ESP-JETA
ESP Journal of Engineering & Technology Advancements
ISSN: 2583-2646 / Volume 2 Issue 2, April 2022 / Page No: 1-5
Paper Id: JETA-V2I2P101 / Doi: 10.56472/25832646/JETA-V2I2P101

Original Article

Automation of Shopping Mart by Self-CheckoutSystem using IOT

Aravinda Rajan V[1], Akshaya R G[2], Ligori Pastina A[3], Gowsalya S[4], Lavanya S[5]
[1]*Assistant Professor Dept. of Information Technology, KLN College of Engineering, Sivaganga-630612, Tamil Nadu, India.*
[2,3,4,5]*Student, Dept. of Information Technology, KLN College of Engineering, Sivaganga-630612, Tamil Nadu, India.*

Received: 31 March 2022 Revised: 08 April 2022 Accepted: 29 April 2022

Abstract: *Huge offers and discounts make more rush in markets and also social distancing is very important in this pandemic situation. In super markets normally customers get a trolley in which they put all the items intended to be purchased from different shelves. After putting all items in trolley, approach the counter for billing and it results long queues at counter. This project gives solution to reduce the manual work in billing and to automate the super market. To fulfil this, RFID tags, RFID reader(em18), web application are used for billing. Trolley consists of sensors like IR sensor (product detection), and RFID makes trolley smart. Loyalty card issued for regular customers. And the entry and exit areas also automated for theft detection. By this practice the problem of long queue on counters, social distancing, need for more number of workers will be solved.*

Keywords: *IR sensor, RFID reader, RFID tags, Servo motors, Web application.*

INTRODUCTION

IoT is a technology, where all objects are connected to the internet by exchanging information. IoT technology simplifies human work. It contains both software and hardware devices. These devices can share data with each other devices. Sensors and actuators play an important role in IoT. IoT is used in many fields such as healthcare, smart home and etc. In this paper we discuss on smart super market with self-checkout system based on RFID technology. Shopping malls are the most frequent place visited by people. Nowadays people prefer to do their work simply with tools rather than doing it themselves.

In all super markets carts are used to purchase the items which the customers want to buy. Smart trolley systems will reduce the customer's shopping time. Most consumers usually make a list with pen and paper while shopping. They have to spend more time to searching for items and paying bills in the billing counter. Waiting in the line can be make customers annoying and tiring. So, it is necessary to overcome this problem by using recent technologies.

Many super markets use barcode technology, mobile applications, Arduino, and RFID. Mostly barcodes are used in many stores today. Barcodes are the bars which stores the information about each product or item. In most of the projects ultrasonic sensors are used to scan the products by customers themselves. Product Id and other information are stored in the barcodes. Barcode scanners are used to scan the barcodes of each item. It could be very slower process than the RFID tags and reader. Cashiers must scan each barcode and generate bills and verify product specifications. Data can only be read and cannot be rewritten by using the barcode. Barcode scanner reads only one barcode at a time, and it contains very less information about the product. These barcodes can easily affect by the weather conditions and easily hacked by third parties. So, it is not much secured. Barcode scanner scans 10000 objects in 53 hours. Instead, RFID done this scanning in 2 hours. It takes a lot of time to scan items with a barcode scanner. In previous projects the LCD display is associated with the RFID cart. So, this is not user friendly. And there is no proper way for bill payment. It makes shops very noisy. Extra features are needed to improve this project as more user friendly and secure.

In this paper, for security purpose the entry and exit area having a RFID reader to scan the RFID tag of the consumer that is used as loyalty card. So, there may be a registered user can enter into the grocery store. The smart trolley has a RFID reader to scan the product's RFID tag. This RFID tags contains the information of that particular product. While scanning the products, the information of the product could be displayed in the web application. After buying all products user can press the bill now button then it will direct to the payment page. Customer can pay the bill at the web application. No need to waiting in the long queue and wasting their time. In exit area, if any of the RFID tags are still in the active stage then it is considered as an unpaid product and the alert message will be shown. This approach will reduce the efforts and shopping time of the customers. In the covid 19 pandemic situation customers must follow the social distancing but customers frequently waiting in the billing counter for billing makes more crowd. So, this methodology will give a best solution to this problem.

