

SAVITRIBAI PHULE PUNE UNIVERSITY

A PRELIMINARY PROJECT REPORT ON

Physical Web with Vending Machine

SUBMITTED TOWARDS THE
PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING (Computer Engineering)

BY

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Under The Guidance of

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CERTIFICATE

This is to certify that the Project Entitled

Physical Web with Vending machine.

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is a bonafide work carried out by Students under the supervision of Prof.A.R.Deshpande and it is submitted towards the partial fulfillment of the requirement of Bachelor of Engineering (Computer Engineering) Project.

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Abstract

A vending machine is a machine that dispenses items such as snacks, beverages to customers automatically, after the customer inserts currency or credit into the machine. But nowadays paying in cash has become a difficulty and cannot be fulfilled every time. Therefore we provide a platform for the vending machine functionalities and management to be handled by cloud using Internet of things. With this approach Online payment for vending machines can be made possible and the stock record is maintained on the cloud for dynamically updating the vendor. In addition to which the users are notified about the presence of the vending machine using Web Bluetooth API.

Acknowledgments

It gives us great pleasure in presenting the preliminary project report on ‘Physical Web with Vending machine’.

*We would like to take this opportunity to thank our internal guide **Prof. A.R.Deshpande** for giving us all the help and guidance we needed. We are really grateful to them for their kind support. Their valuable suggestions were very helpful.*

*We are also grateful to **Prof. Rajesh Ingle**, Head of Computer Engineering Department, PICT for his indispensable support, suggestions.*

*In the end our special thanks to **Mr. Anuj Deshpande** for providing various resources such as laboratory with all needed software platforms, continuous Internet connection, for Our Project.*

Sejal Khatri
Amruta Ranade
Kevin Kaul
(B.E. Computer Engg.)

INDEX

1	Synopsis	1
1.1	Project Title	2
1.2	Project Option	2
1.3	Internal Guide	2
1.4	Sponsorship and External Guide	2
1.5	Technical Keywords (As per ACM Keywords)	2
1.6	Problem Statement	2
1.7	Abstract	3
1.8	Goals and Objectives	3
1.9	Relevant mathematics associated with the Project	4
1.10	Names of Conferences / Journals where papers can be published . .	5
1.11	Review of Conference/Journal Papers supporting Project idea	5
1.12	Plan of Project Execution	6
2	Technical Keywords	7
2.1	Area of Project	8
2.2	Technical Keywords	8
3	Introduction	9
3.1	Project Idea	10
3.2	Motivation of the Project	10
3.3	Literature Survey	10
4	Problem Definition and scope	13
4.1	Problem Statement	14

4.1.1	Goals and objectives	14
4.1.2	Statement of scope	14
4.2	Software context	15
4.3	Major Constraints	15
4.4	Methodologies of Problem solving and efficiency issues	16
4.5	Scenario in which multi-core, Embedded and Distributed Computing used	16
4.6	Outcome	16
4.7	Applications	16
4.8	Hardware Resources Required	16
4.9	Software Resources Required	17
5	Project Plan	18
5.1	Project Estimates	19
5.1.1	Project Resources	20
5.2	Risk Management w.r.t. NP Hard analysis	21
5.2.1	Risk Identification	21
5.2.2	Risk Analysis	22
5.2.3	Overview of Risk Mitigation, Monitoring, Management	23
5.3	Project Schedule	24
5.3.1	Project task set	24
5.3.2	Task network	24
5.3.3	Timeline Chart	25
5.4	Team Organization	25
5.4.1	Team structure	26
5.4.2	Management reporting and communication	26
6	Software requirement specification (SRS is to be prepared using relevant mathematics derived and software engg. Indicators in Annex A and B)	27
6.1	Introduction	28
6.1.1	Purpose and Scope of Document	28
6.1.2	Overview of responsibilities of Developer	28

6.2	Usage Scenario	29
6.2.1	User profiles	29
6.2.2	Use Case View	29
6.3	Data Model and Description	30
6.3.1	Data objects and Relationships	30
6.4	Functional Model and Description	31
6.4.1	Data Flow Diagram	33
6.4.2	Description of functions	34
6.4.3	Activity Diagram:	34
6.4.4	Non Functional Requirements:	35
6.4.5	State Diagram:	36
6.4.6	Design Constraints	38
6.4.7	Software Interface Description	38
7	Detailed Design Document using Appendix A and B	39
7.1	Introduction	40
7.2	Architectural Design	40
7.3	Data design	41
7.4	Component Design	42
7.4.1	Class Diagram	43
.1	References	44
.2	Summary and Conclusion	45
	Annexure A Laboratory assignments on Project Analysis of Algorithmic Design	46
	Annexure B Laboratory assignments on Project Quality and Reliability Testing of Project Design	48
	Annexure C Project Planner	50
	Annexure D Reviewers Comments of Paper Submitted	52
	Annexure E Plagiarism Report	54

List of Figures

5.1	Task Network	25
5.2	Timeline Chart	25
6.1	Use case diagram	30
6.2	erd diagram	30
6.3	Class diagram	32
6.4	Erd Diagram	33
6.5	Activity diagram	35
6.6	State transition diagram	37
7.1	Architecture diagram	41
7.2	ERD diagram	42
7.3	Class Diagram	43

List of Tables

1.1	Project Plan	6
5.1	Project Plan	19
5.2	Risk Table	22
5.3	Risk Probability definitions [?]	23
5.4	Risk Impact definitions [?]	23
A.1	IDEA Matrix	47

CHAPTER 1

SYNOPSIS

PROJECT TITLE

Physical Web with Vending Machine

PROJECT OPTION

Industry sponsored

INTERNAL GUIDE

Prof. A.R.Deshpande

SPONSORSHIP AND EXTERNAL GUIDE

Sponsored By : Marvell Pvt.ltd.

TECHNICAL KEYWORDS (AS PER ACM KEYWORDS)

1. IOT.
2. Cloud Computing.
3. Cloud based storage.
4. Web Application.
5. Web Services.
6. Web based interaction.
7. Web Interfaces.

PROBLEM STATEMENT

To Automate vending machine functionalities for vendors and enabling easy accessibility for users through online payment and establishing a physical interface with the help of beacons.

ABSTRACT

A vending machine is a machine that dispenses items such as snacks, beverages to customers automatically, after the customer inserts currency or credit into the machine. But nowadays paying in cash has become a difficulty and cannot be fulfilled every time. Therefore we provide a platform for the vending machine functionalities and management to be handled by cloud using Internet of things. With this approach Online payment for vending machines can be made possible and the stock record is maintained on the cloud for dynamically updating the vendor. In addition to which the users are notified about the presence of the vending machine using Web Bluetooth API.

GOALS AND OBJECTIVES

Project Goal :Presently operating the vending machines is not user-friendly and it is observed to be time consuming as well. Our project goal is to increase the scope and quality of the vending machine services provided to the people.

Project Objective 1: People use coins or paper money while operating the vending machines due to which there arises a problem when the user does not seem to have exact change with him. **Performance Measure :** Online (cashless) payments are made available for the users for easy purchase of items.

Project Objective 2: The vendors are not aware about the stock required in the vending machines when excess usage of the products occur. **Performance Measure :** Vendors are well informed about the stock management of the machine and are also aware of the customers past transactions.

Project Objective 3 : Finding a vending machine in new locations everytime becomes difficult for people. **Performance Measure :** The users are notified about the presence of the vending machine available in their current location using the Web Bluetooth API.

RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

System Description:

Let S be the solution system , $S = s, e, X, Y, F, DD, NDD, sc, fc$ — shmem

where,

s = start state Wi-fi interfacing

e = end state Product delivered and status recorded

X = Input set

Y = Output set

Input:(Physical address, users choice)

Output:(Product requested , suggestions)

Functions : Fme + Ffriend.

Fme = Main functions.

Fme = (fin , fout,initiate,detect,connect).

Fin : Faddress , Fchoice

Fout:Fdispose , Fsuggest

Finitiate :Fconnectwifi ,Fflashurl,Fconnectaws

Fdetect:Fdetectwifi

Fconnect:Fcw ,Fcaws

Fcw :refresh connection wifi

Fcaws :refresh connection AWS

Ffriend = inbuilt functions.

Ffriend = (fproc , fcloud).

Non Deterministic Data : Physical address of user.

Deterministic Data :Items(as flashed on users device)

Success Conditions:Valid input(i.e valid user choice) is given and the desired result is obtained successfully and also proper internet availability.

