

**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)**

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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 her for her 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.)

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# **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)**

IOT, Cloud Computing, Cloud based storage, Web Application, Web Services, Web based interaction, 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 difficult 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 the users are notified about the presence of the vending machine in nearby area 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.

1. **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.
2. **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.
3. **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

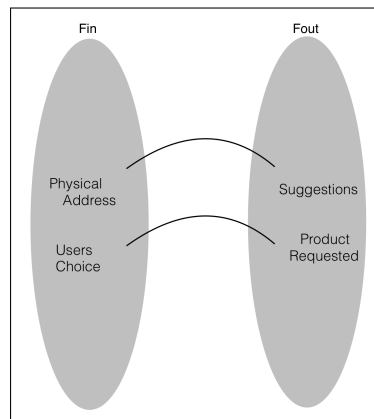


Figure 1.1: Function Diagram

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**

Journal of Internet Services and Applications

IEEE Cloud Computing

IEEE International Conference on Communications.

International Journal of Advanced Computing and Technology

## **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

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). While several solutions and commercial products have been introduced for one-hop Bluetooth communication, the problem of scatternet formation has not yet been dealt with. This problem concerns the assignment of the roles of master and slave to each node so that the resulting MANET is connected. In this paper we introduce two novel protocols for forming connected scatternets. In both cases, the resulting topology is termed a bluetree. In our bluetrees the number of roles each node can assume are limited to two or three (depending on the protocol), thus imposing low slave management overhead. The effectiveness of both protocols in forming MANETs is demonstrated through extensive simulations.

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

Today's manufacturing processes often lack visibility into resource consumption metrics, productivity, and even logistics. The end result is huge blind spots in the building process that often mean a lack of productivity and efficiency, leading manufacturing companies down unprofitable paths.

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.

In the service-oriented architecture (SOA), we distinguish three roles of service owners: service providers, service requesters, and service brokers. Each service provider publishes information to the broker about how requesters can interact with its service. Thus, the broker can assign a fitting service provider to a querying requester. We propose the information published to the broker to be operating guidelines. Operating guidelines are essentially communication instructions for the service requester. We present an automata-theoretic approach that is centered around operating guidelines and is capable of implementing all tasks arising in the SOA.

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

The Physical Web is a generic term that 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 and we will discuss them in our paper. 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. In this paper, we describe the existing models as

well as related challenges. In our analysis, we will target objects enumeration and navigation as well as data retrieving and programming for the Physical 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.

The AWS Cloud Transformation Maturity Model (CTMM) maps the maturity of an IT organizations process, people, and technology capabilities as they move through the four stages of the journey to the AWS Cloud: project, foundation, migration, and optimization. The objective of the CTMM is to help enterprise IT organizations understand the significant challenges they might face to adopt AWS, learn best practices and activities to handle those challenges, and recognize the signs of maturity or expected outcomes to gauge their maturity and readiness at every stage. This whitepaper can guide organizations to measure their readiness for the AWS Cloud, build an effective cloud transformation strategy, and drive an effective execution plan.

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.

Bluetooth (over IEEE 802.15.1), ultra-wideband(UWB, over IEEE 802.15.3), ZigBee (over IEEE 802.15.4), and Wi-Fi (over IEEE 802.11) are four protocol standards for short-range wireless communications with low power consumption. From an application point of view, Bluetooth is intended for a cordless mouse, keyboard, and hands-free headset, UWB is oriented to high-bandwidth multimedia links, ZigBee is designed for reliable wirelessly networked monitoring and control networks, while Wi-Fi is directed at computer-to-computer connections as an extension or substitution of cabled networks. In this paper, we provide a study of these popular wireless communication standards,



evaluating their main features and behaviors in terms of various metrics, including the transmission time, data coding efficiency, complexity, and power consumption. It is believed that the comparison presented in this paper would benefit application engineers in selecting an appropriate protocol.

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.

