Faculty of Engineering & Applied Science

SOFE 4610U Design And Analysis of IoT Software Systems

Reactive Home Disaster Prevention

Slideshow: IOT Project Proposal
REQ: Reactive Disaster Prevention - Requirements
Github: https://github.com/Waleed20210/IOT-Project

Deadline date: 10/20/2022

Group Number*: 4*

Course Instructor: *Ramiro Liscano*

Student Name	**Student Id**
Preet Patel	*100708239*
Tiwaloluwa Ojo	*100700622*
Waleed El Alawi	*100764573*

Problem Description and Statement

Home safety is the number one priority of homeowners. Different detectors such as smoke detectors and carbon monoxide detectors have helped with home safety and disaster prevention. However, the design of such detectors have not been changed for many years. The goal of our project is to modernize such detectors that contribute to home safety using Internet of Things technology. For this project, we will add a smoke detector which can detect smoke and other harmful gasses, a water level detector which can detect any flooding or leakage in the house, as well as a temperature and humidity sensor. These detectors will work together to detect any abnormal conditions in the house to prevent any disaster or further damage to both the residents properties and themselves. We will connect all these detectors to the internet which will allow us to alert homeowners of any potentially harmful events that could happen to their house even when they are out of the house. This would provide the homeowners the ability to alert authorities to prevent any further damage to their property or residents on the property. Such a system could prevent any disaster caused by appliances such as water boilers, furnaces, stoves and from unexpected situations such as a short circuit, water pipe leakage, etc.

Objective

Our system aims to detect several events that can pose a threat to the residence of a home/room or to a building as a whole. It will capture threatening events such as a gas leak, flooding, and unexpected rise or drop in temperature/humidity. The events will be triggered by the following arduino sensors:

- ☐ Temperature and Humidity can be measured using either AM2302 (also measures barometric) or DHT22 sensors
- ☐ Flooding sensor could be achieved using a standard water level detection sensor often found in Arduino kits
- ☐ Smoke and Gas can be detected using the gas sensor module in a typical arduino kit i.e. MQ-2 sensors. These can detect smoke and various flammable gasses such as LPG, Propane, Methane, Hydrogen.

Furthermore, once an event is triggered, the resident/landlord will be notified of the event occurrence.

Requirements

Stakeholders	Requirement ID	Requirement Type	Requirement Description	Priority
Resident/Landlords	REQ 1	Functional	System should detect various household flammable gasses	H
Resident/Landlords	REQ 2	Functional	System should detect if there's a water flooding or leaking	H
Resident/Landlords	REQ 3	Functional	System should detect if the temperature rises above 50 degrees	H
Resident/Landlords	REQ 4	Functional	System should notify the resident/landlord of the event origination	H
Resident/Landlords	REQ 5	Functional	System should notify the user what type of event was triggered	H
Fire department	REQ 6	Functional	System should noitfy authorities if flooding does not drop to 3 feet or below within 4 hours	M
Fire department	REQ 7	Functional	System should notify fire department if temperatures do not drop to normal levels (below 40C) within 4 hours	M
Fire department	REQ 8	Functional	System should notify homeowner if humidity do not drop to normal levels (below 40C) within 4 hours	M
Resident/Landlords	REQ 9	Functional	System should measure humidity	H
Resident/Landlords	REQ 10	Functional	System should notify fire department if smoke alarms detect any gas for more than 15 minutes	M
Resident/Landlords	REQ 11	Functional	System should detect temperature drops below 10 degrees	H
Resident/Landlords	REQ 12	Non-Functional	System should be able work with both wifi and bluetooth	M
Resident/Landlords	REQ 13	Non-Functional	The system MQTT broker should be able to connect no less than 20 clients	M
Resident/Landlords	REQ 14	Non-Functional	The system will utilize MQTT protocol for stable low bandwidth event streams	H

Use Cases

1. **UC-1:** Smoke and Gas Detection
    1.1. **Description:** The gas sensor of the system detects smoke or flammable gas.
    1.2. **Actors:** Property Owner/Resident
    1.3. **Basic Flow:**
        1. Smoke detector on the system detects smoke or any flammable gas.
        2. Detector creates an event on the system containing description such as sensor location and name.
        3. System sends an event occurrence notification to the user
    1.4. **Post Condition:**
        1.4.1. **Successful Condition:** Sensor detects smoke or flammable gas and user receives notification of the event from the system
        1.4.2. **Failure Condition:** System is unable to detect smoke or gas or system is unable to send event notification to the user

2. **UC-2:** Flood Detection
    2.1. **Description:** The system will monitor the level of liquid in the environment it is deployed in. These environments can be in the basement or kitchen
    2.2. **Actors:** Landlords and Residents
    2.3. **Basic Flow:**
        1. Liquid is detected on the wall at 6in above the ground surface.
        2. The sensor sends an event to the actors and simultaneously
    2.4. **Post Condition:**
        2.4.1. **Successful Condition:** An event is streamed to the actor(s) if a flooding event is triggered
        2.4.2. **Failure Condition:** No event is streamed to the near edge computer nor the actor(s)

3. **UC-3:** Temperature and Humidity Detection
    3.1. **Description:** This use case describes temperature and humidity sensor of the system detects humidity and temperature
    3.2. **Actors:**Property Owner/Resident
    3.3. **Basic Flow:**
        1. System detect humidity and temperature
        2. Detector creates an event on the system containing descriptions such as sensor location and name.
    3.4. **Post Condition:**
        3.4.1. **Successful Condition:** Sensors detects humidity and temperature
        3.4.2. **Failure Condition:** System is unable to detect humidity or temperature or system unable to send event notification to the user.