Failure Conditions: Invalid input(i.e invalid user choice) given and desired result not obtained also internet availability not present.

NAMES OF CONFERENCES / JOURNALS WHERE PAPERS CAN BE PUBLISHED

Physical Web in Smart Cities - Advances in Wireless and Optical Communications (RTUWO), 2015

On physical web models - Control and Communications (SIBCON), 2016

International Siberian Conference Finite state machine based vending machine International Journal of VLSI design and communication system 2012.

REVIEW OF CONFERENCE/JOURNAL PAPERS SUPPORTING PROJECT IDEA

1. Zaruba, G.v., S. Basagni, and I. Chlamtac. "Bluetrees-scatternet Formation to Enable Bluetooth-based Ad Hoc Networks." ICC 2001. IEEE International Conference on Communications. Conference Record (Cat. No.01CH37240) (n.d.): n. pag. Web
2. Linthicum, David S. "The Technical Case for Mixing Cloud Computing and Manufacturing." IEEE Cloud Computing 3.4 (2016): 12-15. Web.
3. Massuthe, P., and K. Schmidt. "Operating Guidelines - an Automata-Theoretic Foundation for the Service-Oriented Architecture." Fifth International Conference on Quality Software (QSIC'05) (n.d.): n. pag. Web.
4. Sneps-Sneppe, Manfred, and Dmitry Namiot. "On Physical Web Models." 2016 International Siberian Conference on Control and Communications (SIBCON) (2016): n. pag. Web.
5. Namiot, Dmitry, and Manfred Sneps-Sneppe. "The Physical Web in Smart Cities." 2015 Advances in Wireless and Optical Communications (RTUWO)

(2015): n. pag. Web.

6. Lee, Jin-Shyan, Yu-Wei Su, and Chung-Chou Shen. "A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi." IECON 2007 - 33rd Annual Conference of the IEEE Industrial Electronics Society (2007): n. pag. Web.
7. Simeone, Osvaldo, and Haim H. Permuter. "Source Coding with Delayed Side Information." 2012 IEEE International Symposium on Information Theory Proceedings (2012): n. pag. Web.
8. Zhang, Qi, Lu Cheng, and Raouf Boutaba. "Cloud Computing: State-of-the-art and Research Challenges." Journal of Internet Services and Applications 1.1 (2010): 7-18. Web.

PLAN OF PROJECT EXECUTION

Activity	Planned months
Requirement gathering and feasibility studying	1 july 15 Aug
Planning Activities	16 Aug 31 Aug
Designing Modules	1 sept 31 Oct
Implementation	1 Nov 14 Jan
Testing	15 Jan 15 Feb
Deployment	16 Feb 28 Feb

Table 1.1: Project Plan

CHAPTER 2

TECHNICAL KEYWORDS

AREA OF PROJECT

Internet of Things

TECHNICAL KEYWORDS

1. Internet of Things.
2. Cloud Computing.

CHAPTER 3

INTRODUCTION

PROJECT IDEA

We are proposing a platform for vending machine functionalities and management to be handled by cloud using Internet of things. Online payment for vending machines made possible and stock record maintained on the cloud for dynamically updating the vendor .

MOTIVATION OF THE PROJECT

Presently the people use coins or paper money while operating the vending machines due to this there arises a problem when the user does not seem to have exact change with him and the vendors dont come to know about the stock required in the vending machines when excess usage is done. Hence to minimize these problems we provide an efficient solution.

LITERATURE SURVEY

Physical Web with Vending machine.

Papers referred

Zaruba, G.v., S. Basagni, and I. Chlamtac. "Bluetrees-scatternet Formation to Enable Bluetooth-based Ad Hoc Networks." ICC 2001. IEEE International Conference on Communications. Conference Record (Cat. No.01CH37240) (n.d.): n. pag. Web
Linthicum, David S. "The Technical Case for Mixing Cloud Computing and Manufacturing." IEEE Cloud Computing 3.4 (2016): 12-15. Web.

Massuthe, P., and K. Schmidt. "Operating Guidelines - an Automata-Theoretic Foundation for the Service-Oriented Architecture." Fifth International Conference on Quality Software (QSIC'05) (n.d.): n. pag. Web.

Sneps-Sneppe, Manfred, and Dmitry Namiot. "On Physical Web Models." 2016 International Siberian Conference on Control and Communications (SIBCON) (2016): n. pag. Web.

Namiot, Dmitry, and Manfred Sneps-Sneppe. "The Physical Web in Smart Cities." 2015 Advances in Wireless and Optical Communications (RTUWO) (2015): n. pag. Web.

Lee, Jin-Shyan, Yu-Wei Su, and Chung-Chou Shen. "A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi." IECON 2007 - 33rd Annual Conference of the IEEE Industrial Electronics Society (2007): n. pag. Web.

Simeone, Osvaldo, and Haim H. Permuter. "Source Coding with Delayed Side Information." 2012 IEEE International Symposium on Information Theory Proceedings (2012): n. pag. Web.

Zhang, Qi, Lu Cheng, and Raouf Boutaba. "Cloud Computing: State-of-the-art and Research Challenges." Journal of Internet Services and Applications 1.1 (2010): 7-18. Web.

Abstract: A vending machine is a machine that dispenses items such as snacks, beverages to customers automatically, after the customer inserts currency or credit into the machine. We are proposing a Platform for vending machine functionalities and management to be handled by cloud using Internet of things. But nowadays paying in cash has become a difficulty and cannot be fulfilled every time. Therefore we suggest a platform for the vending machine functionalities and management to be handled by cloud using Internet of things. With this approach Online payment for vending machines can be made possible and the stock record is maintained on the cloud for dynamically updating the vendor. In addition to which the users are notified about the presence of the vending machine using Web Bluetooth API.

Introduction:

The Physical Web is a generic term which describes interconnection of physical objects and web. The Physical Web lets to present physical objects in a web. There are different ways to do that. Usually, the web presentation for a physical object could implement with the help of mobile devices. The basic idea behind the Physical Web is to navigate and control physical objects in the world surrounding mobile devices with the help of web technologies. Of course, there are different ways to identify and enumerate physical objects. Nowadays operating the vending machines has been difficult due to cash payments and location issues.

How to overcome this issue? We hereby suggest such types of vending machines which offer Online (cashless) payments for the users for easy purchase of items and the Vendors are well informed about the stock management of the ma-

chine and they are also aware of the customers past transactions. To begin with we will have a Wi-Fi enabled board on the vending machines which will send beacons to the mobile phones having Bluetooth in their vicinity. Nowadays bluetooth is an open specification for short-range wireless communication and networking, mainly intended to be a cable replacement between portable and/or fixed electronic devices. The specification also defines techniques for interconnecting large number of nodes in scatternets, thus enabling the establishment of a mobile ad hoc network (MANET). The user will receive a notification which will contain a URL flashed by the beacon on his cellphone along with suggestions for other products. and will hence find and approach the vending machine and click on the desired product on his cellphone. The transaction is carried out using the online payment gateways or mobile wallet and is recorded and stored in the cloud which is used for future transactions. In this project we are using Cloud computing in the functioning of the data, cloud computing has recently emerged as a new paradigm for hosting and delivering services over the Internet. It is attractive to business owners as it eliminates the requirement for users to plan ahead for provisioning, and allows enterprises to start from the small and increase resources only when there is a rise in service demand. Many different algorithms are going to be used in this project namely - The travelling salesperson algorithm, Depth first search. Using such algorithms we will provide a platform which will help the vendors manage the functioning of the vending machines in near future.

CHAPTER 4

PROBLEM DEFINITION AND SCOPE

PROBLEM STATEMENT

To Automate vending machine functionalities for vendors and enabling easy accessibility for users through online payment and establishing a physical interface with the help of beacons.

Goals and objectives

Project Goal :Presently operating the vending machines is not user-friendly and it is observed to be time consuming as well.Our project goal is to increase the scope and quality of the vending machine services provided to the people.

Project Objective 1: People use coins or paper money while operating the vending machines due to which there arises a problem when the user does not seem to have exact change with him. Performance Measure : Online (cashless) payments are made available for the users for easy purchase of items.

Project Objective 2: The vendors are not aware about the stock required in the vending machines when excess usage of the products occur. Performance Measure : Vendors are well informed about the stock management of the machine and are also aware of the customers past transactions.

Project Objective 3 : Finding a vending machine in new locations everytime becomes difficult for people. Performance Measure : The users are notified about the presence of the vending machine available in their current location using the Web Bluetooth API.

