data explained above to the MQTT broker. If the Temperature & Humidity Sensor detects humidity levels below 15% (possible fire), the program will publish an emergency alert to the MQTT broker. The sub.py file will run a program that subscribes to the messages on the MQTT broker and receive the data from the Raspberry Pi in real time.

The system is composed of the following hardware items:

- Laptop/PC
- Raspberry Pi
- GrovePi board
- GrovePi LCD RGB Backlight
- GrovePi Temperature & Humidity Sensor
- GrovePi Rotary Angle Sensor
- GrovePi Relay
- GrovePi Buzzer

Block Diagram



Key Processes

main.py:

- MQTT Broker setup
- Temperature Conversion = $(temp\ in\ ºC)\ \times\ 1.8 + 32$
- Rotary Angle Range Conversion = $(data\ \times\ new\ range)\ \div old\ range + new\ minimum$
- If/else statements
- Publish timing using datetime and timedelta

sub.py:

- on_connect() function
- on_message() functions

Reflection

The GrovePi board and its many accessories filled my mind with so many ideas, the Smart HVAC system idea stemmed from the Temperature & Humidity Sensor found in the kit. There were limitations to what I could accomplish, however. Fire detection in this system is based on humidity levels, but only with a considerable amount of data could we use ML processes to detect fires based on the rate of change in home temperatures. This detection method coupled with the humidity data could be used to send alerts to emergency services and lower response times. Though, I could not obtain any data to help me in this endeavor.