We study source coding in the presence of side information, when the system can take actions that affect the availability, quality, or nature of the side information. We begin by extending the Wyner-Ziv problem of source coding with decoder side information to the case where the decoder is allowed to choose actions affecting the side information. We then consider the setting where actions are taken by the encoder, based on its observation of the source. Actions may have costs that are commensurate with the quality of the side information they yield, and an overall per-symbol cost constraint may be imposed. We characterize the achievable tradeoffs between rate, distortion, and cost in some of these problem settings. Among our findings is the fact that even in the absence of a cost constraint, greedily choosing the action associated with the best side information is, in general, suboptimal. A few examples are worked out.

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.

Cloud computing has recently emerged as a new paradigm for hosting and delivering services over the Internet. Cloud computing 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. However, despite the fact that cloud computing offers huge opportunities to the IT industry, the development of

cloud computing technology is currently at its infancy, with many issues still to be addressed. In this paper, we present a survey of cloud computing, highlighting its key concepts, architectural principles, state-of-the-art implementation as well as research challenges. The aim of this paper is to provide a better understanding of the design challenges of cloud computing and identify important research directions in this increasingly important area.

## 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

### TimeLine Chart

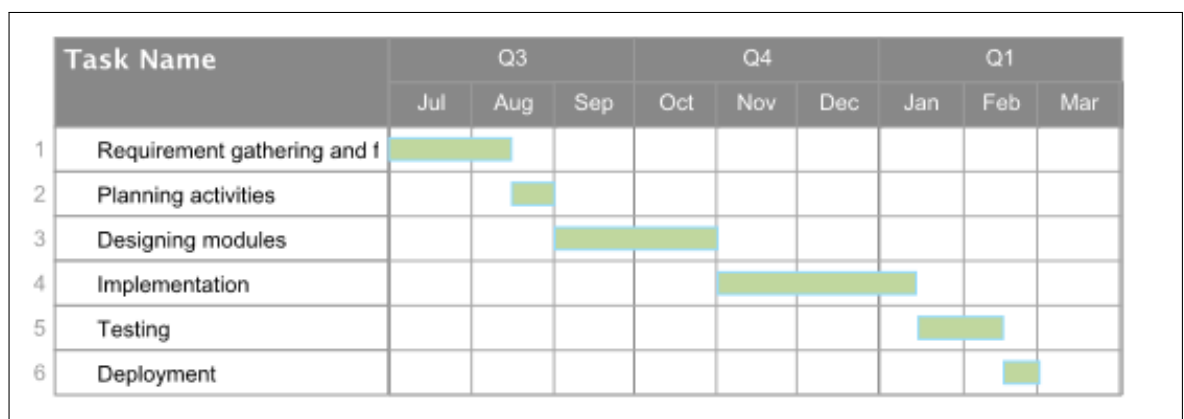


Figure 1.2: Timeline Chart

## **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

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

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## **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.

**Type of vending machine :** Product base. **Products:** Bisleri, CoCo Cola ,other beverages. **Device type :** Mobiles which support chrome browser (e.g.Android/ios)

**Limit of the project** will be internet dependency ,so better connection is required

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 aws iot 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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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.

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.