Statement of scope

This project will consist of creating a platform for vending machine functionalities and management to be handled by cloud using Internet of things.Online payment for vending machines made possible and stock record maintained on the cloud for dynamically updating the vendor. Modules of the platform will include a firmware where hardware is used,cloud communication and a frontend available for users as well as for vendors respectively.

Limit of the project will be internet dependency ,so better connection is re-

quired otherwise the entire system flops .

Functionality mechanism is concentrated on removing the cash payment barrier on the vending machine .

Final product will be used at public places like railway stations,airports,bus stands and can be used by private vendors.

SOFTWARE CONTEXT

Online payment for vending machines made possible and stock record maintained on the cloud for dynamically updating the vendor. Modules of the platform will include a firmware where hardware is used,cloud communication and a frontend available for users as well as for vendors respectively. The software entities used are Web Bluetooth API,Linux,Eclipse(mars). Web bluetooth is the technology in which a bluetooth enabled device is used to flash url which can notify people about a thing in the area ,This is a way towards making things speak . This device is placed at the vending machine and configured to flash a particular url using Seripheral Interface from the controller . The controller is wifi enabled ,so cloud communication is done using awsiot js sdk on the device . The cloud communication also happens at the user side for payment and then the cloud notifies the vending machine that payment is done and vending machine disposes the product.

MAJOR CONSTRAINTS

Need of google chrome browser The user should have google chrome browser to take advantage of this service as currently the web bluetooth technology is supported by only google chrome.

Availability of Wi-Fi connections. The vending machine should be placed in the place where wifi availability is there ,for smoother connection and faster product delivery.If the internet fluctuates then user will have to wait for product and this in turn lead to decrease in product sale.

Location of the vending machines. Vending machine should be placed where it can be accesible to the people i.e the bluetooth range .

METHODOLOGIES OF PROBLEM SOLVING AND EFFICIENCY ISSUES

The single problem can be solved by different solutions. This considers the performance parameters for each approach. Thus considers the efficiency issues.

SCENARIO IN WHICH MULTI-CORE, EMBEDDED AND DISTRIBUTED COMPUTING USED

We will have a Wi-Fi enabled board on the vending machines which will send beacons to the mobile phones having Bluetooth in their vicinity.

The user will receive a notification which will contain a URL flashed by the beacon on his cellphone along with suggestions for other products.

The user will hence find and approach the vending machine and click on the desired product on his cellphone.

The transaction is carried out using the online payment gateways or mobile wallet and is recorded and stored in the cloud which is used for future transactions.

The vending machine then dispenses the product ordered by the user.

The vendor will have an updated list of the stock remaining in the cloud.

OUTCOME

Online (cashless) payments are available for the users for easy purchase of items. Vendors are well informed about the stock management of the machine and they are also aware of the customers past transactions.

APPLICATIONS

Vending machines in airports, malls and offices.

HARDWARE RESOURCES REQUIRED

1. Beacons.
2. Vending machines.

3. Knit board(wifi-enabled micro controller).
4. Mobile phone.(Android or iOs)

SOFTWARE RESOURCES REQUIRED

Platform : Amazon Web Services.

1. Operating System:Linux(Ubuntu16.04).
2. IDE: Eclipse (Mars).(3.0)
3. Programming Language : C , javascript
4. API: Web Bluetooth(4.0)
5. AWSIOT Device SDK JS (Version 1.0.12)
6. Google chrome Browser (version :53.0.2785.143)

CHAPTER 5

PROJECT PLAN

PROJECT ESTIMATES

Our project is based on an Incremental Model.

Cost Estimate

The cost estimate for this project is around Fifty Thousand Rupees.

Time Estimates

Activity	Planned months
Requirement gathering and feasibility studying	1 july 15 Aug
Planning Activities	16 Aug 31 Aug
Designing Modules	1 sept 31 Oct
Implementation	1 Nov 14 Jan
Testing	15 Jan 15 Feb
Deployment	16 Feb 28 Feb

Table 5.1: Project Plan

Project Resources

Papers Referred :

Zaruba, G.v., S. Basagni, and I. Chlamtac. "Bluetrees-scatternet Formation to Enable Bluetooth-based Ad Hoc Networks." ICC 2001. IEEE International Conference on Communications. Conference Record (Cat. No.01CH37240) (n.d.): n. pag. Web

Linthicum, David S. "The Technical Case for Mixing Cloud Computing and Manufacturing." IEEE Cloud Computing 3.4 (2016): 12-15. Web.

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Sneps-Sneppe, Manfred, and Dmitry Namiot. "On Physical Web Models." 2016 International Siberian Conference on Control and Communications (SIBCON) (2016): n. pag. Web.

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Simeone, Osvaldo, and Haim H. Permuter. "Source Coding with Delayed Side Information." 2012 IEEE International Symposium on Information Theory Proceedings (2012): n. pag. Web.

Zhang, Qi, Lu Cheng, and Raouf Boutaba. "Cloud Computing: State-of-the-art and Research Challenges." Journal of Internet Services and Applications 1.1 (2010):

7-18. Web.

AWS—IOT : <https://aws.amazon.com/documentation/iot/>

Wifi enabled knit board : <https://github.com/Makerville/knit>

RISK MANAGEMENT W.R.T. NP HARD ANALYSIS

Project Risks

The dependency on google chrome browser: The user should have google chrome browser to take advantage of this service as currently the web bluetooth technology is supported by only google chrome.

Fluctuations of Wi-Fi connections. The vending machine should be placed in the place where wifi availability is there ,for smoother connection and faster product delivery.If the internet fluctuates then user will have to wait for product and this in turn lead to decrease in product sale.

Location of the vending machines. Vending machine should be placed where it can be accesible to the people i.e the bluetooth range .

Risk Identification

1. Have top software and customer managers formally committed to support the project?

Yes,the top software company manager has approved our idea and is fully committed to support our project.

2. Are end-users enthusiastically committed to the project and the system/product to be built?

The end users in our case being the vendors are happy about the change and betterment we will bring in their bussiness with our platform.

3. Are requirements fully understood by the software engineering team and its customers?

The requirements are understood completely and are taken care of by the software engineering team and its customers.

4. Have customers been involved fully in the definition of requirements?
The customers are involved and are supporting us for the development of the platform.
5. Do end-users have realistic expectations?
Yes the users do have realistic expectations as our platform will bring a betterment and improve their means of business.
6. Does the software engineering team have the right mix of skills?
The software engineering team is the finest we can meet and are at par with their skills.
7. Are project requirements stable?
The project requirements are stable and simple.
8. Is the number of people on the project team adequate to do the job?
Yes the number of people on this project are adequate.
9. Do all customer/user constituencies agree on the importance of the project and on the requirements for the system/product to be built?
The customers agree with our idea and are eager to support us in our endeavour.

Risk Analysis

The risks for the Project can be analyzed within the constraints of time and quality

ID	Risk Description	Probability	Impact		
			Schedule	Quality	Overall
1	Location of vending machine	Low	Low	High	High
2	Availability of WiFi connections	Low	Low	High	High

Table 5.2: Risk Table

Probability	Value	Description
High	Probability of occurrence is	> 75%
Medium	Probability of occurrence is	26 – 75%
Low	Probability of occurrence is	< 25%

Table 5.3: Risk Probability definitions [?]

Impact	Value	Description
Very high	> 10%	Schedule impact or Unacceptable quality
High	5 – 10%	Schedule impact or Some parts of the project have low quality
Medium	< 5%	Schedule impact or Barely noticeable degradation in quality Low Impact on schedule or Quality can be incorporated

Table 5.4: Risk Impact definitions [?]

Risk ID	1
Risk Description	Location of the vending machine.
Category	Development Environment.
Source	Software requirement Specification document.
Probability	Low
Impact	High
Strategy	Do the environment study and then place bluetooth device for respective machine
Risk Status	Identified

Overview of Risk Mitigation, Monitoring, Management

Following are the details for each risk.

Risk ID	2
Risk Description	Availability of the WiFi connection.
Category	Requirements
Source	Software Design Specification documentation review.
Probability	Low
Impact	High
Strategy	Better testing will resolve this issue.
Risk Status	Identified

PROJECT SCHEDULE

Project task set

Major Tasks in the Project stages are:

Task 1: Establishing WiFi connection of the vending machine.

Task 2: Establishing connection between cloud and the vending machine.

Task 3: Activation of beacons.

Task 4: Find the user location and make online payment available (Mobile wallets).

