(Research Article)

Well Turned-out Vending via IOT

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Abstract

This Research Paper describes smart retail based on the IOT (Internet of Things). Today, inventory management is becoming more complex. The biggest problem faced by the store owner is increasing sales and reducing operating costs. Not only the store owner, but also the customer, may face a problem with product finding and product unavailability. To solve this problem, we use IOT technology. IOT aims to integrate networked information systems with real world entities. It connects objects like smart phones, sensors with the cloud where the data is stored. With the help of this system owner can maintain inventory information also place inventory order. The customer can easily see the product information like expiration date, price, nutrients, etc. They can also see if the product is available in store or not. The customer can also share the sales list with other people and receive notification of offers.

Keywords: Internet of things, RFID Technology, Smart Phones, Cloud platforms, Data mining

1. Introduction

The Internet of Things (IOT) is widely accepted in various areas of life. The Internet of Things forms a network of interconnected objects capable of communicating with other objects in the network. IoT is a system of interdependent computing devices, digital machines, objects which are provided with a unique identifier and which have the ability to exchange data on IoT devices without requiring human or machine interaction. Trust is the main factor that allows IoT devices to function properly in the physical world or in the cyber world. There are a large number of applications being developed as part of the IoT tree, including eHealth, smart city, city air pollution control, etc. [5].

With the development of our society, the supermarket is part of our daily life. Due to the wide variety of products on the market, we can buy anything we want. Customers can waste a lot of time looking for what they need. The program aims to enable customers to experience the convenience that the intelligent supermarket Internet of Things has brought to people's lives and to understand what the Internet of Things is and how it really and truly affects the people's lives. In the smart supermarket, we will never hear customers complaining about standing in line to shop and order. [6].

RFID technology, at the heart of IoT, serves as the link

between process flow data and physical asset data. All physical asset data can be associated with process nodes-based RFID. For example, machine tools equipped with RFID can monitor data from physical assets. As for the operating mechanism, RFID tags are attached to the products. [1].

2. IOT Component

2.1 Sensors: Sensors are the eyes and ears of the system as they detect the occurrence of events, the surrounding conditions and transmit the collected information. The job of sensors is to monitor and perceive events or phenomena that take place in the physical world. Each sensor can be classified based on three parameters, namely sensor type, methodology and detection parameters. The type of sensor defines what type of sensor it is, that is to say whether it is a homogeneous or heterogeneous sensor or a one-dimensional or multidimensional sensor. The methodology talks about how a sensor collects information. It can be active or passive in nature. Detection parameters are the number of parameters that a sensor can detect.

2.2 Gateway: All the information that has been detected and collected by the sensors is transmitted to the gateways. Gateways act as a common point of contact in which various types of information from heterogeneous types of sensors are collected. The gateway is responsible for the global addressing of each store using IPv4 addresses. Each gateway is assigned a coverage area, in which each store has been assigned an IP address, thus facilitating the efficient

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identification of the products sold in that store. Each gateway is assigned more than one store to improve the granularity of store identification. The gateway also keeps track of its neighboring gateways as well as the total number of stores operating in its area. Finally, the gateway transmits all forms of unstructured information to the following cloud servers.

2.3 Cloud: It acts as a storage and processing unit for the entire system. All requests from the client are addressed to the cloud level [6]. It also keeps track of all the stores located in a shopping complex as well as the details of each product available in the respective stores. It maintains a database where information relating to each product such as product identifier, product name, date of manufacture, name of manufacturer, product cost, any special discounts offered on that product, shelf life, payment information and its RFID tag serial number. . During the process of purchasing a product, scanned serial numbers are sent to the cloud along with their payment details. Once the purchase is made, RFID readers are notified and prompted to update the product status of the respective products.

2.4 Mobile Device: He acts as a representative of a client. It is the mobile device that allows the customer to search and buy products in real time. Any notification or special offer relating to a particular product is communicated directly to the mobile device pending an appropriate response [2].

3. Existing System

In the mall, the retailer has to go and check the quantity of the products after a certain time. If the product in the supermarket is out of stock is not recognized by retailers until they check out, that is why the great loss of retailers and this process requires staff. For customers as well, if they want a product, they will go to stock and check the availability of the products, which takes time. Plus, they didn't know the real price, nutrition, expiration date before going.