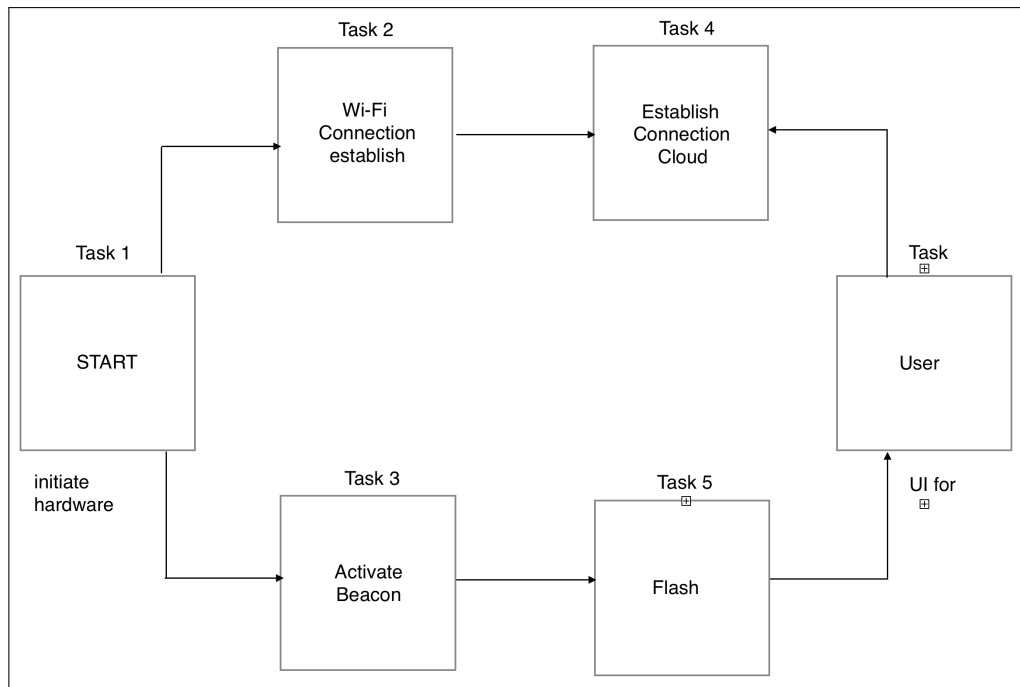


Figure 5.1: Task Network

## Timeline Chart

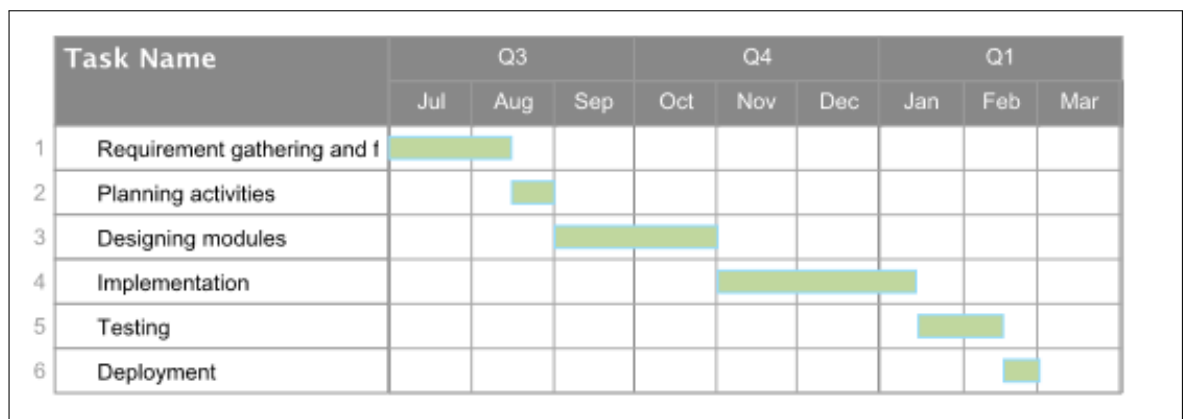


Figure 5.2: Timeline Chart

## 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

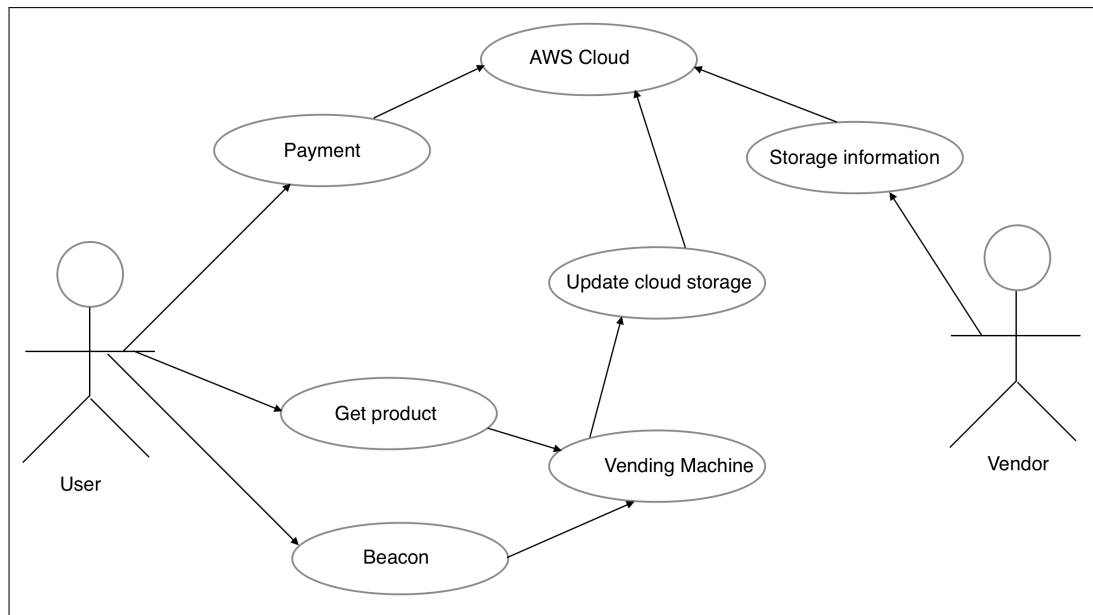