Task 5: Data is updated and stored on the cloud respectively.

Task 6: Vendor is informed about the transaction.

Task network

Project tasks and their dependencies are noted in this diagrammatic form.

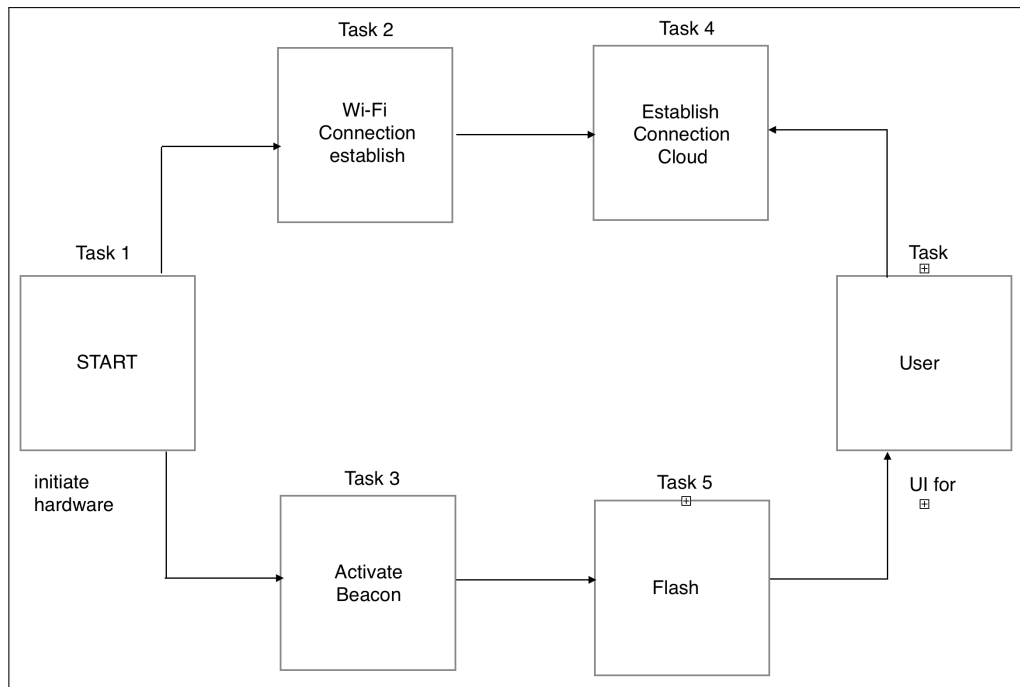


Figure 5.1: Task Network

Timeline Chart

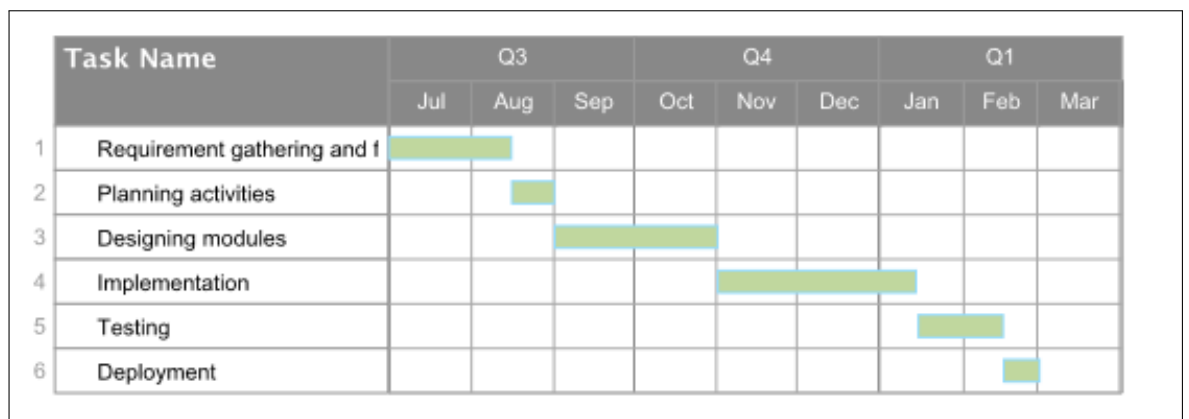


Figure 5.2: Timeline Chart

TEAM ORGANIZATION

College Guide - Prof A.R.Deshpande

Mentor - Mr. Anuj Deshpande

Our project guide helps us efficiently in the development of the project and helps us with our queries. She also provides us with the much needed motivation.

Our mentor guides us through the project and helps us in defining a proper work flow of the project.

Team structure

The team structure for the project is identified. Our project is divided into different smaller modules and the team works independently on different modules. We have three members in our group:

one working on the front end

one working on firmware

one working on cloud communication.

Management reporting and communication

Management and communication within the team is done on a daily basis and the mechanisms for progress reporting and intra team communication are identified as per assessment sheet and lab time table.

CHAPTER 6

**SOFTWARE REQUIREMENT
SPECIFICATION (SRS IS TO BE
PREPARED USING RELEVANT
MATHEMATICS DERIVED AND
SOFTWARE ENGG. INDICATORS IN
ANNEX A AND B)**

INTRODUCTION

Purpose and Scope of Document

Purpose:

An SRS is written in precise, clear and plain language so that it can be reviewed by a business analyst or customer representative with minimal technical expertise. However it also contains analytical models (use case diagrams, entity relationship diagrams, data dictionary etc.) which can be used for the detailed design and the development of the software system. SRS is one of the most critical pieces of software development since it acts as the bridge between the software developers and business analysts. An incomplete or incorrect SRS can have disastrous effects on a software project.

Scope:

Primarily, the scope pertains to the Vending machine providing services to the user and the vendor. It focuses on the vendor, which allows for the sales, distribution and marketing of the products through the vending machine. This SRS is also aimed at specifying requirements of product to be developed but it can also be applied to assist in the selection of in-house and commercial software products. The standard can be used to create software requirements specifications directly or can be used as a model for defining a organization or project specific stan

Overview of responsibilities of Developer

The developer will carry out the following activities:

1. Requirement gathering
2. Planning of the project
3. Designing various modules
4. Implementation of the project
5. Testing of the modules (white box and black box)

6. Deployment of the product (real life usage)

USAGE SCENARIO

Scenario1: User doesn't get notified :

This happens if users bluetooth is not activated ,than he doesn't get the notification .

Scenario2:If the wifi connection breaks while the delivery process

The details are saved at the cloud side and if the vending machine is reconnected then it makes the delivery as the payment status is updated .

User profiles

There are two actors involved in the use case diagram.

1. User
2. Vendor

The user is the person who approaches the vending machine to buy a product and the vendor is the person who sells various products by regularly stocking them up in the vending machine. The relationship between them is similar to a buyer and seller.

