CHAPTER 1

INTRODUCTION

1.1 PROJECT DESCRIPTION

Digital Transformation is riding the next wave of innovation in the retail industry. E- retailers are enticing the shoppers with 'anywhere any time' shopping, faster delivery, personalized offers, easy returns etc. and it is a growing threat to the brick and mortar stores unless they adapt to the technology musings of the digital world. To keep in pace with the technology advancements and increasing competition from the online space, retailers are now rethinking their in- store strategies. Since the visual and sensory experience that the shoppers will get through the physical stores cannot be replicated in e- commerce space with even the most sophisticated technology, retailers are exploring ways to optimize the in-store experience by enabling innovative technologies like Smart Shelves in retail stores.

'Smart Shelves for retail stores' is a IOT application that aims at implementation of Smart Shelves, the electronically connected shelves which can automatically keep a track of the inventory in a retail establishment. RFID smart shelf is a regular shelf with an associated antenna reader, eventually embedded in the shelf, which ideally allows to univocally detecting all the tagged items located on that shelf only. Extending this concept to every shelf in a store makes it possible to automatically locate and inventory every item.

Smart Shelves will implement wireless inventory control system that will be fitted with Antennas. The Antennas can be built-in the shelf itself or be installed under normal shelves. These Antennas should consistently notify the back-end system about the existing quantity of items on the shelves. These wireless devices will use RFID tags and readers to scan the products in the display and stock shelves and must alert store associates when product levels are running low or when a theft is detected. It will also trigger the back-end system about the items that do not belong to certain shelves as "misplaced items".

The Smart Shelves technology can be hugely beneficial for the retailers' selling experience. The smart shelf concept will enable the inventory and store executives to refill stocks from stock room as they get depleted from the store shelf, intimate the buying group about the demand and Out of stock situation. Inform warehouse / Direct shipment vendor for immediate replenishment. Smart Shelves should enable real time and accurate management of inventory data to empower retailers to optimize the in-store sales with the timely filling of stocks, review of items etc. Remote monitoring provision must help retailers to remotely keep a track inside the store and help in quickly identifying and fixing problems inside the store if any, before it impacts the customers.

In this age of technology proliferation and increasing demands from the customers, delivering an enriching customer experience is equally an opportunity as well as a challenge. Smart Shelves empower a retailer to deliver more focused and optimized shopping experience for the in- store retail customers. Smart Shelves technology enables the store executives to have a seamless

information exchange with various participants in the supply chain. Furthermore, it is capable of proactively avoiding "loss of sale" scenarios to a larger extent. Even in this era of digital revolution and internet, brick and mortar stores still continue to be relevant for retail shopping, because of the real time shopping experience it can provide is unmatchable with the e- commerce shopping experience. Unique and optimized in-store experiences enabled by technologies like Smart Shelves, where technology and operations go hand in hand, can lure even more customers back to the stores, thereby re-enforcing the significance of an Omni channel retail experience.

1.2 COMPANY PROFILE

Company Name: Robert Bosch Engineering and Business Solutions Private Limited

Company Address: Cyber Park, No. 76, 77,
Dodathogur Village, Electronic City, Phase 1,
Bangalore- 560100

Website: http://www.bosch-india-software.com/

Founder: Robert Bosch

Head Quarters: Germany

Industry: Information technology and services

President: Vijay Ratnaparkhe ,Managing Director and president of Robert Bosch Engineering and Business Solutions Limited (RBEI) since 1st September 2010.

RBEI is a 100% owned subsidiary of Robert Bosch GmbH, one of the world's leading global supplier of technology and services, offering end to end engineering, IT and business solutions. Founded in 1998, the company has grown to over 15000 associates in 2015, becoming the largest software development centre of Bosch outside Germany and establishing itself as the 'Technology Powerhouse of Bosch' in India. The company has a global footprint with sales offices in North America, Europe and Asia Pacific regions. With eight avant-garde development centres spread across Bangalore and Coimbatore in India, Ho Chi Minh City in Vietnam and Guadalajara in Mexico, it nurtures, build and sustain enduring customer relationships to enable direct operational and strategic benefits. This is realised through qualified, motivated and flexible professional associates, who uphold the heritage and values of Bosch, marked by quality, reliability and innovation to enhance the interest of our customers and the community lived in.

