An Internship Report on

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Asset Monitoring for Smart Cities

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Contents

1 Preface and acknowledgment

For two months from June 2017 till July 2017 I did an internship at TCS, Pune. TCS is a global leader in IT services, consulting, technology and digital solutions with a large network of Innovation and Delivery Centers. This report details the project assigned to me.Through the assignment, I did not only gain a lot of knowledge but more importantly, I also had a great chance to sharpen my skills in a professional working environment. Not less important than the technologies that I have learnt is the communication skills that I have acquired through discussions with supervisors and experts in the field.

I am heartily thankful to TCS management for providing us all the facilities and infrastructure to take my work to the final stage. It is the constant supervision, moral support and proper guidance of my respected project guide **Mr. Shashank Jain** , who motivated throughout the work. I express deep sense of gratitude and respect to my seniors. Without their enthusiasm and encouragement this desertion would not have been completed. Their valuable knowledge and innovative ideas helped me to take the work to final stage. Also, their full-fledged support, constant availability has helped in accomplishment of my work in time.

2 Abstract

This project tackles the problem of managing city assets in an intelligent and efficient manner. The solution prototype involves tracking and monitoring various assets in real time in a city. Asset tracking helps users plan and deploy assets efficiently to cover the most area. Monitoring various sensor data(of assets) in real time helps perform timely preventive maintenance and will, in the future, help perform predictive maintenance as well. This solution prototype essentially combines networking and with assets or in other words, create an **Internet Of Things**. This technology will thus help us make a smarter city.

The solution consists of two main components:

- **Web Server**: This is responsible for pulling asset and sensor data from IBM Maximo, and issuing warnings for preventive maintenance.
- **Web Client**: This is the User Interface that can be accessed by any internet browser.

Users can see assets on an interactive map. They also have the option to see real time readings of each asset, and create Work Orders in Maximo for preventive maintenance. The system notifies the user if a sensor is approaching critical threshold.

3 Introduction

The webapp uses various softwares and technologies to create a full stack solution. Services and softwares used in the project are described in this section.

Actual implementation is described in the next section.

IBM Maximo

IBM Maximo Asset Management is an enterprise asset management (EAM) software solution product. It is a solution which enterprises use to track the operation, maintenance and disposal of assets. Built upon a J2EE service-oriented architecture, it is also the basis of IBM's Tivoli Process Automation Engine.

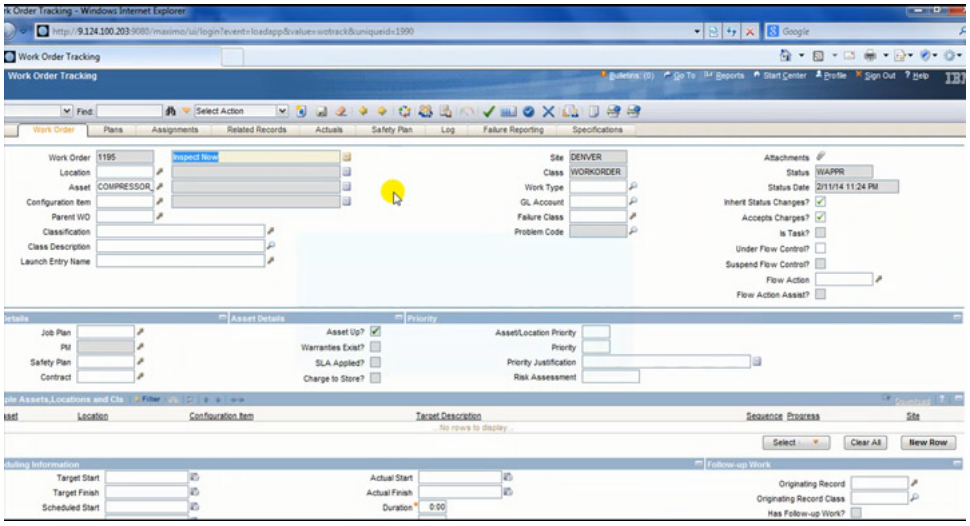

Figure 1: Maximo UI

In the solution prototype, the asset and sensor data is pulled from Maximo database. Maximo is also used to to create Work Orders for preventive maintenance of assets.