This project aims to develop an IOT system that can be controlled remotely using an Android application. It includes automatic inventory management with a load sensor and RFID tag attached to it.

4. Literature Survey

4.1 RFID-based production data analysis in an IoT-enabled smart workshop: In this Research Paper, RFID is used to analyze production in an IoT-enabled smart workshop. In manufacturing environments, production and production transparency are carried out. It generates increasing production data which is sometimes discrete, uncorrelated and difficult to use, so the RFID based production data model is built to formalize and correlate heterogeneous production data. With this, evaluate the execution of the process control

as the RFID tags are attached to the WIPs (Work in Progress) to form intelligent WIPs.

4.2 Interactive shopping ecosystem based on IOT: In this Research Paper, an interactive purchasing model with a merger of IOT and cloud computing and provides efficient product access, control and monitoring. The goal of the system would be to create an interactive shopping ecosystem where customers don't need to waste time researching a particular product. The system would serve as a guide for the client.

4.3 Real-time shopping improvement and acceleration using indoor map, smart suggestions and calculations, based on a Smartphone app1: This document focused on real-time shopping and would guide customers to quickly track the goods they want in a store. The customer also has an interior card. Suggestions based on customers' buying habits, shelf location and total product price calculated before going to the counter would be provided to improve the customer shopping experience as well as product promotion. in store, regardless of the update required by the retailer.

4.4 Cloud-based online retail management framework: a different look: This paper is to give such a platform for a salesperson where they can set up their stores and deal with customers according to them. This website will act as the cloud to store store information where customers can search the store details they want.

5. Proposed System

The main goal of the project is to use IOT technology to solve the real-life problem of the retailer and the customer using the Android app. In the proposed system, retailers know that the quantity of product remains on the market. Basis of this If the products are less in quantity, we send a warning message to the retailer office to reload the products or order a new one from the seller. Next to the customers there is an app that will help detect whether the product is available or not and, if available, it shows the actual price, nutrition, expiration date, etc. related to this product, which saves the customer time.

In the proposed system, if the product is less in quantity, the system gives a warning message to the server or to the administrator and the server receives the warning message and takes the necessary measures. If the product is lower, the admin fills it, otherwise he gives the order for a new product. It also gives the system map which will help the customer to find the product and buy it. For the customer it also gives an option like the list, discount, which helps the customer to list the products that want to buy by them also the customer creates his own list. The administrator may have the right to add or remove products from the supermarket. Which will update instantly in the mobile app?

6. System Architecture

Figure 1. System architecture

Figure 1 shows the Software architecture of the system in this two input are given to arduino UNO from HX711 and RFID Reader where Load Cell give analog input to HX711 and it convert it into digital and give to arduino and RFID tag give information about product to RFID reader and it give to arduino. This all information process by arduino processor and using WiFi Module it store on Cloud.

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In this mobile device, use to control the mobile app which handles the simple operation on customer side, such as view product list, view product map, search product, product nutrition, product expiration , etc. everything related to the customer. Using this customer, create their own product list and also see the product's discount rate.

For administrator login they perform different application like add or remove product, see user list , keep track on product purchase, etc.

The mobile application also gives a warning message if the product is less in quantity and after receiving a warning message the administrator passes the inventory using the web server. To order, they use the web server. The web server displays detailed information about all products connected to the cloud. This system architecture is based on arduino input gain and provides output by arduino after some operation. If any hardware fails between processes, it will affect the system and deliver wrong information to the cloud. This bad information access by Android device and web server and perform an operation on this bad information. For this it is necessary to always keep track of the properly maintained hardware device.

7. Flow Diagram

Figure 2. Flow diagram

7.1 Customer: The customer is the most targeted user of this system. The application is designed by targeting the customer. The client can perform the following operations: [3]

- Make a list of items.
- Consult the list.
- Look for products in store.
- Get product details.