Use Case View

Use Case Diagram. Example is given below

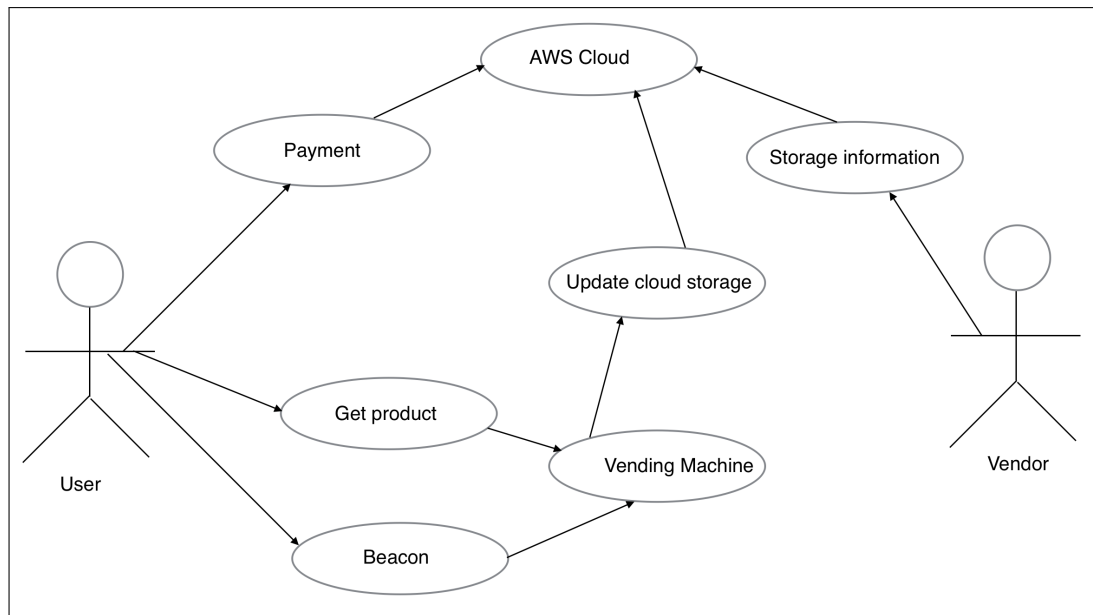


Figure 6.1: Use case diagram

DATA MODEL AND DESCRIPTION

Data objects and Relationships

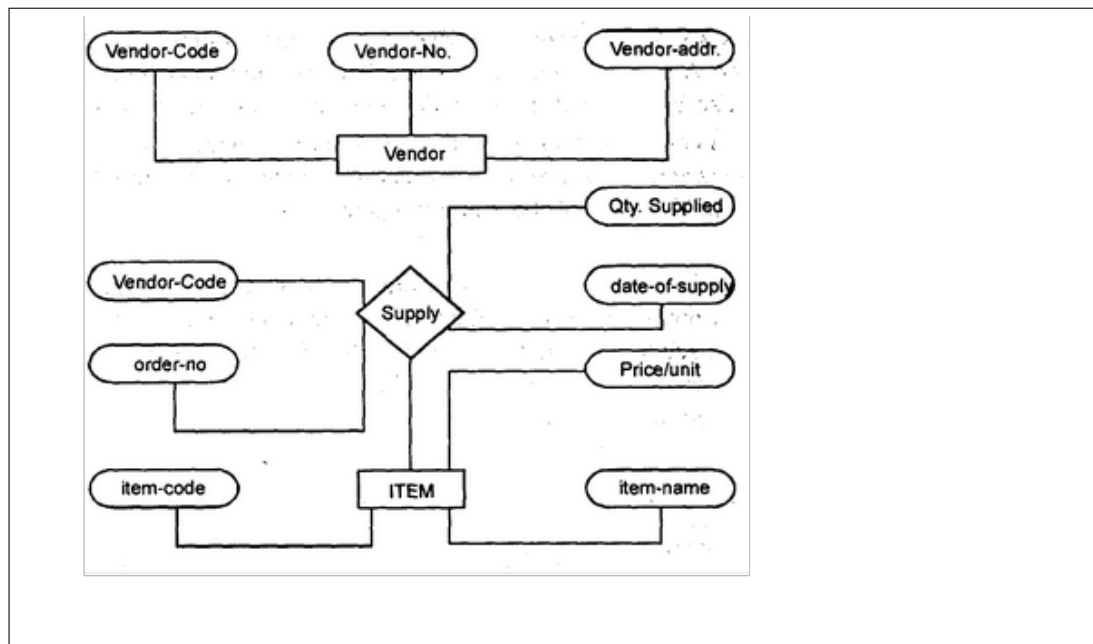


Figure 6.2: erd diagram

FUNCTIONAL MODEL AND DESCRIPTION

Our project consists of these software functions–

Interfacing knit board with the vending machine. In this function we are writing codes and storing them on the stlink programmer. The stlink works with both its end, one end is connected to the vending machine's motors and the other end is connected to the knit board. Using the flash process we will store and use the code dynamically.

Knit board to AWS (Amazon Web Services)–

In this function we will connect the knit board functionalities to the cloud server. This will be done via the REST(Representational state transfer) protocol.

REST : They are one way of providing interoperability between computer systems on the internet. REST-compliant web services allow requesting systems to access and manipulate textual representations of web resources using a uniform and predefined set of stateless operations.

There are six guiding constraints that define a RESTful system. These constraints restrict the ways that the server may process and respond to client requests so that, by operating within these constraints, the service gains desirable non-functional properties, such as performance, scalability, simplicity, modifiability, visibility, portability, and reliability. If a service violates any of the required constraints, it cannot be considered RESTful.

Cloud to Device(vendor's side)–

In this function we will connect the cloud to the Vendor's device through a mqtt protocol. Mqtt(MQ Telemetry Transport) Protocol :

It is an ISO standard (ISO/IEC PRF 20922)publish-subscribe-based "lightweight" messaging protocol for use on top of the TCP/IP protocol. It is designed for connections with remote locations where a "small code footprint" is required or the network bandwidth is limited. Further the vendor will have his own database server where all the data collected will be stored and saved. Here various algorithms will be applied to find the location of the vending machine which needs the reloading of products.

We are providing a platform to the vendors such that they will be able to store the user's past transaction history as well.

