LAB University of Applied Sciences

PROJECT PLAN

IOT-VILLA (SUMMER COTTAGE PROJECT)

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TEAM ORGANISATION

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PROJECT SCOPE AND OBJECTIVES AND DELIVERABLES

The goal of this project is to develop a robust,seamless and secured IOT system intergrated to the cottage homes thus making it easier to track and manage some faults without necessary impacting the customers user experience. The key objectives will include:

- Implementing a reliable sensor data colletion pipeline
- Developing a secure and user-friendly browser-based UI for data interaction.
- Ensuring data security and system scalability.

Deliverables

- Fully integrated sensor network.
- Cloud-based data storage and processing framework.
- Web-based dashboard for real-time data monitoring.
- Security protocols for data protection.

FEATURES AND SENSORS

The features below are designed not only to improve ROI but also to enhance the user experience without interfering with the client or diminishing the enjoyment of their stay:

QR Code System:
This system will be installed at the door or in any open space. It will be used for channeling complaints and enabling smart login to the facility. Once the customer enters their username and password, the system will activate the key locker.

Ultrasonic Sensor:
This sensor will be installed in the sauna and will notify the business owner when the wood quantity exceeds a specified threshold.

PIR Motion Sensor:
This sensor will help detect intrusions and will also allow the owner to verify if a client has exceeded their allotted stay, thereby helping to prevent any unpleasant situations.

Water leak sensor: This will control the water flow in pipes and indicate inf there is leakage in the piping system.

Temperature sensor: this will monitor the lake temperature and indicate when is favorable for swimming or other activities related to the lake

FEATURES AND SENSORS CONT

Below are some of the sensors and their specifications:

- Water flow sensor (Capacitive moisture sensor V2.0):

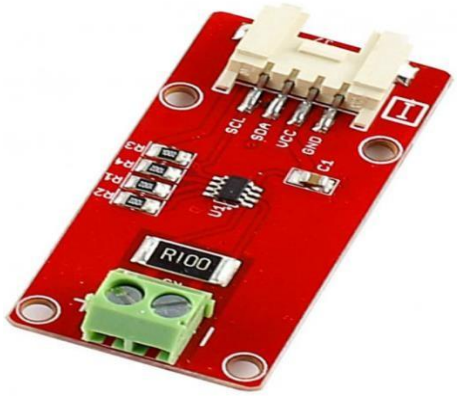
- PIR motion sensor

NB : From the sensors highlighted herein , the only sensors we have in our inventory is the ultrasonic sensor for the wood storage. The other sensors will need to be purchased.

- DSA18B20 Temp sensor:

- Ultrasonic detector:

- INA219 current sensor



DATA FLOW AND COMMUNIATION

- The sensors will collect real-time data from sauna, motion , water system and lake temp.
- Raspberry PI Pico W processes the data and triggers the local alerts.
- Pico W sends data via **Wi-Fi** using **MQTT** or **HTTP API.**
- Cloud (AZURE, FIREBASE / THINGSPEAK) : we will also use **NGINX** ,**NODE JS** for the backend and **INFLUX DB**
  will store the data collected from the sensors.
- WEB UI fetches data from the cloud for remote monitoring and the **INFLUX DB** can also be used for visualisation.

SECURITY PLAN

To attain the project goal, one of the main factors is to ensure secure data transmission and storage, to achieve this milestone,
our system need to untergrate encryption, authentication and access control. Below are some common threat and the how we

will mitigate this problem

Potential threat :

- Unauthorized access
- Device hijacking
- DDOS (Distributed Denial of service)
- Data tampering

Data transmission:

- Encryption with TLS to prevent man in the middle attack.
- Network firewalls will be used to allow only necessary traffic using Acess Control List (ACLs)

Data storage & WEB UI :

- Performing daily automated backup activities to prevent data loss.
- Setting up MFA (Multifactor Authentication)
- Use google e-captcha to prevent automated bot attacks
- By preventing unauthorised users from accessing sensor logs and setting with the help of roles-based access control.

IOT Devices

- Closing all unsued ports on pico unless needed.
- Secure the microcontroller inside a locked enviroment to prevent tampering and or damage

ENERGY EFFICIENCY PLAN

Since the Raspberry Pi Pico W and connected sensors will operate in a remote summer cottage environment, optimizing energy consumption is crucial. Below is a detailed energy efficiency strategy to maximize battery life, minimize power wastage, and enhance sustainability.

Power optimisation for raspberry pi pico W

- With the use of the INA219 we will be able to monitor the power usage and optimise settings.
- Ultrasonic & PIR sensors should be powered only when needed.
- Collect data at longer intervals (every 5-10 minutes) instead of continuously.
  Example: Lake temperature sensor runs every 15 minutes instead of every second.
- We will alsso use the machine.lightsleep() or machine.deepsleep() in mycropython.

WORK BREAKDOWN STRUCTURE (WBS)

Our project is divided into several substeps as highlighted below. (next slide)

- Sensor selection
- Simulation (WOKWI)

Material and sensor purchase

- Purchase of required sensors
- Testing of purchased sensors

Implementation of embedded part

- Installation of sensors
- Cabling with other components of the microcontroller

Cloud Setup

- Azure cloud implementation
- Nginx setup and configuration
- Influx DB setup and configuration

Front-end and back-end

- WEB UI setup and configuration
- Node js setup and configuration
- REST API setup and configuration.

Testing and visualisation

- Security test
- Fonction test
- Dashboard visualisation