Project Design Report

Smart shopping cart

Group Number:

18

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ABSTRACT

This study develops a Smart shopping which helps to avoid many problems in current super market system. such as queue, time delay, unknown offers and etc. This system will be basically used in Super market and other shopping centers. The proposed system has an embedded micro controller connected to RFID sensor and a keypad as an input and display as an output. Each shopping cart in the super market is connected to a server installed at the main monitoring location in the super market through a wireless network. The system will immediately show updates to customers about products. The following aspects will be addressed by the system mainly.

- Easy to use
- Low cost
- User friendly
- Speedy operation

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SAFETY INSTRUCTIONS

Before using your new Smart shopping cart, please read this manual thoroughly to ensure that you know how to operate the features and functions that your new appliance offers safely and efficiently.

- This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision
- The Smart shopping cart is designed for indoor use only.
- Make sure the product stays away from hazards like staircases, sources of water etc.
- Slots and openings at the base and the near the LCD display are provided for ventilation; to ensure reliable operation of the product and to protect it from overheating. These openings must not be blocked or covered.
- This product should be operated from the type of power source indicated on the user manual.
- When charging, do not use a plug socket and wiring equipment for more than their rating capacity.
- Do not use a damaged power cord, plug or a loose power outlet. To prevent damage do not leave the power cord exposed on the floor.
- Do not dissemble the product.
- Warnings and Important Safety Instructions in this manual do not cover all possible conditions and situations that may occur. It is your responsibility to use common sense, caution, and care when installing, maintaining, and operating your appliance.
- You need to remove all the protective plastic film before you initially plug the product in
- Children should be supervised to ensure that they do not play with the appliance
- Do not damage the product circuit

Introduction

Overview

Super markets already have carts why this? What's meant by "smart"?

Our system was approved to achieve mainly to goals, real time show current bill of products that he/ she purchased or put in carts another is automate billing method in cashier. (Usual procedure is check products into cart and bill). Through our system real time cashier know the bill of each cart. Reduce cashier work and crowd at cashier. Designing of system involve three key aspects Network communication between cashiers' application and shopping carts real time, securing payments information and persist them and an Embedded system in shopping carts to connect and identify the products.

IDENTIFICATION OF PARTS

• Body



WIFI Transfer module

RFID scanner





Power plug

• Cashiers Desktop application

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▼ Products				
Add Product				
Remove Product	ŀ	Add Product		
View Products				
▼ Carts				
Add Cart	Product Id			
Remove Cart		-		
▼ Cashiers	Product Name			
Add Cashier	Selling Price	Γ		
Remove Cashier	Sening Price]
Modify Cashier	Date of Exp			
▼ Sales				
Today Sales	Discount			
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SETUP

Using the product (Customers)

1. Power On the system





2. Press Start (Key 4) for setting up the system

3. Instruction screen



4. Check the price and offers





5. Adding an item to the cart Press 1 for adding items to the cart







• Total price is showing in the screen





6. To cancel an item Press 2



7. To remove an item Press 5





Software side setup (Cashier)

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	Password	
	Log in	
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Login to the system

Total carts are showing in the application menu



If a cart is using by a customer, then Cart will be online

(Orange dot will change to green dot)

Cashier can select a cart and check the items in the cart



Menu will be updating in real time. If customer put an item to the cart. They will appear here. Cashier can monitor here

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Cashier monitors the shopping cart

TECHNICAL NOTE

Data flow in System

How it's work

Customer turn on shopping cart using key pad and moving it

Server knows Cart is active

Update Cart status in Cashier

Customer pick a product and put inside cart



Cart identify product and make Request to server for more info of the product if request is accepted Response back to cart, notify connected cashiers' Desktop application update particular cart bill everywhere.

Display product info in cart for a while, then display updated

bill

It will continue until customer finishes shopping.

Customer finishes shopping, he can pay through one of the cashier

Architectural Design





Hardware Architecture

ARDUINO MEGA 2560 REV3



Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world.

Specification

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
Flash Memory SRAM	256 KB of which 8 KB used by bootloader 8 KB
Flash Memory SRAM EEPROM	256 KB of which 8 KB used by bootloader 8 KB 4 KB
Flash Memory SRAM EEPROM Clock Speed	256 KB of which 8 KB used by bootloader 8 KB 4 KB 16 MHz
Flash Memory SRAM EEPROM Clock Speed LED_BUILTIN	256 KB of which 8 KB used by bootloader 8 KB 4 KB 16 MHz 13
Flash Memory SRAM EEPROM Clock Speed LED_BUILTIN Length	256 KB of which 8 KB used by bootloader 8 KB 4 KB 16 MHz 13 101.52 mm
Flash Memory SRAM EEPROM Clock Speed LED_BUILTIN Length Width	256 KB of which 8 KB used by bootloader 8 KB 4 KB 16 MHz 13 101.52 mm 53.3 mm