Figure 6.1: Use case diagram

## DATA MODEL AND DESCRIPTION

### Data objects and Relationships

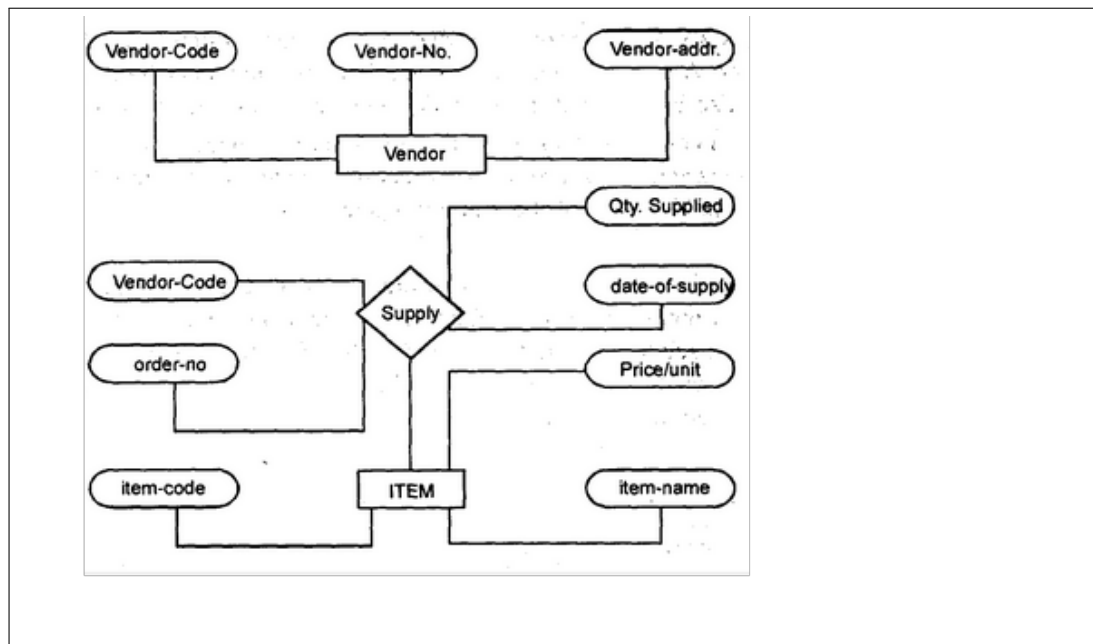


Figure 6.2: erd diagram

## 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.