Plotly

This is an API service for plotting graphs. In the application, Plotly is used to plot real time graphs of sensors attached to assets.

Mapbox

This is another API service which is used for plotting assets according to their latitude and longitude on a map.

Python

The programming language used by the Webserver.

4 Implementation details

Web Server

The server is written in Python2. Minimum required specs:

Operating System	Linux 64/32bit with Python interpreter
RAM	1GB
Processor	Intel i3 series or above
Network Connection	1MB/s

One Web Server is able to serve multiple clients. The Web Server's functions are:

- It reads asset data from IBM Maximo database. This includes asset ID, latitude/longitude etc.
- It reads stream data from IBM Maximo. This data includes the streaming data provided by sensors attached to each asset.

  The server then broadcasts this data to all Web Clients, who can view it in real time.
- The Web Server is also responsible for performing analytics on sensor data. It generates warnings if sensor data is exceeds critical thresholds.

Web Client

The client webpage needs only an Internet browser to view. It allows users to perform the following tasks:

- **Track assets**: Asset can be viewed according to location on a map in the browser.
- **Asset status**: Sensors attached to assets provide data feeds, which can be viewed graphically in the browser.
- **Preventive Maintenance**: The system automatically detects if sensor readings are exceeding critical thresholds. In this case, the system will notify users with a warning message or, if sensor is in critical state for a long time, it will recommend creating a Work Order to service the faulty asset.

  Both these tasks are done in real time, with a maximum latency of 2 seconds.

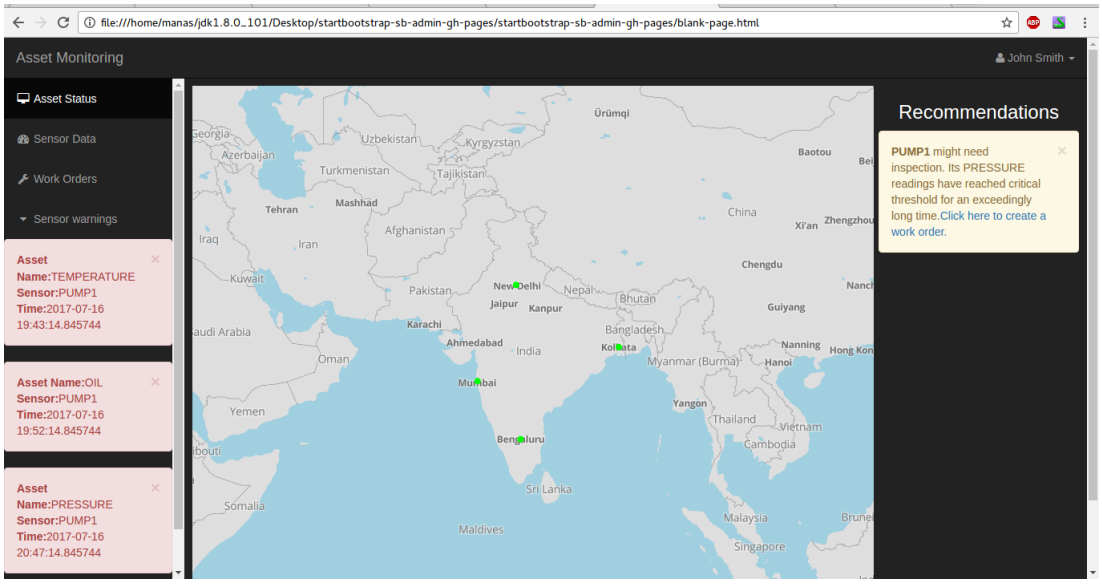

Figure 2: The map, showing asset locations. System generated warnings are shown on the left. Recommended Work Orders are shown on the right

