

STOCKWATCH: A Web Product Management with Shelf Stock Detector System

Jonh Ray B. Medina, Jay Stein Jeremi P. Lacsamana, Vaughn Florenz B. Bustos, Eimanson C. Maybituin, Joshua Carl S. Palabasan

Abstract— The StockWatch is a web product management with shelf stock detector system, which was developed to ease the problems of some supermarket about the problem of products being out of stock with the use of IoT (Internet of Things) devices. The system aims to deliver product status reports automatically. The methodology used in developing the proposed system is Design Thinking, which is an effective method to develop the system required by the supermarket. In addition, the development tool of the system are PHP Laravel Framework, JavaScript and MySQL to store the data. The StockWatch have been developed successfully by satisfying the requirements of client.

Index Terms— Stocks Monitoring, Internet of Things (IoT), Web Application, Wireless Sensor, Tracking System

1 INTRODUCTION

In grocery shops, one of the most common problems is tracking of products inside the shelves. Employees sometimes tend to overlook of restocking products because they have to inspect every shelf now and then just to check on the availability of the products. This paper proposed a project that will reduce the supervising work of the employee in the supermarket which involved the checking of an available stock in every shelf of inside the supermarket by integrating an IoT device (Arduino Ultrasonic Sensor). The device will be inside the shelf and it will get the distance data of the product or the item then it will throw into the database. The data that has been thrown into the database will be the basis to notify the manager or supervisor if certain distance data in the stocks is met in a web application. IoT technology is the extension of Internet connectivity into physical devices and everyday objects. The ability of the system is to have a faster and easier way of accessing data and track products in a shelf. With this system, the supervisor will get a notification from the device whenever the supply of a product is running out. The general objective of the study is to develop a product stock detector management system that will notify the grocery shop manager and supervisor if a product needs to be restocked. The system will eliminate the out-of-stock products creating holes in shelves or display unattractive presentation for customers and to help merchandiser daily work. This system is an alternative way of a supermarket to solve the problem in in monitoring the stocks of each shelf. StockWatch will also help the customer to eliminate looking for the items they had planned to buy or moving to another store to find their desired item which leads to loss of sales on the part of the organization. It will also help the organization to reduce human errors when it comes in monitoring the available products. The shelf detector is embedded into the web application which will keep track the available product using Internet of things because it

provides safety and comfortable living for a human.

RELATED LITERATURES AND STUDIES

To help enhance and improve the idea of the StockWatch based on the demand in the Information Technology trend, this section will discuss the studies or literatures conducted with the researchers.

Stock Management System

Stocks Monitoring Management System is needed by the organization to reduce human errors when using traditional way of managing the inventory of the organization. It also reduces the work done by the employees which causes the organization to perform efficiently (Hooi et. al., 2013). Other provides a Stocks/Product Monitoring Management System by implementing an inventory system which has an Internet of Things (IoT) integrated technology by using RFID which tracks the data in the inventory (Ravinchandra et. al., 2016). Without Stocks/Product Monitoring Management System stock monitoring in the organization will take so much time and the possibilities of encountering Out-Of-Stock products will increase. The challenges that Stocks Monitoring Management System with IoT integrated technology faces are when there is no internet, the system will not function properly (Moorthy et. al., 2017). The hardware used to the proponent's proposed system is the Raspberry Pi as the micro-controller which controls the ultrasonic distance sensor (hc-sr04) integrated with the proponent's proposed system (Zhang et. al., 2016).

Internet of Things

Internet of things provides safety and comfortable living for a human. Internet of things also generates business opportunities (Singh&Singh, 2018). With Internet of Things we can have smart watch, smart car, and smart city (Sriram, 2015). Others used IoT for their business like a smart warehouse with IoT supported Inventory Management system (Yerpude& Singhal, 2018). Without Internet of Things is like a world without oxygen. Everything that has monitor and remote control is related to IoT. Imagine a world without traffic lights, tv, air condition, a patient that need their heart rate to be monitored, and smart phones. The security is the biggest challenges of IoT. These are related to authorization, access control, and authentication (Elkhodr et. al., 2014).

Wireless Sensors

Shelf Detector system is needed by the organization to solve the problem of shelf being Out-Of-Stock which causes customer to take too much time looking for the items they had

- *Jonh Ray B. Medina is pursuing his Doctor of Philosophy in Computer Science at Technological Institute of the Philippines, Manila City, Philippines. Currently a full time professor of Angeles University Foundation under the College of Computer Studies.*
- *Jay Stein Jeremi P. Lacsamana , Vaughn Florenz B. Bustos, Eimanson C. Maybituin , and Joshua Carl S. Palabasan are graduate of Bachelor of Science in Information Technology at Angeles University Foundation, Angeles City, Philippines*

planned to buy or moving to another store to find their desired item which leads to loss of sales on the part of the organization (Frontoni et al., 2014). Other provides solution with regards to parking space problems by using sensor that detects the availability of the parking space embedded in a Smart Parking System (Rahman & Bhoumik, 2019). Without Shelf Detector System it will be difficult to the store person to check every single product in a shelf that will cause the shelf to be in the state of being Out-of-Stock (Dhiman & Raina, 2017). One of challenges of Shelf Detector System is the capability of this system to gather real-time data (Vilayatkaret al., 2019). The project that the proponents aim to implement also uses Raspberry Pi to be the microcontroller as well as the ultrasonic distance sensor as the product detector (Lee et al., 2015).