RFID-RC522



MF RC522 is a highly integrated read and write card chip applied to the 13.56MHz contactless communication. Launched by the NXP Company, it is a low-voltage, low-cost, and small-sized non-contact card chip, a best choice for intelligent instrument and portable handheld devices

Specification

- MFRC522 chip based board
- Operating frequency: 13.56MHz
- Supply Voltage: 3.3V
- Current: 13-26mA
- Read Range: Approx 3cm with supplied card and fob
- SPI Interface
- Max Data Transfer Rate: 10Mbit / s
- Dimensions: 60mm × 39mm

ESP8266





The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif Systems.

The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

Specification

- 802.11 b / g / n wireless standards;
- STA / AP modes support;
- TCP / IP protocol stack, One socket;
- Supports standard TCP / UDP Server and Client;
- Supports serial port baud rate configuration: 1200/2400/4800/9600/19200/38400/57600/74800/115200 bps;
- Supports serial data bits: 5/6/7/8 bits;
- Supports serial parity: none;
- Supports serial stop bits: 1/2 bit;
- Pin-compatible with Arduino UNO, Mega;
- Arduino Pinout 2/3/4/5/6/7/8/9/10/11/12/13;
- ESP8266 GPIO Pinout 0/2/4/5/9/10/12/13/14/15/16 / ADC / EN / * UART TX / UART RX;
- KEY button: modes configuration;
- Dual-Ports DIP switches: switching Arduino and ESP8266;
- WiFi operation current: continuous transmission operation: ≈70mA (200mA MAX), idle mode: <200uA;
- Serial WiFi transmission rate: 110-460800bps;
- Temperature: -40°C ~ + 125 °C;
- Humidity: 10%-90% non-condensing;

- •
- Weight: about 20g (0.7oz); Operating Voltage 2.5V ~ 3.6V •

Others

- Key pad •
- Display

Schematics and Design



fritzing

Software Architecture

Front End

User Interfaces are implemented in JavaFx. For consuming web service, we used Apache HttpClient library. In Smart shopping cart front end is implemented in two ways. Administrative mode and Client mode. Admin panel is to control the system, such as creating new data and editing data, adding new products and etc. For client/user mode, relevant user can check the data of buying product and other related details. Front end is developing using following technologies;

Design View

Ad	ld Product
Product Id	
Product Name	
Colling Drice	
Selling Price	
Date of Exp	
Discount	
Image if Available	Browse
	Product Id Product Name Selling Price Date of Exp Discount

Cashiers Desktop application

S 5	
	Used For Icon
	UserName
	Password
	Log in



Back End

Back end is developing using following technologies;

- 1. Spring boot
 - a. Our application is implemented using Spring boot. It is popular one in Java. Spring Boot is an "opinionated" application bootstrapping framework that makes it easy to create new RESTful services (among other types of applications). It provides many of the usual Spring facilities that can be configured easily usually without any XML.
- 2. MySQL database



Database ER Diagram

Security Aspects

1. Token based authentication using Jwts (Javscript web token)

Token is created when cashier initiate communication with Server.Jwt token is passed with every api call.

2. Network communication using SSL certificate,

In our case server and nodes are in limited physical area,

Controllable area. But using this system in large scale this is not possible and it involve payment transaction so it need secure way to transmit data through network.

3. Role based accessing

It protects only some roles have authorization to access important data and manipulate.

TESTING

During the testing phase, the basic idea was to unit test each component individually, then integrate those components into the system and test each module following a bottom-up approach. Therefore, the testing phase consisted of three stages. Namely

- Software/ system unit testing
- Software/ system integration testing test for the functionality of the interfaces
- Software/ system validation final testing from the users point of view

Development and Execution Platform:

The embedded software was directly developed and tested on a target execution platform (Arduino ATmega2560)

Embedded Hardware:

Fixed the most crucial modules and components (such as the batteries and display) in such a way that they could be easily replaced upon failures.

LCD:

Initially the LCD was tested using a regular 5V power adapter. Thereafter a voltage regulator was used to provide the required voltage using the batteries as per the design.

RFID-RC522:

Initially RFID was tested using the power from Arduino(3.3V). thereafter 3.3V regulator was used to provide the required voltage using the batteries as per the design.

ESP8266:

Initially this WIFI module was checked individually with a different server with Arduino power supply. Thereafter it is integrated with main circuit and 3.3V regulator.

KEYBOARD:

Initially keyboard was checked individually with custom inputs. Thereafter it was integrated with main system.

Power sources and Recharging:

The viability of the battery was checked individually. It can be easily replaced and recharged.