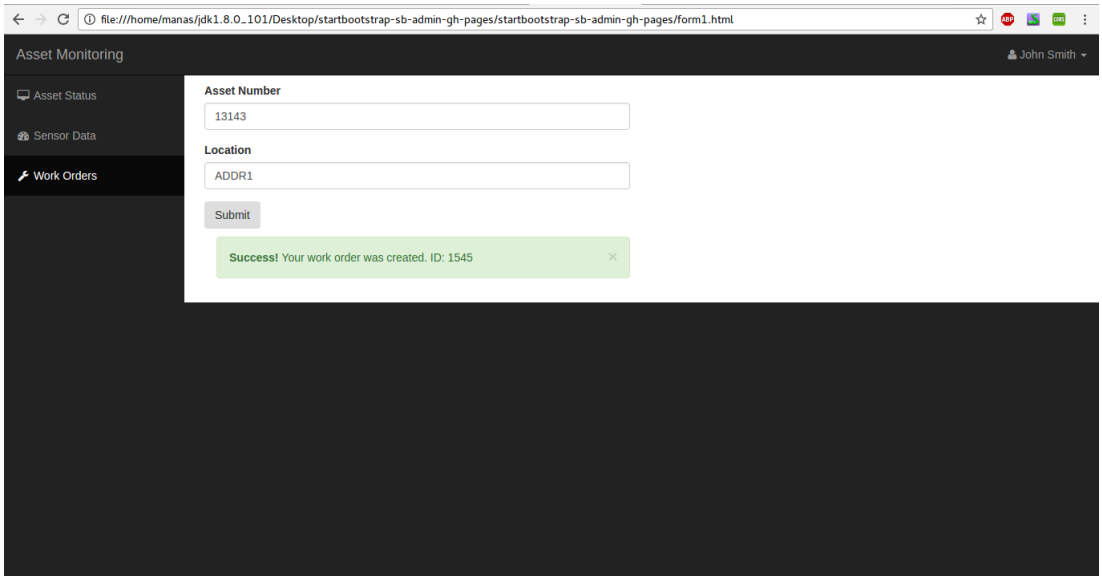

Figure 3: Work Order creation page.

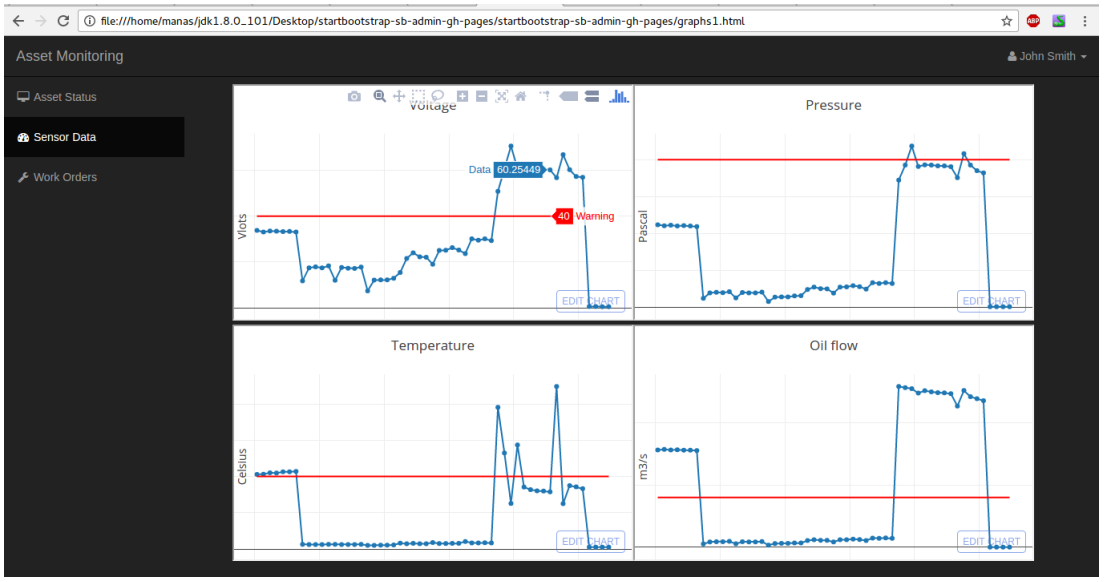

Figure 4: Sensor data being streamed in real time

5 Conclusion and Further work

Thus a proof of concept for asset maintenance has been demonstrated. This solution is scalable, which is suitable for use in a smart city environment where there could be thousands of assets and users.

However, there is much which can be improved upon in the future. Using machine learning algorithms, the server could be improved to provide **predictive maintenance** instead of the current preventive maintenance.
In addition to generating Work Orders, users can also be given the option of creating Requisition/Purchase Orders.
The app can also be made more versatile by integrating it with asset management softwares other than Maximo.

References

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