Software Requirements Specification

for

Development of a Machine Simulator

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Content

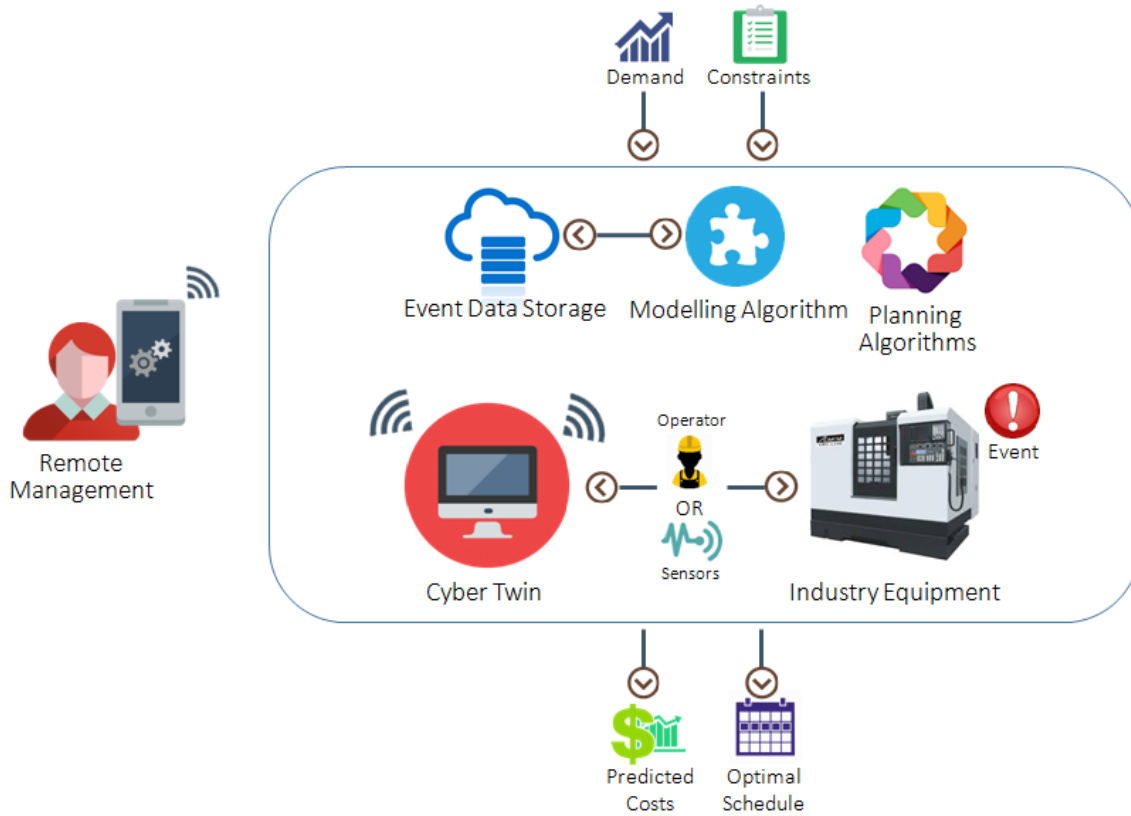# 1. Introduction

1.1 Purpose

Development of a software to automate a cyber twin for the machines in Industry. The operator of that machine would feed the inputs about the usage which would be sent into the cyber twin which gives an analysis of the errors and usage of the machine. Cyber Twin will also predict data using past data .A graphical interface of analysis will be accessible by person who has more technical knowledge of the machine to keep a track of events that machine encounters. This would facilitate the technician to take decisions for the machine regarding its preventive maintenance. The main aim is to bring everything online.

1.2 Product Scope

This is a commercial software of a practical use in the industry. It simplifies and systematizes the work for the industry. ''In simpler words operator of the machine doesn't need to stick to the location where the machine has been installed.'' Machine can be operated from anywhere in the industry as long as it is accessible through software by internet connection. Agents can talk with each other and take necessary actions. Now there are bulky record files where everything is done manually.These bulky records constitute a log of technical or non-technical details about machine and operators.This software targets to counter this problem.