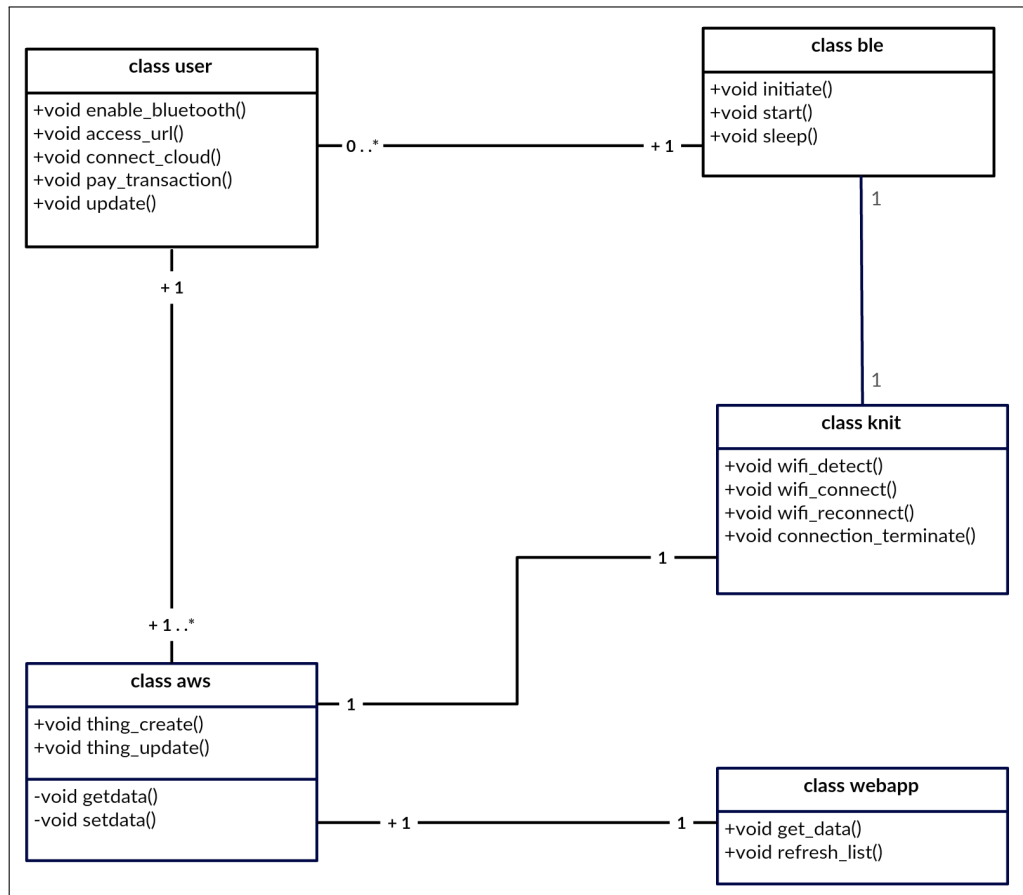


Figure 6.3: Class diagram

## **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:**

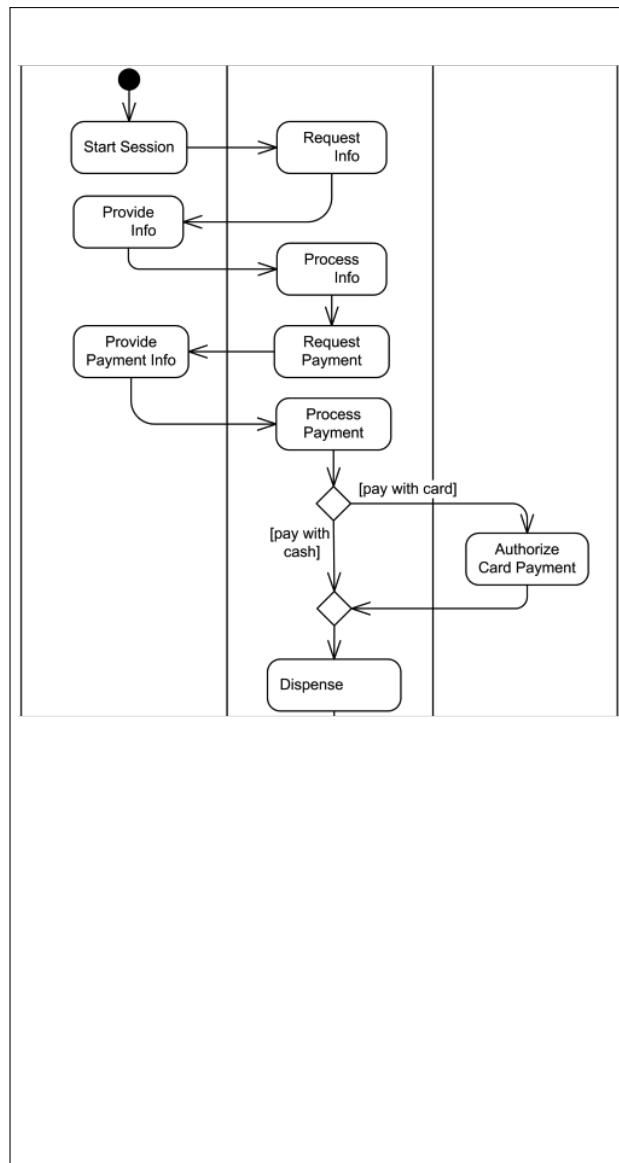


Figure 6.4: Activity diagram

