NSBM Green University

Faculty of Computing

PUSL2022 Introduction to IOT

Internet of Things (IoT) Group Project

Project Initiation Document

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IOT Project Proposal

Title:

- Predictive Maintenance System.

Background:

The goal of this project is to develop a predictive maintenance system for diesel generators using IoT technology. The system will collect sensor data from the diesel generator and use it to identify early signs of failure, allowing for preventive maintenance to be scheduled. This will help to reduce unplanned downtime and maintenance costs. The system will use a hybrid edge-cloud architecture to process the data and generate predictions about the Remaining Useful Life (RUL) of the diesel generator's critical components. These predictions will be used to generate alerts for the maintenance team, so they can schedule preventive maintenance and avoid unplanned downtime.

Literature Review:

- Industry 4.0's "smart factories" are being created in large part thanks to the Internet of Things (IoT), which uses a network of connected devices, sensors, and software to monitor and optimize the manufacturing process. In smart factories, predictive maintenance utilizing IoT can also be utilized to avoid machine breakdowns, minimize downtime, and increase equipment longevity. We can observe a project comparable to ours from the information provided above. However, we are focusing on a single machine, but this initiative was designed to cover an entire facility. As a result, our initiative is unlike any other.
- In this project, we aim to prevent equipment failures in industrial settings by using IoT technology for predictive maintenance. We will attach sensors to critical machinery to collect data on vibration, temperature, and current. As an example, let's imagine we are doing this project on a generator. We will then analyze how many petroleum liters are needed to generate power for an hour. When the generator burns extra petroleum to generate power, our system will detect this from the sensors we are using and send a report and alert to the user informing them that something is wrong with the machine. We are using five sensors focused on five main parts of the machine for this project. We are focusing on one machine to generate the report.
- Our aim is to minimize equipment failures of our user's machine and reduce the maintenance cost to have a better cash flow.

Aim:

- This project aims at developing an IoT-based predictive maintenance system to identify early signs of failure in diesel generators and schedule preventive maintenance to reduce unplanned downtime and maintenance costs.

Objectives:

- To inform the user about the problem before it happens.
- To allocate the cash flow for the maintenance for the future repairs .
- Reduce maintenance costs by minimizing unnecessary preventive maintenance and avoiding costly repairs due to equipment failure.
- Improve operational efficiency by reducing downtime and increasing machine availability.

System Overview:

- Sensor requirements
    - Vibration sensors: Vibration sensors track the condition of the generator, engine, and other critical components.
    - Temperature sensors: The temperature of the engine coolant, oil, and other vital components are tracked using temperature sensors.
    - Fuel level sensors: The fuel level in the tank is tracked using fuel level sensors. Maintaining sufficient fuel levels is crucial since a diesel generator can sustain damage from running out of fuel.
    - Oil pressure sensors: It's crucial to maintain the oil pressure because both high and low oil pressures can damage the engine, and this sensor also can be used to find oil leaks.
    - Current sensors: The generator may become overloaded and fail as a result of high current draw. Electrical system issues can also be found using current sensors.

- Usage of edge computer system.
    - We are using edge computer systems because it can process data at the source which can result in reduced latency and improved performance. This is very important in this scenario because we are developing a Predictive Maintenance System which is supposed to identify and alert early signs of failure.

- Data processing task outline
    - We are developing this Predictive Maintenance System to identify hardware failure in its early stages to reduce the costs and maintain a better financial flow inside the company.
    - To do so, using the sensors such as Vibration, Temperature, Fuel level, Oil pressure and Current we can keep track of everything that can cause harm to the generator and that will cause in reduced Remaining useful life (RUF).
    - Basically, we are using the sensors mentioned above to detect anomalies before it gets critical and harms the whole unit which can increase the cost of repair later on.

- Communication infrastructure and cloud.
    - Sensors/IoT devices are used to collect data from the diesel generator. The sensors/IoT devices can be connected to the diesel generator using a variety of methods, such as wired connections or wireless connections. The sensors/IoT devices need to be connected to a cloud platform or server so that the data they collect can be stored, analyzed, and used to generate predictive models. The protocol method we will be using for this IoT project is MQTT. And the connectivity method will be Wi-Fi.

- Data storage method and Data analysis
    - The method we are using for data storage is to use a time series database. One of the databases we can use is InfluxDB. And once the data is stored, it can be analyzed in variety of ML algorithms to identify patterns and trends. From the results of that data analysis, it can be used to train predictive models that can estimate the RUL of the diesel generator's critical components. At the end of this we can identify early signs of failure and schedule preventive maintenance. This will reduce unplanned downtime and maintenance costs. Resulting in a better cash flow as well.

