A

Project Report

On

"IoT Based Smart Shopping Trolly"

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Abstract

There has been an emerging demand for quick and easy payment of bills in supermarkets. This project describes how to build an automated and time saving system for the world of retail which will make shopping experience impetuous, customer friendly and secure. In this paper, smart cart is proposed that will be capable of generating a bill from the cart itself. The customer will make the payment in no time through a rechargeable credit card and which will help to maintain database and introduce schemes and offers in stores accordingly. The designed cart eliminates the effort of self packaging, makes the best use of cart storage space and involves security mechanism for theft control.

The smart cart uses RFID technology for shopping and payment, AVR microcontroller for peripheral interfacing and inventory management. This innovative system will help the stores to see a rise in their sales along with delighting customers.

Introduction

The shopping trolleys currently used all over the world are simple carrying basket with wheels as an added facility. The trolleys do not respond in any ways to the user and just serve the purpose of carrying the items to be bought by person.

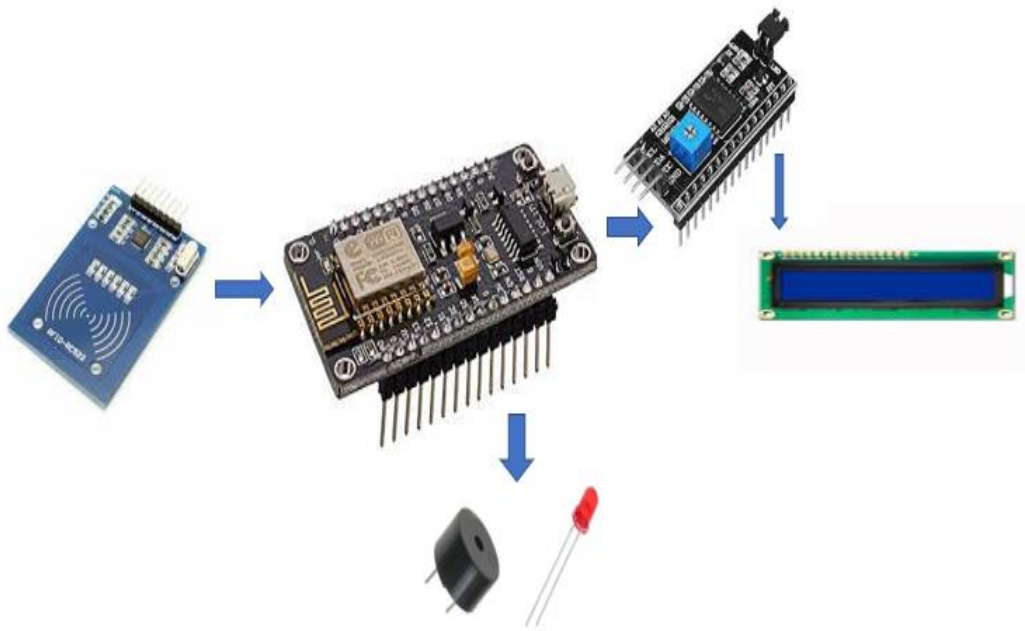
We, by our project on ‘Smart shopping cart’, are thinking ways to make this a more advanced system.

We have in our project added a feature through which the person gets the bill amount of his/her products or items kept in the cart on the cart itself. The product uses a RFID system which is well known for scanning multiple items at a given time.

The RFID reader will be mounted on each cart and as soon as the customer starts keeping items in the cart, the RFID reader starts scanning the tags on each item and displays the total bill amount on the LCD which is attached along with the RFID reader upon the cart. Thus, our smart shopping cart provides real time response to the people using it.

All this system combined, make our project “Smart shopping cart with Automated Billing with the use of RFID”. Which is a small step towards making a smarter India!

Block diagram and description



This project consists of mainly 3 parts – 1. Control Unit (NodeMCU) 2. Scanning module (RFID Reader) 3. I2C module and Display.

The output from the RFID module is fed to the NodeMCU. NodeMCU then analyses the input and finds out the product name and their price. At the same time these values will be displayed on the 16×2 LCD display. The sum of all products also displayed on the screen. Also, buzzer and LED are used to indicate when the RFID tag is being used. The graphic diagram is shown as follows.