Web Application

Web application helps reduce the amount of time to access application content, buy product, transfer money, and manage business from anywhere (Kaur & Bhanu, 2018). Web applications perform useful tasks that helps its user and it has cross platform compatibility. (Sharma et al., 2016). Without web application an IT department or business will have a hard time and disrupt users when changing version of their application. It can also cost more rather than saving (Kiruthika et al., 2016). In recent years more and more hackers are targeting web applications. Huge data being used online exposed number of vulnerabilities like fraud and online attacks (Yadav et al., 2018). Having a well secure web application plays a huge role in the company because nowadays they usually depend on websites to manage their businesses. In order to do have well secured website it requires an extensive knowledge and planning in developing the application. Common problems for web applications are dealing with bugs, because bugs have the possibility to leak information about the system. Businesses that uses web application main problem is being vulnerable to security, so focusing more on the security development of the website will avoid from security threat (Alzahrani et al., 2017).

Tracking Systems

As we all know the use of traditional method of tracking information which is using pen and paper to list down all the data gathered inside the organization takes so much time and prone to human errors that's why it is important to have a computerized tracking system that can ease and reduce human errors and have a more precise and efficient data gathering (Abdulsada, 2017). Others provide tracking system by listing all the data gathered in the database which can be accessed on the web or mobile applications (Alrifaie et al., 2019). If there is no computerized tracking system data gathering maybe difficult because information gathered may change at some point (Kim et al., 2015). One of the challenges of tracking systems is the security and how will the organization obtain the trust and loyalty of the client (Frontoni et al., 2019).

METHODOLOGY

Design Thinking

The methodology that has been used in developing the system is design thinking methodology because it is used to solve encountered problems and find solutions to the problems. This methodology involves the logical imagination and experiences to create the possible outcome that the

users will benefit. The stages of the design thinking are "Empathize" is to understand the to understand a problem on how it occurs and how to solve it also gain deeper knowledge on people who are experiencing the issues and problems. The second stage is to "Define" which is to analyze all the data and information collected the define stage helps the researchers to understand the pain points and challenges of the participants and users. The third stage is to "Ideate" in order to generate multiple ideas because we already know and understand the user's needs in the first two stages. The fourth stage is to "Prototype" stage is experimental to find the best possible solution for the problem. The prototypes must also be simple so that it can be produced faster and not waste time. Then the fifth and final stage is to "Test" which is to test the system by the participants and users to identify if the solution is effective or not and if it does need improvement and in order for the users to criticize the product itself.

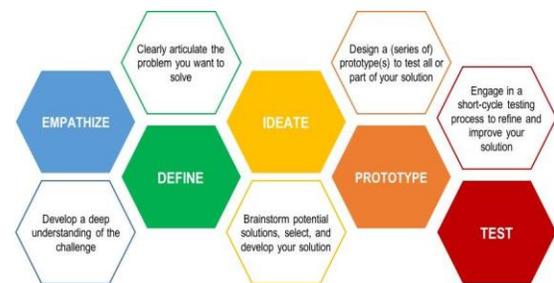


Figure 1. Design Thinking Framework

Survey Result Discussion

Surveys and Interview approach was used, because this technique primarily must gain an understanding of the grocery shops that sometimes merchandisers are having hard time to regularly check the current stocks of products. We gathered our observation and ideas to seek information that can be used in the development process. The methods were chosen because it enables the researchers to establish a relationship with the grocery store vendors and grocery shoppers, therefore, gain their response and cooperation. Based on the researcher's interviews, the information provided is that running out of stocks in grocery shelves is common that can lead significant reduction of shoppers and consequent drop on sales. It was also mentioned, that the man power of grocery store is lacking because merchandisers are always busy checking and restocking of products.

1. Likert Scale- The proponents used Likert Scale System to get the tallies of the questions and given weight as
2. Weighted Mean- The proponents used this weighted mean to get the average result of each answers based on the questions.