RELATED WORKS

Pranavi Satheesan gave a overview paper on Enhancement of Supermarket using smart trolley. I improves the user-friendly shopping. The Aim of this study is to offer a smart trolley for a grocery store which enables the customers to get advantage through the device. Techniques included are loyalty accounts, photo processing, recommendation, voice assistants and man or woman counting and price checkout alert systems are used so that the overall performance of a smart trolley is increased.

Kabil Dev and associates used wi-fi module to automate the supermarket. Smart trolley is one such smart device which is more convenient and makes the process easy to buy without any delay. In this smart trolley the invoice may be paid concurrently without the need to wait in the bill counter. Once the purchase is over amount is paid through online or offline which is totally based on the consumer. This flexibility isn't furnished in the existing trolley. This smart trolley includes Arduino UNO, RFID reader and tag, wireless module.

UG students introduced a supermarket to calculate how many merchandises are offered and to generate the invoice for the consumer. At present, many supermarkets are attempting to similarly reduce exertions prices by means of moving to automated checkout machines, where a single worker can be replaced instead of 4 to 5 machines, but right now they could help only a couple of clients at time. A RFID reader is a device that is used with RFID tags. The reader has an antenna that emits radio waves, the tag responds by sending back its information. An RFID tag is a combination of microchip with an antenna in a compact package; the packaging is designed to permit the RFID tag to be attached to an item to be tracked. The tag's antenna receives signals from RFID reader or scanner and sends back with some extra information.

Hemalatha gave a review paper for one of the foremost problems confronted by consumers ie; while shopping in a grocery store the inability to buy objects in a short time and additionally customers have to carry items to the billing counter. In this paper, a efficient approach is introduced to triumph over those problems by creating a smart trolley the usage of RFID and GSM is to complete the duties. Each product from shopping center/super marts may be attached with a RFID tag, to identify its type. Each trolley is implemented with a Product identity tool (PID) that includes microcontroller which includes PIC16F877A, lcd, an RFID reader and it's far applied to the smart smartphone app, and is surroundings pleasant as properly.

PROPOSED METHODOLOGY

This document gives the outline of Automation of Super market using RFID (Radio Frequency Identification) System and theft detection is also identified in exit area of super market. This project consists of modules such as entry are , exit area, trolley , website to display products purchased and bill and Payment module.

The flow of project is as: When a customer enters the mart their loyalty card is first scanned using RFID reader in entry area. If consumer is considered as authorized user, gate is opened using servo motor. If not registered, then “Please register!!!” message is displayed on LCD screen. Customer can then register using website’s “signup” button. After entering, a trolley is picked and QR code of website linked with super market is scanned. Login page appears, the user types his credentials and that page redirects to the dashboard where the list of products purchased will be appear. The customer start purchasing by putting the products into the trolley, it contains RFID reader, LCD display, buzzer, ESP32, IR sensor and servo.

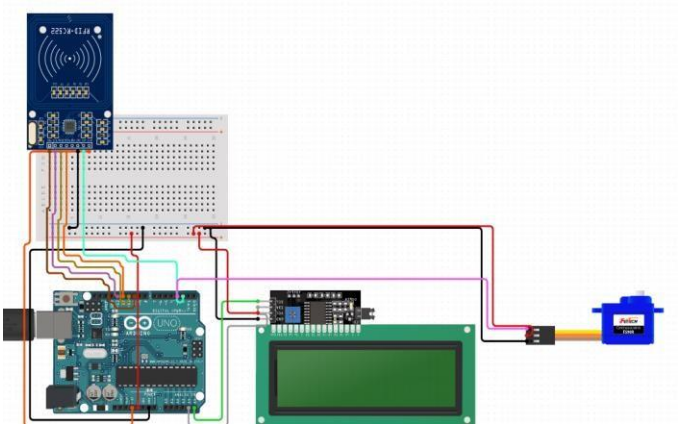

Fig. 1 Circuit Diagram

The product which consists of active RFID tag on it is scanned in RFID reader and then trolley is opened by object detection, simultaneously the products along with its description (name, price, expiry date, quantity, weight) is displayed in the website. The Customer cannot drop products into trolley without scanning RFID reader because trolley opens and closes when object approaches nearby. If product exceeds the expiry date buzzer sound is made. If user wants to remove the product from trolley “Remove” button is clicked and trolley is opened.