- User Interface of the mobile application
    - We will be using Flutter to make this mobile application.
    - Below is a demonstration of our UI. The first one is the main page. And the other two are examples of different tabs we have that the user is able to check.
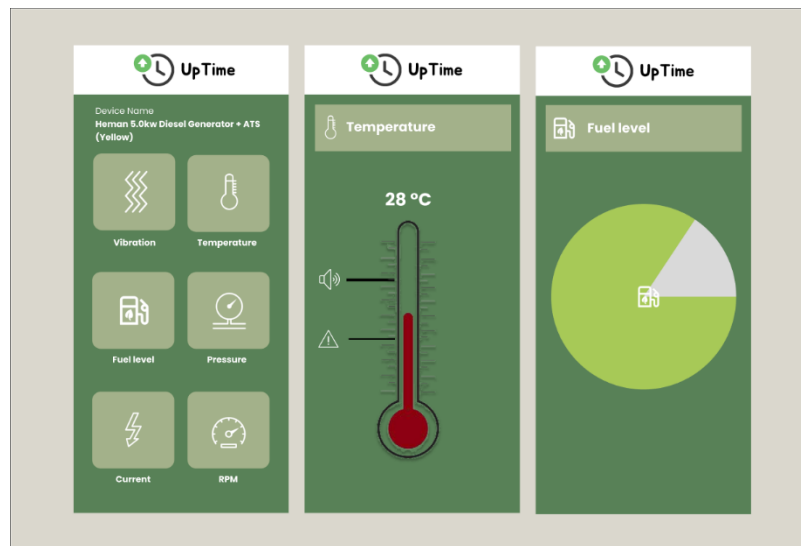
Expected Outcome:

- Extend the life of assets.
- Improve operational efficiency.
- Enhance worker safety.
- Improved production quality.
- Time saving.
- Budget allocation.

Gantt Chart:
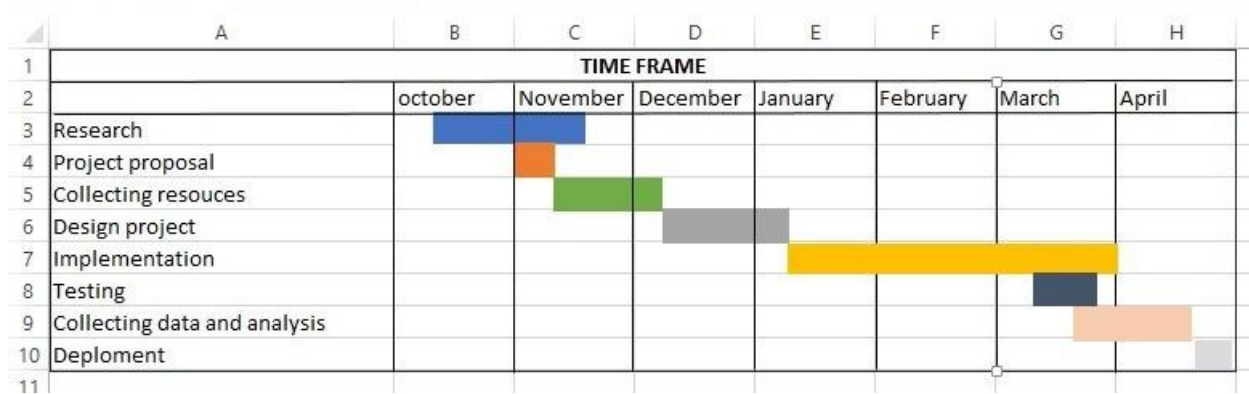
References:

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- Kumar, R. (2021). Understand IoT for Predictive Maintenance in Manufacturing. [online] Top Business Software Resources for Buyers - 2021 | Software Advice. Available at: https://www.softwareadvice.com/resources/iot-predictive-maintenance/.

- Guide to IOT implementation (2023) Infinum. Available at: https://infinum.com/iot-implementation/?utm_term=iot+development&utm_campaign=%5BSE%5DIoT%2BGuide%2BTo%2BImplementation%5BUS%5D&utm_source=adwords&utm_medium=ppc&hsa_acc=3192734393&hsa_cam=20712446780&hsa_grp=157883207751&hsa_ad=678482353674&hsa_src=g&hsa_tgt=kwd-299776066693&hsa_kw=iot+development&hsa_mt=p&hsa_net=adwords&hsa_ver=3&gclid=CjwKCAiAxreqBhAxEiwAfGfndDJ0xhzx1SZUlDxE2yC_uFj22Q95qOQredqbRkiTG6tmwDRdiZANbxoCcgwQAvD_BwE (Accessed: 10 November 2023).

Group Contribution

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1	10899221	Ashen Abeysekara	Background, Aim, System Overview
2	10899200	Pallawala Bandara	Literature Review
3	10899249	Galbada Dharmadasa	Gantt Chart
4	10899269	Mudalige Gunawardana	System Overview
5	10899364	Senanayake Senanayake	Objectives, Expected Outcomes, UI Design