RESULTS AND DISCUSSION

Our first objective is to develop a module that control the stock management and provides a good customer satisfaction by lessening out of stocks products at grocery racks. The problem was solved by creating a website to monitor the products and eliminate out of stock shelves and adding hierarchy of users. Another objective is to create a new smart way to monitor the products. This was solved by using raspberry pi as the

microcontroller and ultrasonic sensor as the distance sensor. The sensor is connected to a breadboard and microcontroller, the idea behind the project is that a specific distance is assigned to the sensor and will stop sending data if that specific distance is acquired. In this way if the sensor detected that the product is out of reach depending on the specified distance, it will send a notification to the website that the product needs to be restocked. Another objective is to develop a system that eliminates the out-of-stock products creating holes in shelves or display unattractive presentation for customers. The problem was solved by adding and introducing Internet of Things because IoT provide different kinds of uses like wireless networks and sensors. Our next goal is to design a module that will help the employees daily work by sending notification to the manager or supervisor if the product is about to run out of stock. We solved this by creating a tracking system. In this way, the merchandiser does not have to check the products in shelves every now and then because the manager and supervisor can just easily command an employee to restock a product after they received the notification through the website.

Survey Results

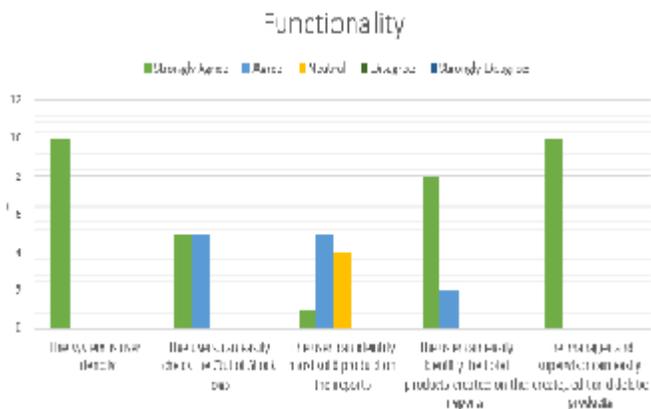


Figure 2. Website Functionality Test Results based on Surveys

Based on the surveys feedback during the testing stage the figure 2 shows the percentage of the evaluations to the website functionality questions. The first criteria received 10 Strongly Agree rating. The second criteria received 5 Strongly Agree and 5 Agree rating. The third criteria received 1 Strongly Agree, 5 Agree and 4 Neutral rating. The fourth criteria received 8 Strongly Agree and 2 Agree rating. The fifth criteria received 10 Strongly Agree rating.

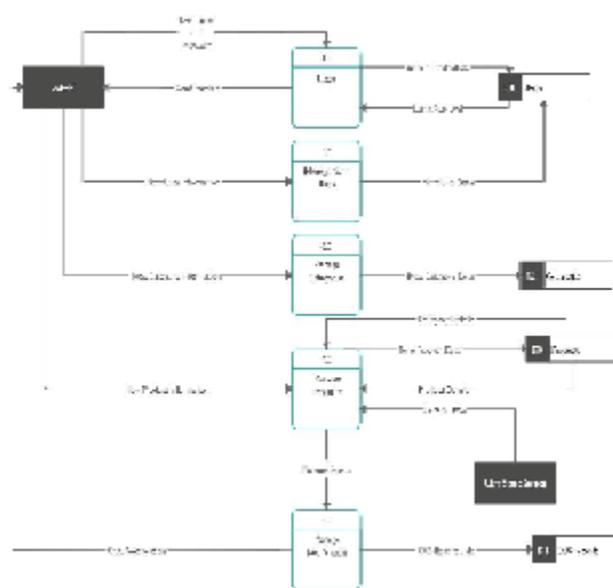


Figure 3. Device Functionality Test Results based on Surveys

Based on the surveys feedback during the testing stage the figure above shows the percentage of the evaluations to the device functionality questions. The first criteria received 4 Strongly Agree and 6 Agree rating. The second criteria received 10 Strongly Agree rating. The third criteria received 10 Strongly Agree rating.

Data Flow Diagram

In order to develop the web application which is connected in the shelf detector, figure 4 was used to keep track the flow of the system.

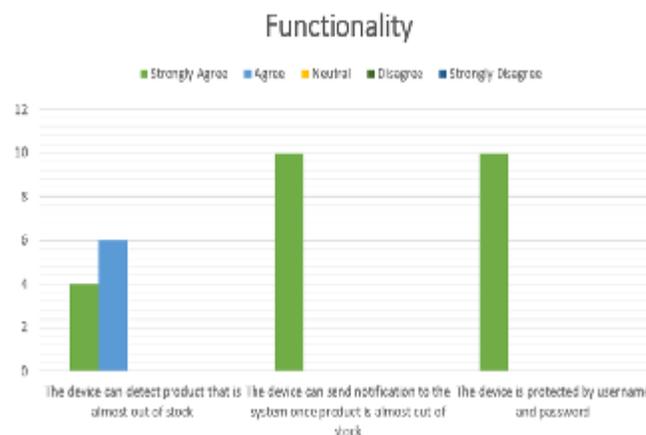


Figure 4. Stockwatch Data Flow Diagram

Product Monitoring Shelf with Raspberry pi and Ultrasonic sensor

The figure 5 is the prototype of shelf detector system which will track to monitor the available stocks inside the shelf in a retail store. This device will also send information to the web application then the user such as the supervisor or manager will see the available stocks.

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