Live IOT machine data using Augmented reality

DISSERTATION

Submitted in partial fulfillment of the requirements of the

M. Tech. Software Engineering Degree Programme

By

Aravind Prabhu

2017SP93044

Under the supervision of

Sumeet Raj (Senior Developer)

Dissertation work carried out at

SAP Labs, Bangalore

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE

Pilani (Rajasthan) INDIA

(April 2019)

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**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**SECOND SEMESTER 2018-19**

**SESAP ZG629T DISSERTATION**

Dissertation Title: Live IOT machine data using Augmented reality

Name of Supervisor: Sumeet Raj (Senior Developer)

Name of Student: Aravind Prabhu

ID No. of Student: 2017SP93044

## Abstract

The main objective of the project is to make peoples life easier and to improve the business process. With the help of augmented reality now we can see the live data of a machine and know its state. So, this will help in maintenance of the machineries and to speed up the business process. There will be 8.4 billion connected things in 2017, setting the stage for 20.4 billion Internet of Things (IoT) devices to be deployed by 2020, according to analyst firm Gartner. So, with IOT and Augmented reality together we can get the information about the device/machine in front of you with ease and it will help in improving the efficiency of the business process .Smart engineering processes can save manufacturers millions of dollars by identifying potential flaws in products before they ship, in addition to reducing the time to ship a product. As the data in the world is exploding drastically, now data has become power. Also, the way we can access data also has changed over time. Now everyone has so much computation power in their hand that everything they need is available at a single click.

But even then, to get some information we must search online and surf through lots of webpages just for a simple task in like getting price of an item. In business domain also, we must go to a monitoring dashboard and do many clicks to know the to get current state of machine which is in front of you. So, this is an overhead which can be avoided and can be improved to make life easier.

# Problem Statement

As the data in the world is exploding drastically, now data has become power. Also, the way we can access data also has changed over time. Now everyone has so much computation power in their hand that everything they need is available at a single click.

But even then, to get some information we must search online and surf through lots of webpages just for a simple task in like getting price of an item. In business domain also, we must go to a monitoring dashboard and do many clicks to know the to get current state of machine which is in front of you. So, this is an overhead which can be avoided and can be improved to make life easier.

# Business Process Flow

The business flow would have the following:

* The IOT machine data will be streamed to the IOT service .
* The Machine floor manager can walk up to the machine and get the live data in the web interface .
* The Augmented reality is also integrated in the web interface.
* Using the Augmented reality web interface, the Machine floor manager can open the web application in his hand-held device and can see the status of the machine.

# Objectives

The main objective of the project is to make peoples life easier and to improve the business process. With the help of augmented reality now we can see the live data of a machine and know its state. So, this will help in maintenance of the machineries and to speed up the business process. There will be 8.4 billion connected things in 2017, setting the stage for 20.4 billion Internet of Things (IoT) devices to be deployed by 2020, according to analyst firm Gartner. So, with IOT and Augmented reality together we can get the information about the device/machine in front of you with ease and it will help in improving the efficiency of the business process .Smart engineering processes can save manufacturers millions of dollars by identifying potential flaws in products before they ship, in addition to reducing the time to ship a product.

# Uniqueness of the project

There are solutions focused on IOT or Augmented reality but their adoption in industry is very less. There are some solutions offered by companies like ptc and L2 Technology Services, but they are focused on the process of fixing/repairing of the equipment and not on the machine details at current time. The idea in this project is to make an AR solution which can integrate to any type of IOT device.

# Benefits to the organization

SAP is leading in terms of adapting unique and upcoming technology solutions to help the world run better. There is currently no solution combining both IOT and the Augmented reality. Also, this coincides with SAP’s vision that is, to help world run better and improve people’s life.

# Scope of Work

The Augmented reality will be an Android app which will communicate with this Gateway service that will be deployed on Cloud foundry to get the data. Also, Hardware sensors will be used to send data to gateway. So main scope of this project is the Augmented reality application showing the IOT data .The IOT sensor and the gateway services that will be built will help in showing the end to end scenario of the application.

# Resources Neededs

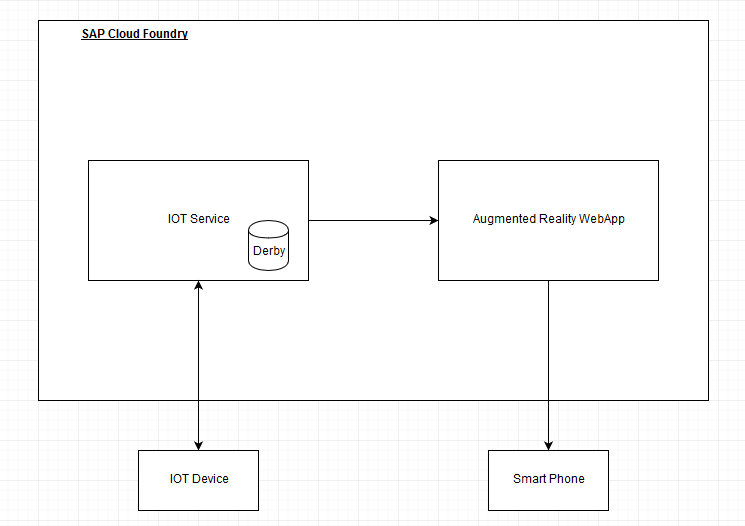
|  |  |
| --- | --- |
| Software (Frameworks, Cloud platform) | 1. AR.js framework. 2. Spring boot. 3. Cloud Foundry Account. |
| Hardware | 1. Any Windows PC 2. Hardware sensors |