Overview of Smart Manufacturing System

Demand

Constraints

Remote Management

Event Data Storage

Modelling Algorithm

Planning Algorithms

Cyber Twin

Operator

OR

Sensors

Industry Equipment

Event

Predicted Costs

Optimal Schedule

Creating Cyber Twins for Industrial Assets

Processing Jobs
Idle
Precaut. Check
Under PM
Under CM
Changing Setup

Physical Machine A

Interface

Cyber-Twin Machine A
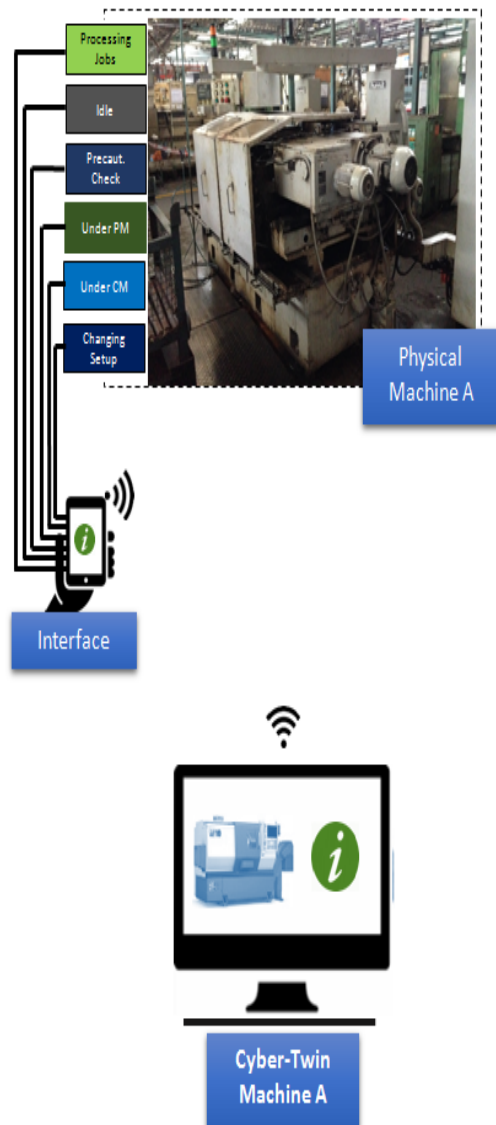
- Exact virtual replica of physical asset.

- Interfaces with the asset to bring it online.
  - Embedded sensors
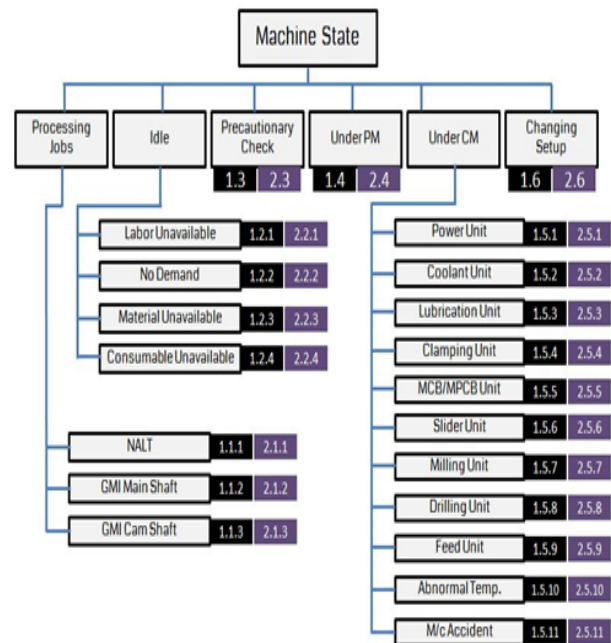 - Human operated interface

- Social
- Intelligent
- Autonomous

Machine State

Processing Jobs	Idle	Precautionary Check	Under PM	Under CM	Changing Setup
		1.3 2.3	1.4 2.4		1.6 2.6

Labor Unavailable	1.2.1	2.2.1
No Demand	1.2.2	2.2.2
Material Unavailable	1.2.3	2.2.3
Consumable Unavailable	1.2.4	2.2.4

NALT	1.1.1	2.1.1
GMI Main Shaft	1.1.2	2.1.2
GMI Cam Shaft	1.1.3	2.1.3

Power Unit	1.5.1	2.5.1
Coolant Unit	1.5.2	2.5.2
Lubrication Unit	1.5.3	2.5.3
Clamping Unit	1.5.4	2.5.4
MCB/MPCB Unit	1.5.5	2.5.5
Slider Unit	1.5.6	2.5.6
Milling Unit	1.5.7	2.5.7
Drilling Unit	1.5.8	2.5.8
Feed Unit	1.5.9	2.5.9
Abnormal Temp.	1.5.10	2.5.10
M/c Accident	1.5.11	2.5.11

Figure: Cyber Twin model of a HMT Facing and Centering Machine at **AVTEC Ltd, Pithampur.**

2. Overall Description

2.1   Product Perspective

The product would be broadly divided into 2 major components:
  a) A web interface for the operator of the machine.
  b) Another web interface for the technicians and managers for providing analysis of the details of the machine.