### 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

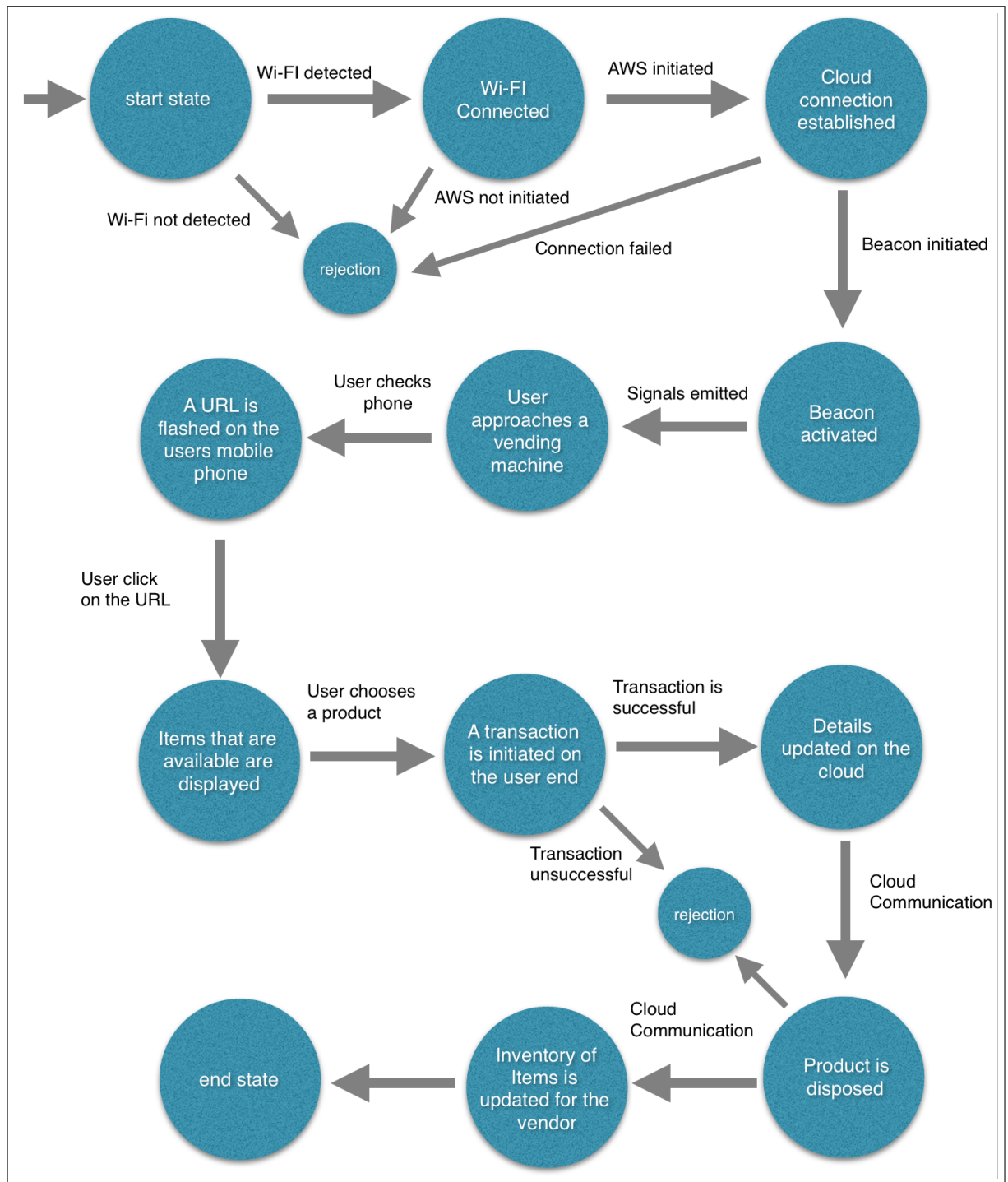


Figure 6.5: State transition diagram

## **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**

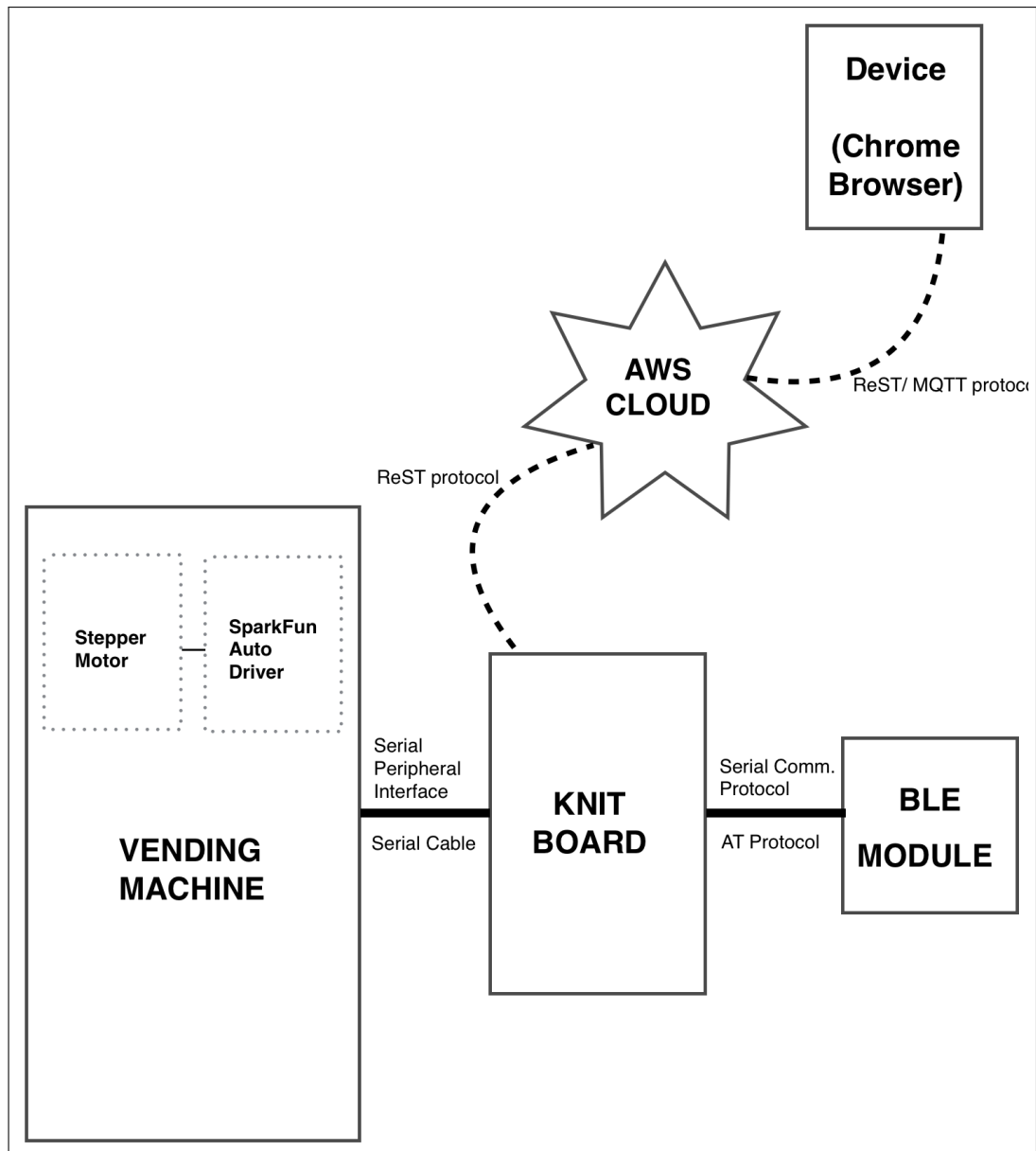


Figure 7.1: Architecture diagram

## 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 driv-

ing 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**

## **REFERENCES**

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.