Bosch Engineering and Business Solutions through the years has been loyal to the fundamentals that drive the Corporate Social Responsibility (CSR) charter. The Social Responsibility charter is aligned to their vision towards extending 'Smart Solutions' to create long lasting value to the society.

CHAPTER 2

LITERATURE SURVEY

2.1 EXISTING AND PROPOSED SYSTEM

EXISTING SYSTEM

The past two years have witnessed an explosion of interest in radio-frequency identification (RFID) and supporting technologies, primarily due to their rapid expanding use in tracking grocery products through the supply chain. RFID technology is expected to improve automation, inventory control, and checkout operations in stores, factories, and warehouse [1]. Currently, supermarkets and other retailers across the world are planning large-scale item-level deployments of the RFID systems for consumer goods. Leading retailers such as Wal-Mart, Marks & Spencer, Tesco, Metro, Coles Myer and Mitsukoshi etc. are implementing RFID solutions for their supply chain management [2][3]. The increasing demand spurs the development of so-called "RFID Smart Shelf". Besides for retail application, smart shelf is also expected to be applied in libraries to manage large volumes of books and other media, in pharmaceutical industry to track and monitor the tagged bottles, and in offices to manage important documentation[4].

For item-level tracking and management in short distance, near-field coupling is the most straightforward approach because of the limited detecting range. RFID technology enables detection and recognition of tagged items, which associate an object to an univocal identification code [5][6]. In a preliminary development stage, RFID technology was mainly applied to access control and inventory management. However, the advantages of this technology rapidly extended its applicability to other areas like object location [7]. RFID technology world assigned frequency band from HF up to microwaves. At ultrahigh frequency (UHF), the usable band ranges from 860 to 960 MHz [8]. In fact, in order to be compatible with mobile communications assigned bands, the International Telecommunications Union (ITU) has allocated for RFID three different intervals of the UHF band for different world regions. In general, UHF RFID tags cover the widest range of applications and its unit cost is the lowest [9]. Tag cost is a critical issue for retail store RFID deployment; therefore, this work focuses on the UHF RFID band [10].

PROPOSED SYSTEM

A near-field UHF RFID has recently received a lot of attention as a possible solution for item-level tagging (ILT), the biggest market of RFID, where HF RFID has traditionally been used. The existing UHF RFID of far-field concept has several advantages compared to HF RFID but performance of UHF RFID is more susceptible to objects nearby tags [11][12]. In addition to that, UHF RFID may unintentionally detect some other tags in far-field region since the field region is not localized. So we think that UHF RFID is more suitable for pallet and case-level tagging, long range applications, than item-level [13]. However near-field concept in UHF is well established and is already used in a few areas of UHF RFID. UHF near-field RFID is increasingly popular for item-level tagging because the tag can be detected more consistently on various objects such as

bottles of water, garments, DVDs, and small items [1-3]. ILT RFID has special requirements making it different from other categories of RFID like pallets and cases. That is, tags must be small and be read among a number of closely spaced items [14][15]. Near-field UHF RFID means that the tag chip of standard Gen2 and reader system are used in the same way as far-field communication but the antennas for a tag and reader are designed to communicate by near-field coupling using electric or magnetic field [16]. The near-field RFID antenna is a key factor for UHF item-level tagging systems. The near-field reader antenna is optimized to read near-field tags placed on products with various packaging options. In this paper, the UHF near-field antennas of a reader and tag are designed and these are used for the application of an RFID smart shelf for wine management [17].

2.2 FEASIBILITY STUDY

Smart shelves in retail store is feasible technically, economically and operationally.

Technical Feasibility

The technical feasibility concentrates on the feasibility of system in terms of tools and technology & justify for exploitation of the technology so as to arrive at the solution for a given problem. The application uses node js to create REST APISs. Operates on a single-thread, uses an event-driven and a non-blocking I/O approach. Single thread is used to handle multiple concurrent requests. All long-running tasks (data access, input/output) are always executed asynchronously on top of worker threads[18].Node.js makes this type of concurrent programming easier to utilize. This model is highly efficient and scalable as Node.js is basically always accepting requests because it’s not waiting for any read or write operations. That makes it lightweight and efficient to support hundreds of thousands of concurrent requests.