7.2 Retailer: The administrator has a privilege database. The store owner must access and manipulate the admin and he performs the following operation. [3]

- Login
- Manage the administrator profile
- Add/Delete/Update Product.
- Logout

8. Implementation

8.1 Microcontroller - Arduino UNO: Arduino Uno use for building Digital devices and interactive objects that can sense and control objects in the physical world. It has 14 Digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

8.2 ESP 8266-01 (Wi-Fi module): The ESP8266 WiFi Module is a self-contained with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

8.3 Load Cell: A load cell is described as a “weight measurement device necessary for electronic scales that display weights in Figure its.” However, load cell is not restricted to weight measurement in electronic scales. Load cell is a passive transducer or sensor which converts applied force into electrical signals. They are also referred to as “Load transducers”.

However, the only load cells which are prevalent are the load cells based on strain gages. The reason behind the wide adoption of strain gage-based load cells is their characteristics:-

Small size compared with other types of load cells. Long operating life due to lack of moving parts or any parts that generate friction. Ease in production due to small number of components.

8.4 HX711 (Weighting Sensor Module): Weight Sensor Module is based on HX711, which is a precision 24-bit analog-to-Digital convertor designed for weigh scale and industrial control applications to interface directly with a bridge sensor. Compared with other chips, HX711 not only has a few basic function, also contains high integration, fast response, immunity, and other features. The chip lowered the

cost of the electronic scale, at the same time, improving the performance and reliability

8.5 RFID Reader and Tag: RFID is an acronym for “radio-frequency identification” and refers to a technology whereby Digital data encoded in RFID tags or smart labels (defined below) are captured by a reader via radio waves. RFID is similar to barcoding in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. The most notable is that RFID tag data can be read outside the line-of-sight, whereas barcodes must be aligned with an optical scanner.

RFID signifies to tiny electronic gadgets that comprise of a small chip and an antenna. This small chip is competent of accumulating approx. 2000 bytes of data or information.

9. Algorithm

Function	Functionality
Start()	It marks the beginning of the whole system
Controller()	It orchestrates the flow of information and controls the Operation of the entire system.
Product_Info()	It is used to keep track of all information regarding a particular product such as product code, product price, product name, Price, product expiration date, etc. [2]

Mobile_Application()	This function represents the mobile application. All queries relating to research or purchase of a product are achieved by this function.
Reader()	Reader is read the product information.
Alert_Warning()	This function give alert message if product less in quantity.

Step 1: Start()

Step 2: Controller()

Step 3: Product_Info()

Step 4: Mobile_Application()

Step 5: Start() → Mobile_Application()

Step 6: Mobile_Application() → Controller()

Step 7: Controller() → Mobile_Application()

Step 8: Tag() → Mobile_Application()

Step 9: Mobile_Application() → Reader()

Step 10: Reader() → Controller()

Step 11: Controller() → Reader()

Step 12: Reader() → { Tag(), Alert_warning() }

Step 13: Alert_Warning() → Product_Info()

Step 14: Controller() → Product_Info()

Step 15: Controller() → Stock_Mgmt()

Step 16: Stock_Mgmt() → Investment_Ratio(), Order_level()

Step 17: Stop()

Step 18: End[2]

10. Advantage

- It reduces time and effort.
- User friendly.
- Easily access the product information.
- Cost efficient.
- It is feasible to use.

11. Limitations

- User must have an Android smart phone to use this app.
- The system depends on the news of the administrator to be always precise.
- The administrator must enter the valid username and password to log into the system.

- The administrator should update the system if necessary.
- User must be in business premises in order to receive live data via RFID tags (not applicable to current app version)
- The user's phone must have the ability to read RFID tags or they must have a device connected via the Internet in order to receive live data. [3].

12. Dependencies

- Most of the customers use Android smart phones.
- Most of the shop owners use Android smart phones.
- All users have the basic knowledge to operate a mobile smart phone.
- People would like to fit into the new technology without any hesitation.
- All users know the language English, as the User Interface will be provided in English.
- Most of the Android smart phones would have the facilities to run this application.
- The System can access the Database with ease.
- There won't be any issues in reading RFID tags.
- The memory load would be affordable by the memory card in the smart phone.[3]

13. Conclusions

This app automatically manages inventory which is very efficient for the store owner in an economical way. He will notify the store owner of the product when the quantity of the product is less so that he can refill that product in the rack. It can save human energy and time, and all the operations can be done by Android APP, which makes it very user-friendly.

With this app, the customer can easily see product availability and product information such as nutrients, price, quantity. Also seeing where the product is actually using the MAP function in the system which will help the customer guide the product path and save the customer time.

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