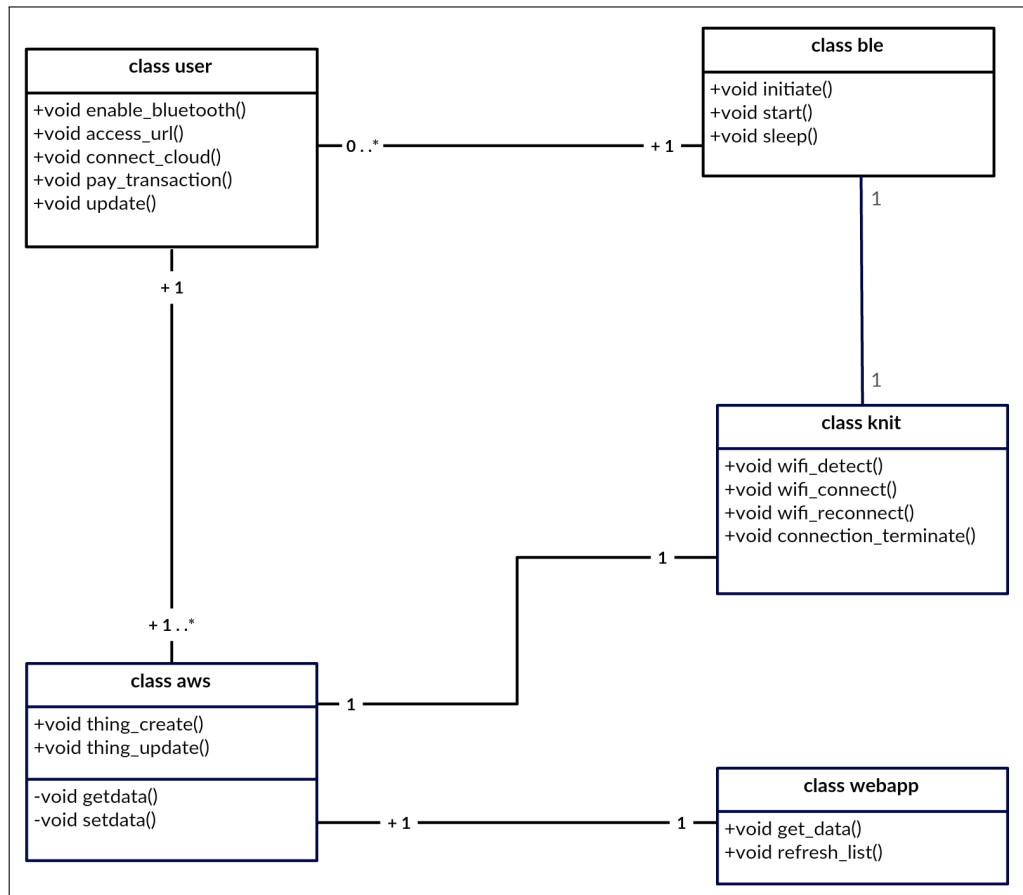


Figure 6.3: Class diagram

Data Flow Diagram

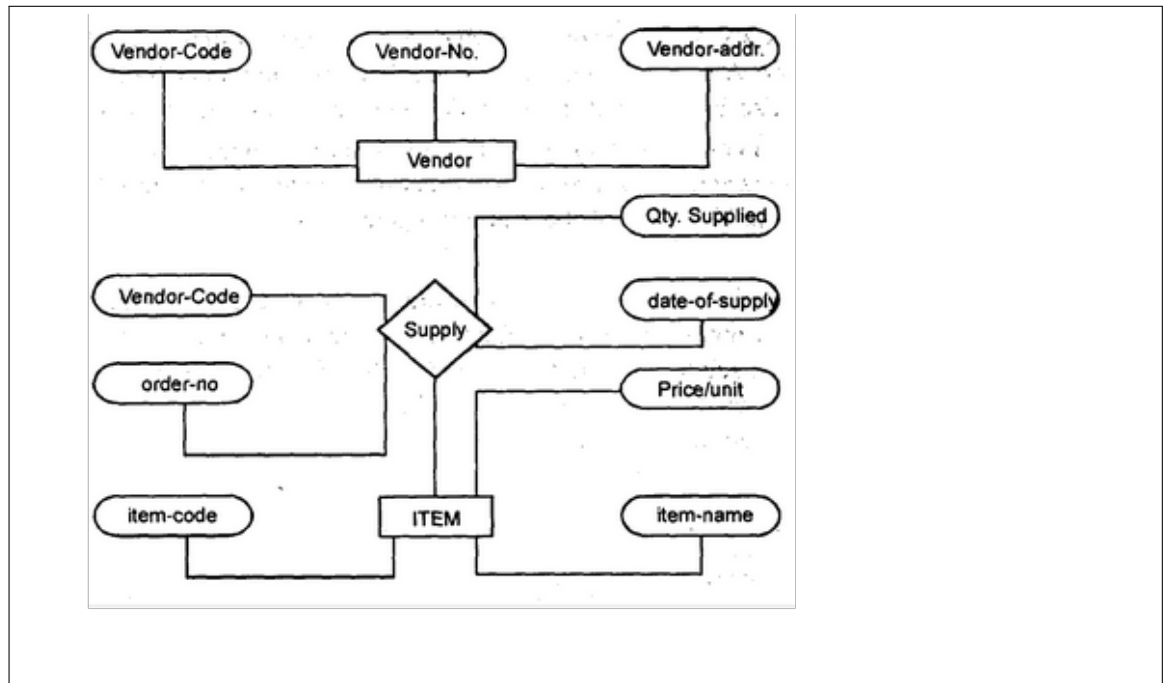


Figure 6.4: Erd Diagram

Description of functions

Fme = Main functions.

Fme = (fin , fout,initiate,detect,connect).

Fin : Faddress , Fchioce

Faddress is the function to get user device address and store it in the database .

Fchoice is the function which maps users choice with his particular id ,which further can be used for data analysis

Fout:Fdispose , Fsuggest

Fdispose is the function which is used to validate if payment is done or not and accordingly dispose the product from the vending machine.

Fsuggest is the function which suggests product to the user after analysing its previous choice of products .

Finitiate :Fconnectwifi ,Fflashurl,Fconnectaws

Fconnectwifi :function to connect to the wifi once the device is initiated

Fflashurl This function is used to wake up beacon and make it flash url

Fconnectaws is used to connect knit board to AWS once its connected to the wifi

Fdetect:Fdetectwifi

Fconnect:Fcw ,Fcaws

Fcw :refresh connection wifi

Fcaws :refresh connection AWS

Activity Diagram:

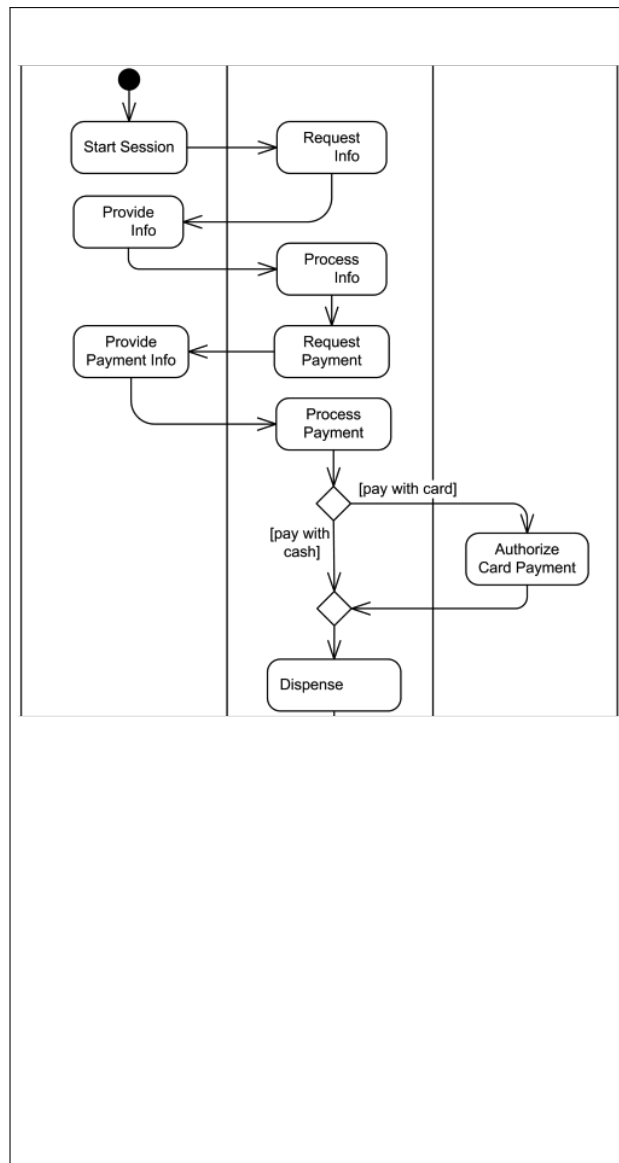


Figure 6.5: Activity diagram

Non Functional Requirements:

Interface Requirements:

SPI -Serial Peripheral Interface used to connect Stepper motor driver to Knit board.

Requirement : The driver must support SPI interface and also the board used should support SPI interface .

Performance Requirements:

Proper Functioning Wifi module to make most of the internet connectivity.

Faster AWS response for quick disposal of products as user would most likely be in hurry in most of the cases

Software quality attributes :

Reliability : Complete Reliability on the internet access in the area

Modifiability :Modifiability is supported as the Beacon url is modifiable according to the vendor.

Performance : Performace is measured by day to day testing and respective changes are made to enhance the performance

Security : For security the protocols used are mqtt and https for data transfer.

Testability :Various tests will run at the machine side and updates will be sent on the cloud and respective measures will be taken

Usability : The will be self adaptable using the testing responce and performance checks,also user adaptability takes place as the data recorded by the user is analysed and respective approach takes place.

State Diagram:

State Transition Diagram

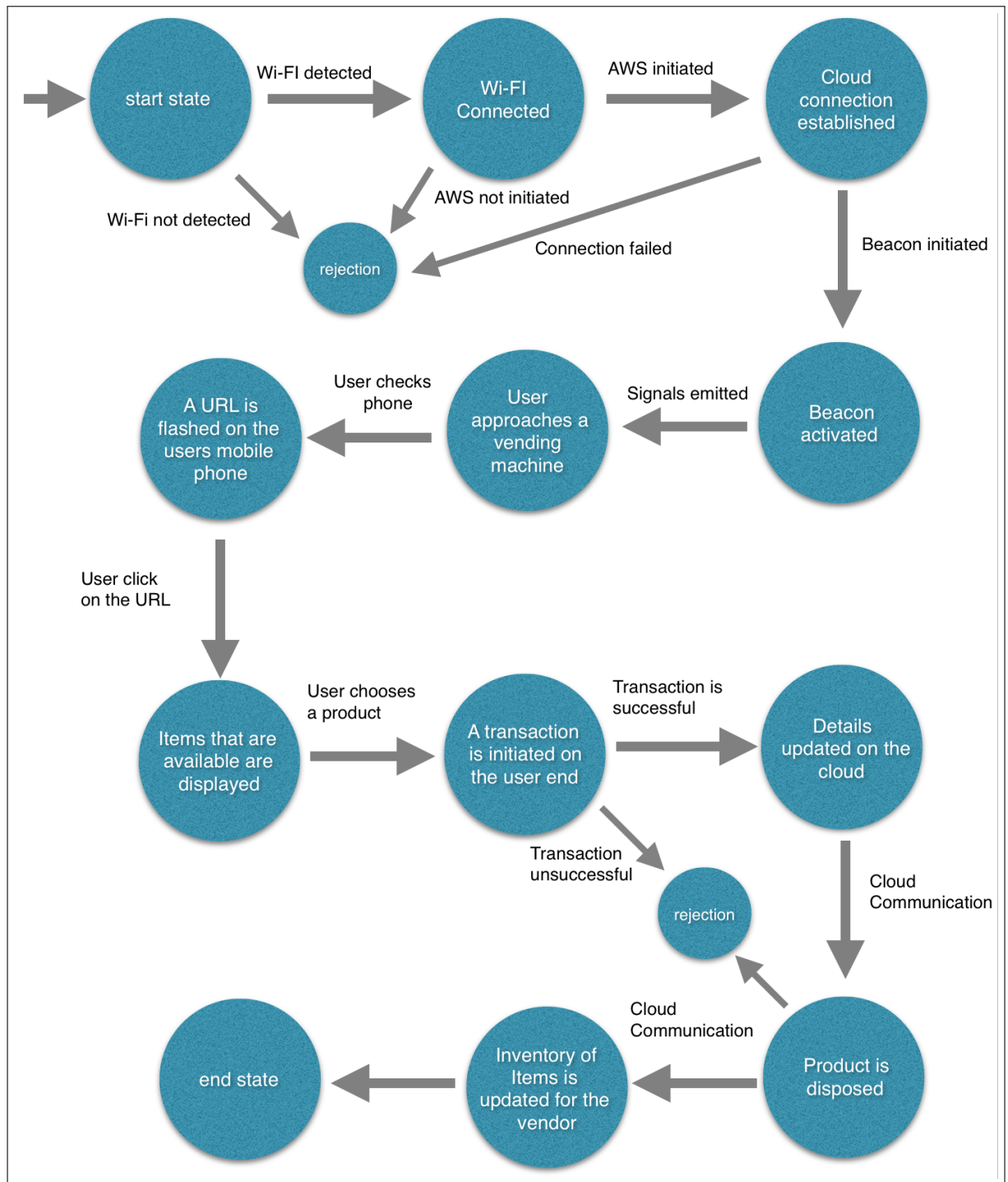


Figure 6.6: State transition diagram

Design Constraints

Any design constraints that will impact the subsystem are noted.

Software Interface Description

Software interfacing is done between knit board (wifi enabled board) and Amazon web services using aws iot js sdk .So the data is updated in time intervals to the cloud .Concept called thing shadows is used at the cloud side to dynamically update data . Interfacing is also done between cloud and vendor device for dynamically publishing the updated data at the AWS .

CHAPTER 7

DETAILED DESIGN DOCUMENT USING

APPENDIX A AND B

INTRODUCTION

We will have a Wi-Fi enabled board on the vending machines which will send beacons to the mobile phones having Bluetooth in their vicinity.

The user will receive a notification which will contain a URL flashed by the beacon on his cellphone along with suggestions for other products.

The user will hence find and approach the vending machine and click on the desired product on his cellphone.

The transaction is carried out using the online payment gateways or mobile wallet and is recorded and stored in the cloud which is used for future transactions.

The vending machine then dispenses the product ordered by the user.

The vendor will have an updated list of the stock remaining in the cloud.