The front end design is accomplished using Oracle JET. It is targeted at intermediate to advanced JavaScript developers working on client-side applications. It's a collection of open source JavaScript libraries along with a set of Oracle contributed JavaScript libraries that make it as simple and efficient as possible to build applications that consume and interact with Oracle products and services, especially Oracle Cloud services. Complete JavaScript development toolkit Leverages popular open-source technologies, Full lifecycle management for template based SPA, Built in accessibility support, Support for internationalization (28 languages and 190+ locales), Rich set of UI components, Advanced two-way binding with a common model layer, Powerful routing system supporting single-page application navigation, Smart resource management, Built-in mobile support[19].

Net beans IDE is used for development. NetBeans IDE is the official IDE for Java 8. With its editors, code analyzers, and converters, you can quickly and smoothly upgrade your applications to use new Java 8 language constructs, such as lambdas, functional operations, and method references. Batch analyzers and converters are provided to search through multiple applications at the same time, matching patterns for conversion to new Java 8 language constructs.

Economic Feasibility

The Economic feasibility concentrates on the varied expenses incurred by the organization in order to arrive at a solution for a given problem statement. This involves the cost of the code employed to arrive to the solution, external devices or hardware utility cost, resource cost & development time of the project.

Smart shelves for retail store is developed using free and open source technologies like node js, mongodb and oracle jet.. The IDE used in development is Net Beans, which is free. Thus Monitoring system is economically feasible as this is built (developed) using these free and open source technologies[20].

Operational Feasibility

The operational feasibility measures how well the planned system can solve the problems of prevailing system and falls exactly in the scope of project which is analyzed throughout the analysis part.

Smart shelf in retail store operationally feasible because it solves the traditional problems of out of stock challange and automates the whole process.

2.3 TOOLS AND TECHNOLOGIES USED

TOOLS USED

Microsoft visual Studio Code

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code.

IMPINJ READER

Impinj’s fixed and handheld RAIN RFID readers and antennas deliver visibility of tagged inventory and assets with the performance, quality, and reliability necessary for robust Item Intelligence solutions. Impinj Speedway readers are high-performance, enterprise-class fixed readers

NET BEANS 8.1

NetBeans is a software development platform written in Java. The NetBeans Platform allows applications to be developed from a set of modular software components called modules. Applications based on the NetBeans Platform, including the NetBeans integrated development environment (IDE), can be extended by third party developers

ORACLE JET

Oracle JET is targeted at intermediate to advanced JavaScript developers working on client-side applications. It's a collection of open source JavaScript libraries along with a set of Oracle contributed JavaScript libraries that make it as simple and efficient as possible to build applications that consume and interact with Oracle products and services, especially Oracle Cloud services.

TECHNOLOGIES USED

HTML

Hyper Text Markup Language, commonly abbreviated as HTML, is the markup language used to design front end for web applications. Along with CSS, and JavaScript, HTML is an essential technology utilized to design front end, as well as to design user interfaces for mobile[48].

CSS

Cascading Style Sheets (CSS) is a language used for applying style to the front designed by markup languages[49][50]. Although most of the time this is used to set the style of web pages or front end written in HTML and XHTML, the language can be set to any XML report, including plain XML, SVG and XUL, and is material to interpret in discourse, or on other media.

NODE JS

Node.js is an open-source, cross-platform JavaScript runtime environment for developing a diverse variety of server tools and applications. Although Node.js is not a JavaScript framework, many of its basic modules are written in JavaScript, and developers can write new modules in JavaScript.

KNOCKOUT JS

Knockout is a JavaScript library that helps you to create rich, responsive display and editor user interfaces with a clean underlying data model. Any time you have sections of UI that update dynamically (e.g., changing depending on the user’s actions or when an external data source changes), KO can help you implement it more simply and maintainable.

2.4 HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENTS

Reader: RFID Readers

Tags: RFID tags and Beacons

Antennas

VONET Wifi Bridges.

Processor: 64-bit, four-core, 2.5 GHz minimum per core(Minimum)

RAM: 16GB(Minimum)

SOFTWARE REQUIREMENTS

IDE: Net Beans (v8.2)

Database Server: Mongo DB (v3.2.9)

Operating System: Windows 8.1

Platform: nodejs, impinj reader.

Environment: Visual studio code.

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