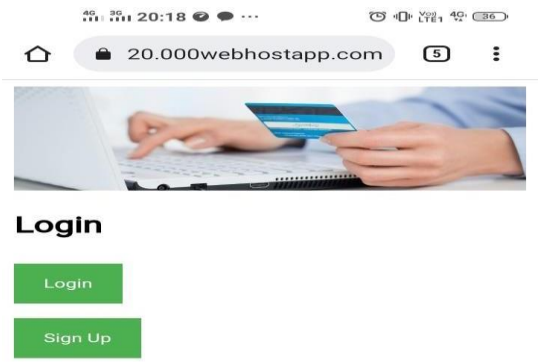

Fig. 2 Web Application home page

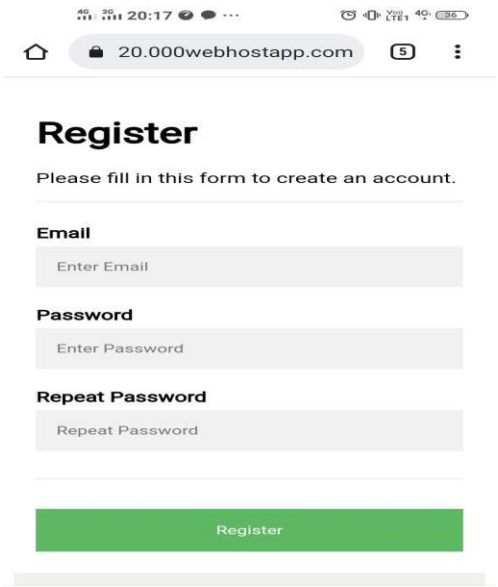

Fig. 3 Registration page for New User

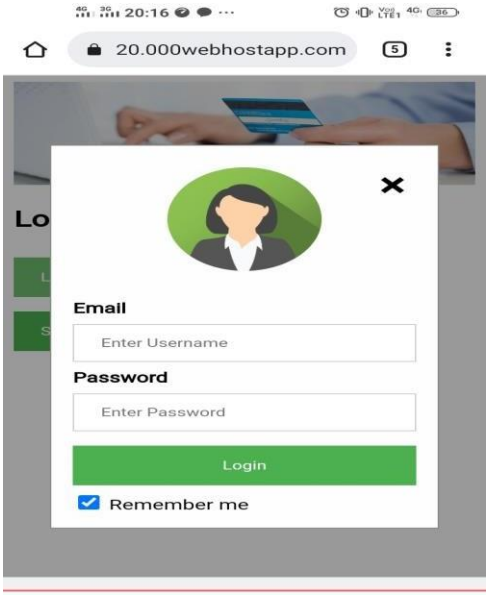

Fig. 4 Login Page for Registered User

The user takes product from trolley and scanned on reader before placing it on shelf. After finishing the purchase, the user clicks “Pay Now” button on the screen which then redirects to payment gateway where user can pay bill by using Gpay, Paytm, debit cards etc. After paying for the products those RFID tags will be deactivated. If a person tries to take a product without paying, RFID will in active state and gate will not be opened and buzzer sound is made in exit area.