2.2   Product Functions

Event Logging -The operator of the machine could enter the data to perform regular jobs of the machine.
The operator could be able to monitor functioning of the machine and perform operations sitting anywhere in the industry.
The operator would enter the times of his absence and failures, if any.
Remote Management -The manager of the lab could know about the operating of the machine, sitting elsewhere.
Forecasting-The output of the algorithm yields statistics about the working of the machine which would be very useful in preventing wear and tear of the machine and take necessary measures on time.

2.3   User Classes and Characteristics

The product is anticipated to be used by the following users:
a)   Operator of the machine: One of the interfaces of the product would be used by the operator (usually having less technical and educational skills) to give input to cyber twin about functioning of the machine. It also facilitates the operator to monitor the machine operations from anywhere within the industry as long as product is accessible by the network.
b)   Manager or Technician: Another interface would be meant for manager or technician (usually having technical expertise) in the industry. Current status and analysis of the errors and usage of the machine would be provided by product which will aid in decision making for a machine at any instance of time.

2.4   Operating Environment

Application would be web based and has to be run from a web server.It will work on apache web server.

2.5   Design and Implementation Constraints

There might be issues regarding the loading of the interface as website will contain many images to assist operator who doesn't have much education.
The website needs to be hosted on a server either intranet or internet by the company.
The design of the software would be a webpage containing buttons ,menu and lists which would guide the use of the product.
Database would be maintained for analysis of functioning of the machine.
Industry's organization will be responsible for maintaining this database.

2.6   User Documentation

Although the product would be user friendly, user manual would be provided along with the software. Online help would also be available.

2.7   Assumptions and Dependencies

Algorithm regarding Machine Learning has been provided by client. In continuation to this graphical user interface would be created so the software could meet the industrial requirements.

3. External Interface Requirements

3.1 User Interfaces

The user interface for the software shall be compatible to any browser such as Chrome, Mozilla or Safari by which user can access to the system.
The user interface shall be implemented using any tool or software package like Bootstrap, JavaScript, AJAX etc.

3.2 Hardware Interfaces

Since the application must run over the internet, machines shall require to connect internet. As for e.g. Modem, WAN-LAN, Ethernet Cross-Cable would act as hardware interfaces.