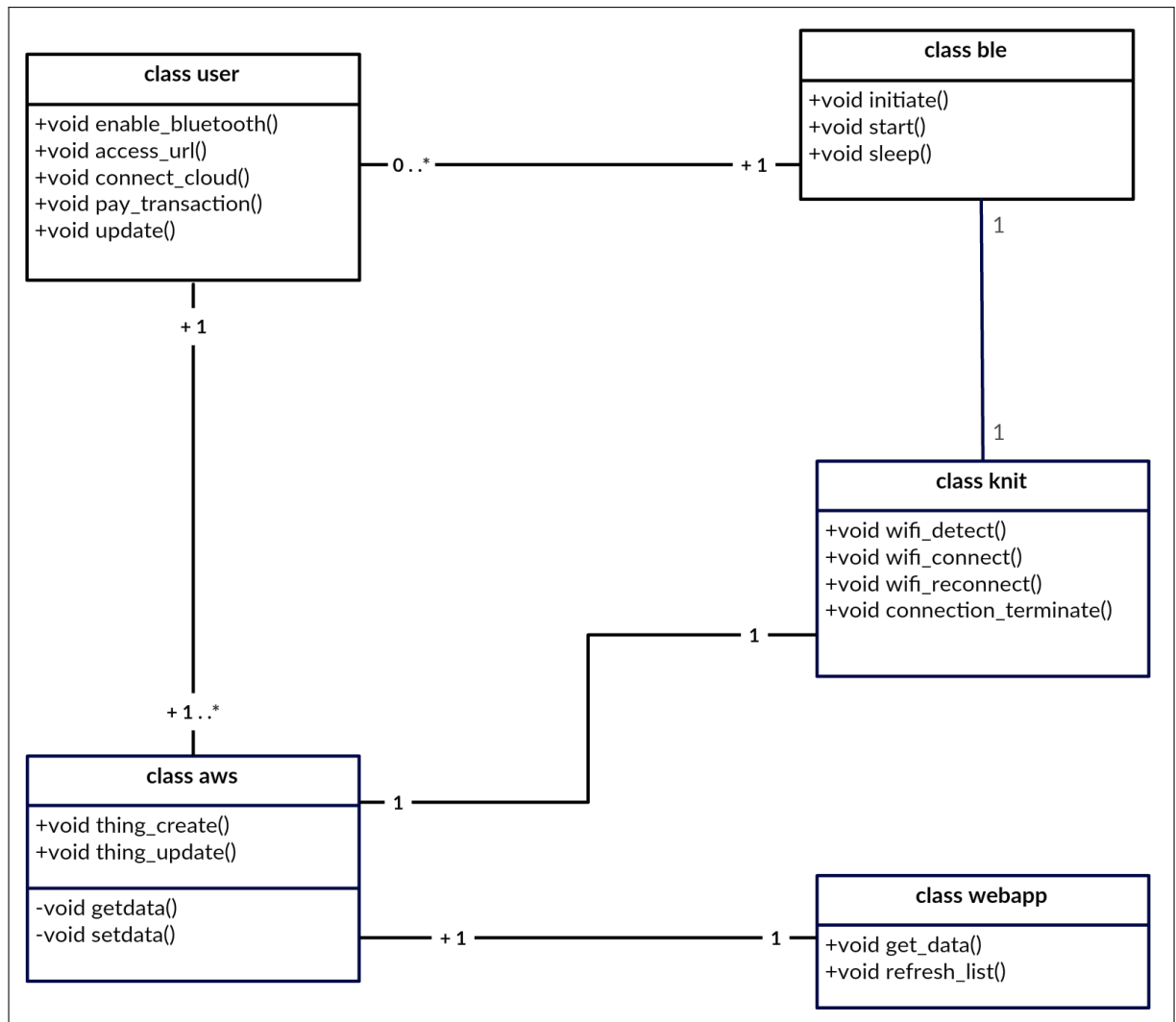


Figure 7.2: Class Diagram

4. Sneps-Sneppe, Manfred, and Dmitry Namiot. "On Physical Web Models." 2016 International Siberian Conference on Control and Communications (SIB-CON) (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.
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of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi.” IECON 2007 - 33rd Annual Conference of the IEEE Industrial Electronics Society (2007): n. pag. Web.

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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