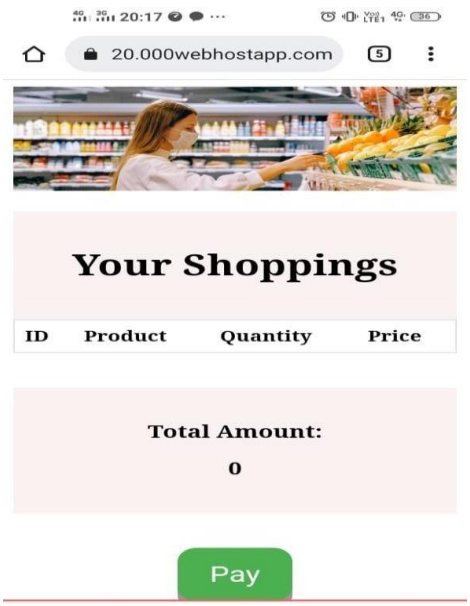

Fig. 5 Billing Page

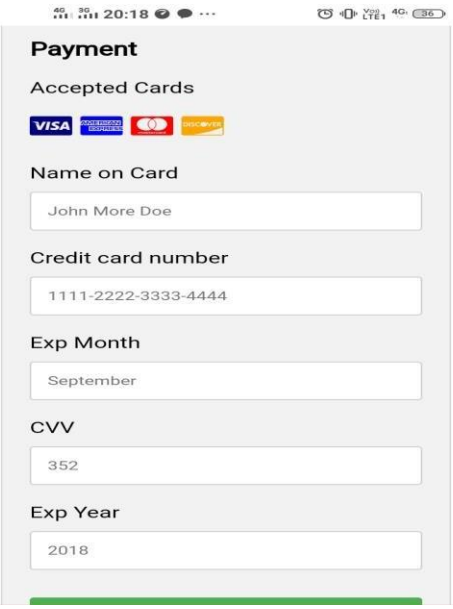

Fig. 6 Payment Gateway

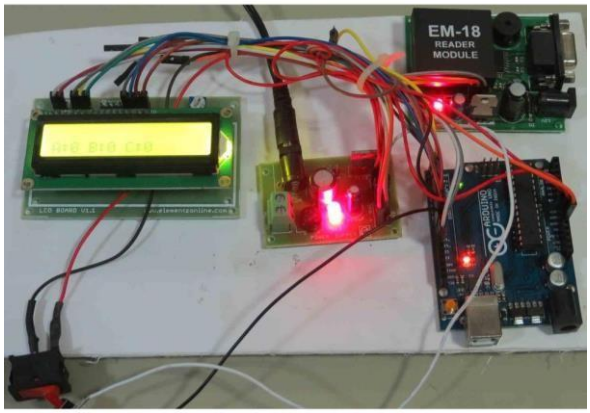

Fig. 7 Smart Trolley

HARDWARE DESCRIPTION

RFID

Radio frequency identification gadget (RFID) is an automated era and aids machines or computers to become aware of objects, document metadata or manipulate man or woman target via radio waves. RFID tags are a kind of tracking gadget that makes use of radio frequency to look, become aware of, music, and speak with gadgets and people. RFID tags carry specific product numbers. If clients pay for items with a credit score, debit or client's bargain card, outlets can link the purchases to the recorded RFID statistics and use that marketing data to map out person customers' actions through a store.

IR (INFRARED) SENSOR

IR sensor is an electronic device, that emits the light in order to smell some object of the surroundings. Infrared sensors are also used to measure distance or contiguity. The reflected light is detected and also an estimate of distance is calculated between sensor and object. These sensors are good for discovery between 100cm-500 cm (1-5 measures/ 3-15 bases). The long range makes them a good volition to sonar sensors.

ARDUNIO ESP32

ESP32 is a series of low- price, low- power contrivance on a chip-micro regulators with integrated wi-fi and binary-mode Bluetooth. In expressions of connectivity, maximum Arduino forums do not have wireless or Bluetooth capability on their veritably own, and this includes the Arduino zero. The ESP32 dev tackle is clearly less precious than Arduino Uno, which means which you get a lesser important board for a lower price.

.*LCD (Liquid-crystal display)*

TV screen(Liquid Crystal Display) is a type of flat panel display which uses liquid dishes in its primary form of operation. They work by using liquid dishes to produce an image. The liquid dishes are bedded into the display screen, and there is some form of backlight used to illuminate them. The factual liquid demitasse display is made of several layers, including a concentrated sludge and electrodes.

SERVO MOTOR

The servo motor is most generally used for high technology bias in the artificial operation like robotization technology. It's a tone contained electrical device, that rotate corridor of a machine with high effectiveness and great perfection. The affair shaft of this motor can be moved to a particular angle. Servo motors are substantially used in home electronics, toys, buses, aeroplanes, etc..

CONCLUSION

The suggested methodology uses a RFID based system for automation of super market and for theft detection. The entry and exit areas are also authorized for customers in time in super markets. It is simple and practical approach to be used in daily life. Along with this smart shopping cart help customers skip the long queues at the cash counter, provide a total contactless shopping trip, reduce man power in super markets, provides options to customers to select mode of payment.

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