ARCHITECTURAL DESIGN

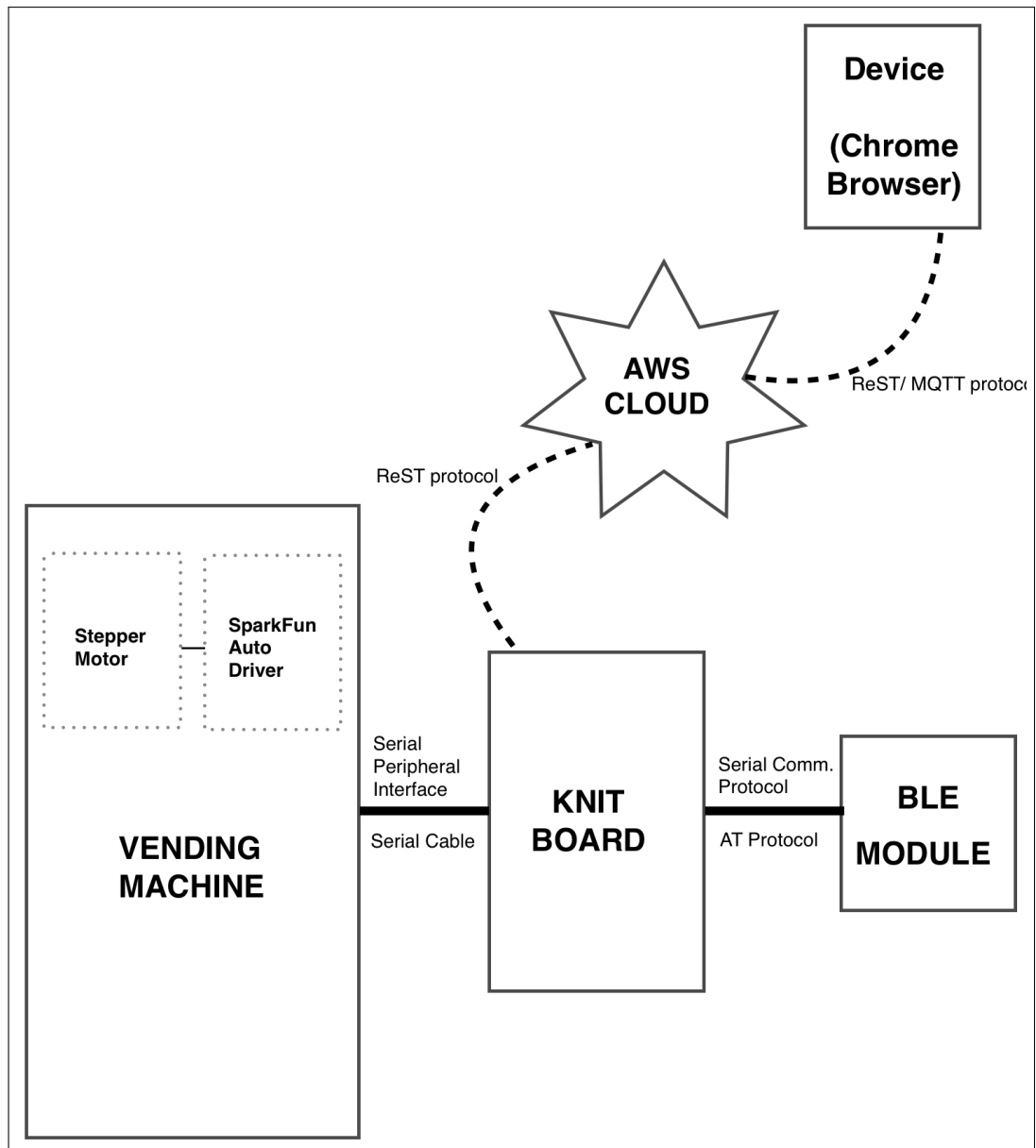


Figure 7.1: Architecture diagram

DATA DESIGN

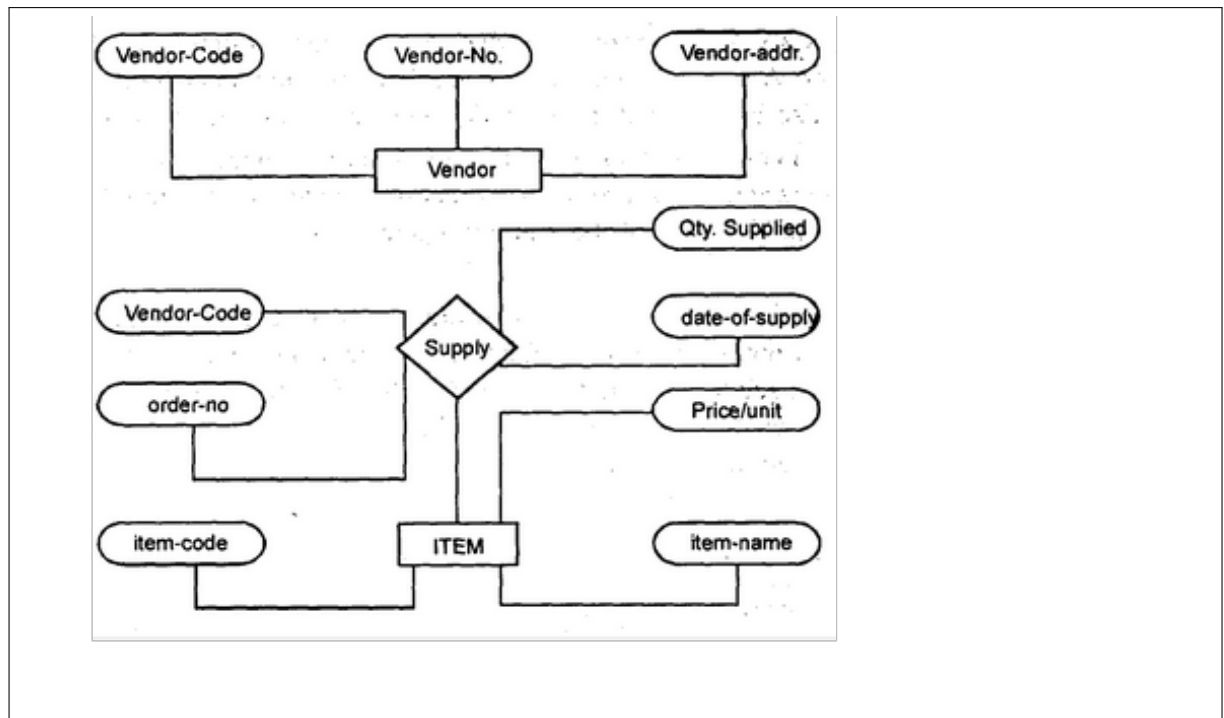


Figure 7.2: ERD diagram

COMPOENT DESIGN

Algorithm used is Dijkstra's algorithm. Dijkstra's algorithm is an algorithm for finding the shortest paths between nodes in a graph, which may represent, for example, road networks. For a given source node in the graph, the algorithm finds the shortest path between that node and every other. [3]:196206 It can also be used for finding the shortest paths from a single node to a single destination node by stopping the algorithm once the shortest path to the destination node has been determined. For example, if the nodes of the graph represent cities and edge path costs represent driving distances between pairs of cities connected by a direct road, Dijkstra's algorithm can be used to find the shortest route between one city and all other cities. As a result, the shortest path algorithm is widely used in network routing protocols, most notably IS-IS and Open Shortest Path First (OSPF). It is also employed as a subroutine in other algorithms such as Johnson's.

Explanation:

The cost which we will be using will not just be the cost of the path but the added priority of the product

The cost = distance + PriorityMappedValue(dependent on product)

So the product with highest priority that is which is higher demand will be given lower value which will reduce the cost and that path will be preferred

Accordingly we can calculate and let the vendor know which machine he should approach first

Class Diagram

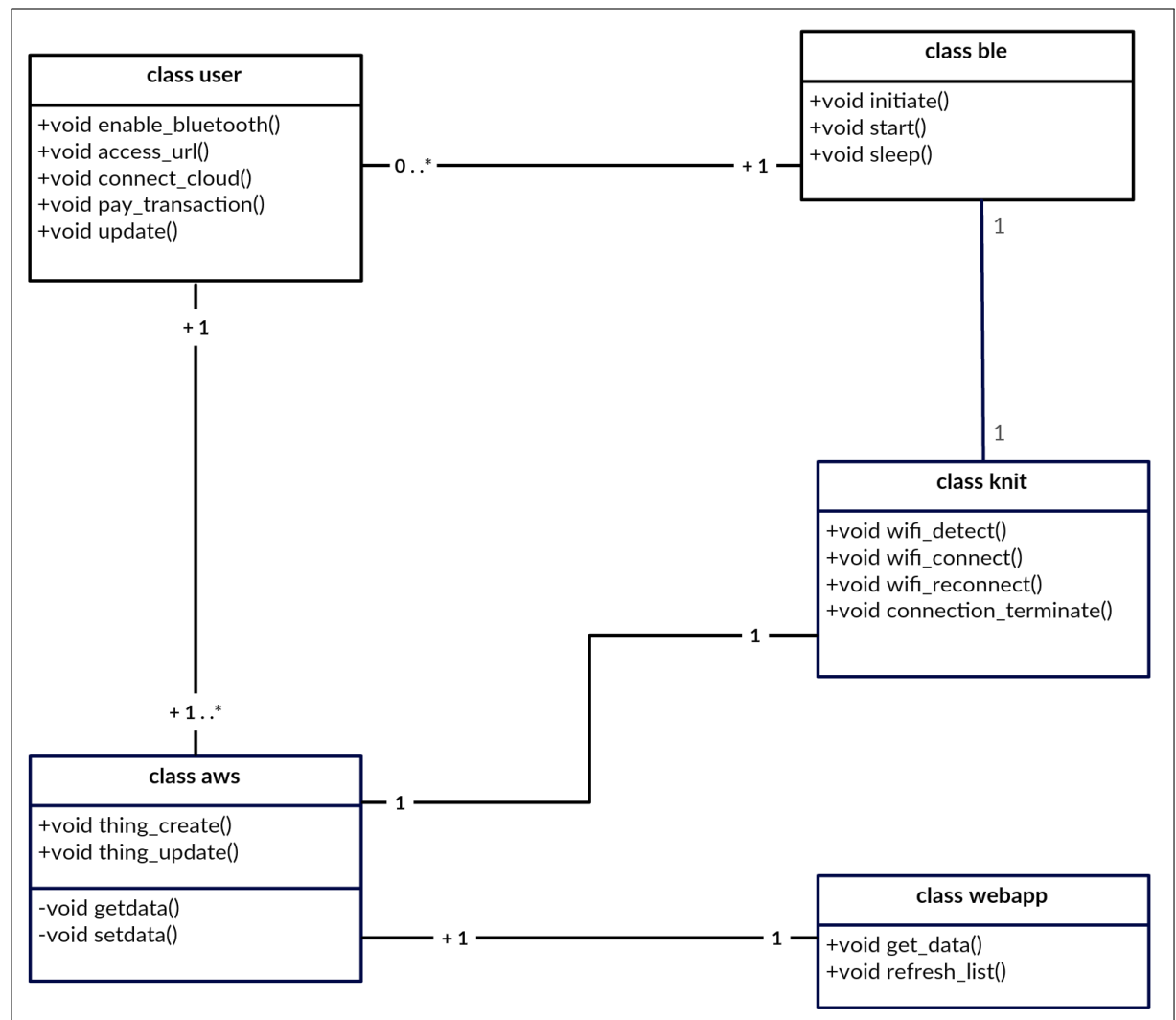


Figure 7.3: Class Diagram

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SUMMARY AND CONCLUSION

We expect to learn web bluetooth technology and its applications .Also to learn how a actual product is launched and how to take care of the finished product delivery. Steps in beginning of this project from collecting the vendor requirements to take care of the user test cases involved and then simulatng the environment to predict future risks and then applying Risk Management on it .

ANNEXURE A

LABORATORY ASSIGNMENTS ON

PROJECT ANALYSIS OF ALGORITHMIC

DESIGN

To develop the problem under consideration and justify feasibility using concepts of knowledge canvas and IDEA Matrix.

Refer [?] for IDEA Matrix and Knowledge canvas model. Case studies are given in this book. IDEA Matrix is represented in the following form. Knowledge canvas represents about identification of opportunity for product. Feasibility is represented w.r.t. business perspective.

I	D	E	A
Increase	Drive	Educate	Accelerate
Improve	Deliver	Evaluate	Associate
Ignore	Decrease	Eliminate	Avoid

Table A.1: IDEA Matrix

Project problem statement feasibility assessment using NP-Hard, NP-Complete or satisfy ability issues using modern algebra and/or relevant mathematical models.
input x,output y, $y=f(x)$

ANNEXURE B

LABORATORY ASSIGNMENTS ON

PROJECT QUALITY AND RELIABILITY

TESTING OF PROJECT DESIGN

It should include assignments such as

Use of divide and conquer strategies to exploit distributed/parallel/concurrent processing of the above to identify object, morphisms, overloading in functions (if any), and functional relations and any other dependencies (as per requirements).

It can include Venn diagram, state diagram, function relations, i/o relations; use this to derive objects, morphism, overloading

Use of above to draw functional dependency graphs and relevant Software modeling methods, techniques including UML diagrams or other necessities using appropriate tools.

Testing of project problem statement using generated test data (using mathematical models, GUI, Function testing principles, if any) selection and appropriate use of testing tools, testing of UML diagram's reliability. Write also test cases [Black box testing] for each identified functions.

Additional assignments by the guide. If project type as Entrepreneur, Refer [?],[?],[?], [?]

ANNEXURE C

PROJECT PLANNER

Using planner or alike project management tool.

ANNEXURE D

REVIEWERS COMMENTS OF PAPER

SUBMITTED

1. Paper Title: Physical Web with Vending Machine
2. Name of the Conference/Journal where paper can be submitted : Physical Web in Smart Cities - Advances in Wireless and Optical Communications (RTUWO), 2015
On physical web models - Control and Communications (SIBCON), 2016
International Siberian Conference Finite state machine based vending machine
International Journal of VLSI design and communication system 2012.
3. Paper accepted/rejected : Not applied yet.
4. Review comments by reviewer : not yet applied
5. Corrective actions if any : not yet applied

ANNEXURE E

PLAGIARISM REPORT

Plagiarism report