3.3 Software Interfaces

The input given by the operator would go via the php page into the database.
The algorithm would fetch the data from the database whose analysis would be displayed in another view where the manager can also interact.
The design of the interfaces would be done using JavaScript and Ajax and the mobile view would be supported through bootstrap.
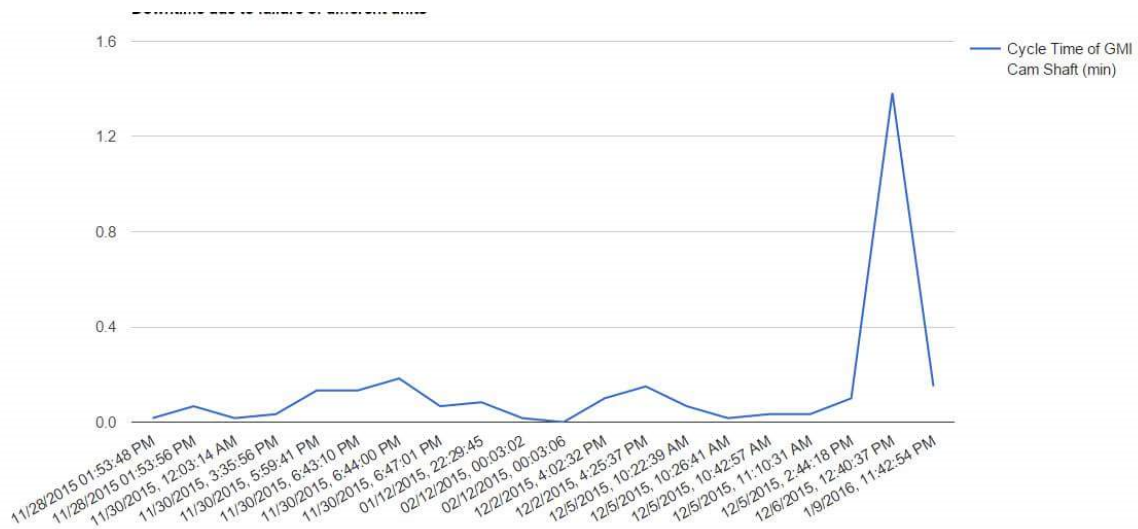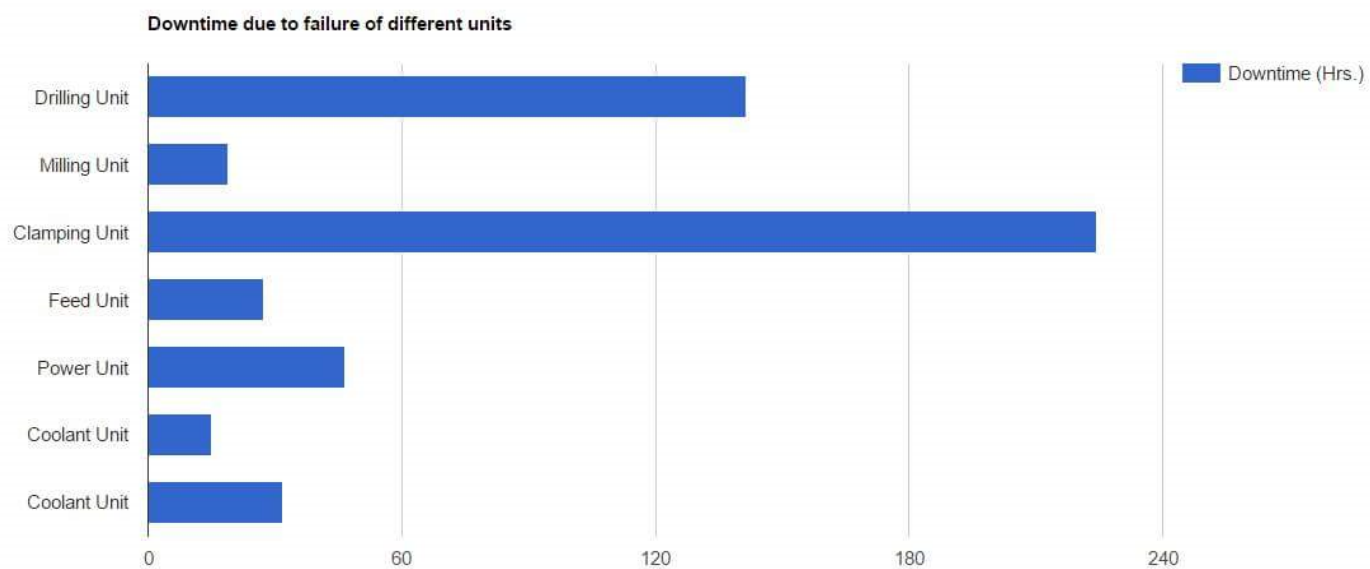
4. Functional Requirement

4.1 Operator's Perspective

a) Interface would be efficient and functionalities would be easily accessible to fulfil the requirements of highly frequent events like processing jobs (as shown in the table).
b) Image Buttons would be available corresponding to each part of the machine for its operation.
c) Interface would be made user friendly and operator could easily get the essence how to use the product and would appreciate that.
d) Interface would contain list of all those events that manager must get to know and operator would update the same for the machine during his job hours.

4.2 Manager's Perspective

a) Updates and status of the machine would be taken care by the product and aesthetic analysis of the usage, failures and errors would also be provided.

b) Product will provide following kind of analysis for the machine which would facilitate decision making for any machine.

Downtime due to failure of different units

Legend: Downtime (Hrs.)

Unit	Downtime (Hrs.)
Drilling Unit	~140
Milling Unit	~20
Clamping Unit	~225
Feed Unit	~28
Power Unit	~48
Coolant Unit	~15
Coolant Unit	~30

5. Other Nonfunctional Requirements

5.1 Performance Requirements

It's a real time software. Managers and Technicians would be able to see real time status of machine.

5.2 Usability

· The lab technicians should be computer and internet literate, and should be able to input the details about the working of the machine on an interface.

· They must also have basics of English language.

· Others who want to access the data must have an internet connection and should know how to use a website(both mobile and pc)

· User manual would prove helpful in using the software.

5.3 Security Requirements

There will be a login system so that only trusted people can give input about machine.
Data about machine would only be shown to manager and technician.

APPENDIX 1

S No	Word	Meaning
1	User interface	the **user interface**(UI) is everything designed into an information device with which a human being may interact
2	Anticipate	expect
3	Automate	mechanize

4	Algorithm	A set of rules for solving a problem in a finite no of steps
5	Apache	Apache HTTP Server is a cross-platform web server application that allows web to serve websites to users over the web
6	Bootstrap	Bootstrap, a sleek, intuitive, and powerful mobile first front-end framework for faster and easier web development.
7	Ajax	Asynchronous JavaScript and xml
8	WAN	Wide area network
9	LAN	Local Area network
10	Ethernet	Protocol to transmit data within the same network segment
11	Modem	Device which enables computer to transmit data
12	HTTP	Hyper text transfer protocol