# Potential Challenges and Risks

1. We are going to deploy our IOT Gateway service to in cloud platform, so there might be an issue in terms of data access when the cloud is down.
2. Making the android app efficient to get the real time data.
3. Choosing current AR framework to work with android.
4. Potential challenges in managing IOT sensor data.
5. Time required to learn and adopt the Augment reality framework.

# Solution Architecture

Architecture diagram of the application:



This Architecture has two main components:

* IOT Service
* Augmented Reality Service/ Web App

# IOT Service:

This service is where the IOT devices push data and the IOT service provides the device management and the persistent of the Realtime data. This data is used to create analytics and create alerts for the device. This is the core service which is the OT(Operational Technology) part of the IOT. In fact, it’s one of the essences of the IoT (although IT and OT convergence goes back earlier, certainly in some of the just mentioned areas). Yet, with IoT is happening faster and at a broader scale than before and Gartner’s words become more actual than ever. In case you’re not familiar with the – by now – ‘good old’ IT versus OT debate: IT is what you think it is. Information technology or the corporate IT team, led by a CIO. OT is operational technology as we’ll see but it’s in the mix of both that interesting things happen. Of the previously mentioned markets IT and OT integration is, for instance, key in building management in the age of IoT.

# Augmented Reality WebApp:

This augmented reality service is a browser-based application which does not need any application to be explicitly installed on the device .This is based on a JavaScript library AR.js which provides the augmented reality capability. AR.js is a solution for efficiently doing augmented reality on the web. This AR.js used A-frame for its rendering . A-Frame is a web framework for building virtual reality (VR) experiences. A-Frame is based on top of HTML, making it simple to get started. But A-Frame is not just a 3D scene graph or a markup language; the core is a powerful entity-component framework that provides a declarative, extensible, and composable structure to three.js. AR that can be easily experienced on today’s phones and easily designed using web technology. The AR.js project is about enabling those people. So now, anybody with a modern phone can enjoy open-source AR, free of charge, cross-platform and without installation.

# Detailed Plan of Work

|  |  |  |  |
| --- | --- | --- | --- |
| # | Task Name | Expected date of completion | Deliverables |
| 1 | Validation of Augmented reality Framework | 18 Feb | Testing multiple AR frameworks |
| 2 | Browser Based AR Validation | 25 Feb | Browser Based AR sample test code |
| 3 | Designing the Flow | 4 Mar | Design the classes and interfaces for the application |
| 4 | Documentation | 11 Mar | Create initial versions of documentation |
| 5 | IOT Service Initial Setup | 11 Mar | IOT Service Design |
| 6 | IOT Service Prototype Development | 20 Mar | IOT Service prototype Implementation |
| 7 | Cloud Foundry Deployment of IOT Service | 28 Mar | Application hosted on Cloud foundry |
| 8 | Prototype of Augmented Reality Design | 30 Mar | Designing and prototyping the Augmented Reality App |
| 9 | Integration of IOT service and Augmented Reality App | 1 April | Integration of IOT service and Augmented Reality service. |
| 10 | Deployment of Augmented reality to Cloud foundry | 3 April | Augmented Service hosted to Cloud foundry |
| 11 | Testing the end to end sample scenario | 4 April | Testing sample low level integration. |
| 12 | Enhancing the IOT service | 8 April | IOT Service Enhancement. |
| 13 | Hardware Connection to IOT service | 20 April | Streaming of data from hardware sensors to IOT service. |
| 14 | Testing | 22 April | Perform end to end tests and bug fixes |
| 15 | Enhance the Augmented Reality application | 29 April | Multiple IOT devices Marker detection |
| 16 | Multiple Sensors to Hardware | 17 Jun | Testing with Multiple Sensors |
| 17 | Bug fixes | 21 Jun | Fix issues during tests, continue till zero bugs found |
| 18 | Documentation | 26 Jun | Update documentation for missing information (if any). |

**Completed Work**

|  |  |  |  |
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# Plan for Remainder of the project

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| 1 | Testing the end to end sample scenario | 4 April | Testing sample low level integration. |
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**Date: 4th April 2019**

**References**

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* Web VR - https://glitch.com/culture/an-intro-to-webvr/
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* Cloud Foundry - https://www.cloudfoundry.org/
* SAP Cloud Platform - <https://cloudplatform.sap.com/index.html>