Components and their specifications

List of components:

1) ESP8266 NodeMCU

2) I2C module for LCD display

3) LEDS

4) Power supply

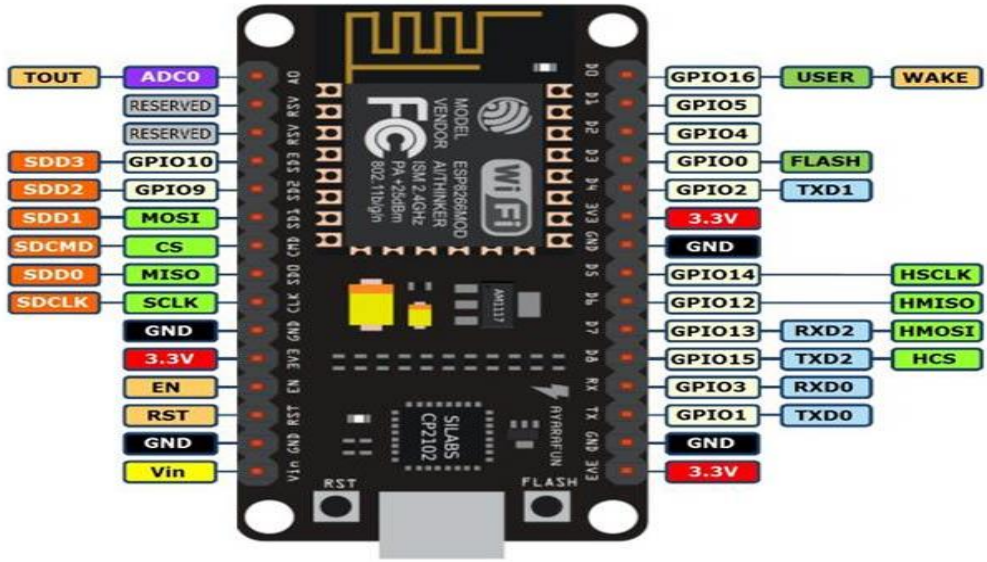
5) LCD display

6) RFID Reader and card

7) Push Button

8) Connectors

1.ESP8266 NodeMCU:



The NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 wi-fi SoC from expressive systems, and hardware which was based on the ESP 12 module. Later, support for the ESP32 32-bit MCU was added.

NodeMCU combines “node” and “MCU” (microcontroller unit). The term “NodeMCU” strictly specking refers to the firmware rather than the associated development kits.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing MCU and antenna.

Specifications:

Microcontroller - Tensilica 32-bit RISC CPU Xtensa LX106
Operating Voltage – 3.3V
Input Voltage (recommended) - 7-12V
Input Voltage (limits) – 7-12V
Digital I/O Pins - 16
Analog Input Pins - 61
UARTs- 1

SPIs- 1

I2Cs- 1

Flash Memory – 4 MB

SRAM – 64 KB

USB- TTL based on CP2102

Clock Speed – 80 MHZ

Power:

The power pins are as follows:

• VIN. External Power supply

• Micro-USB. NodeMCU can be powered through the USB port.

• 3V3. Regulated 3.3 V can be supplied to this pin to power the board

• GND. Ground pins

Memory:

NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features makes it ideal for IoT projects.

Input and Output:

• Control Pin: EN, RST. the pin and the button reset the microcontroller

• Analog Pin: A0. Used to measure analog voltage in the range of 0-3V

• GPIO: GPIO1 To GPIO16. NodeMCU has 16 general purpose input output pins on its board

• SPI: SD1, CMD, SD0, CLK. NodeMCU has four pins available fir SPI communication

• UART Pins: TXD0, RXD0, TXD2, RXD2. NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.

- I2C: NodeMCU has I2C functionality support but due to the internal functionality of these pins, you must find which pin is I2C.

Communication:

ESP8266 Client-Server Wi-Fi Communication Between Two Boards (NodeMCU) ... Then, the server and the client will exchange data (sensor readings) via HTTP requests. We will program the ESP8266 boards using Arduino IDE. In this example, we will send BME280 sensor readings from one board to the other.

2. I2C Module for LCD Display

I2C Module has a inbuilt PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display.

These modules are currently supplied with a default I2C address of either 0x27 or 0x3F. To determine which version you have check the black I2C adaptor board on the underside of the module. If there 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.

The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly.

Features: -

- Operating Voltage: 5V

- Backlight and Contrast is adjusted by potentiometer
- Serial I2C control of LCD display using PCF8574
- Come with 2 IIC interface, which can be connected by Dupont Line or IIC dedicated cable
- Compatible for 16x2 LCD
- This is another great IIC/I2C/TWI/SPI Serial Interface
- With this I2C interface module, you will be able to realize data display via only 2 wires.

3. LED

Super bright 3mm LEDs are extremely bright. They are suitable for use in your projects, illuminations, headlamps, spotlights, car lighting, or models. They go anywhere where you need low power, high-intensity reliable light, or indication. They go easily into a breadboard and will add that extra zing to your project. Initially no LED blows indicating that there is no obstacle at other side of the curve. If any obstacle comes between mountain and ultrasonic sensor Red LED blow for ha lf minute indicating object at other side.

4. Power supply

Power supply is also called as power supply unit Or PSU that supplies power to computer. Most personal computers can be plugged into standard electrical outlet. Then power supply pulls the required amount of electricity and converts the AC current DC current. It also regulates the voltage to eliminate spikes and surges common in most electrical systems. The power supplies are rated in terms of the number of watts they generate. The more powerful the computer, the more watt it can provide to the components.

5. RFID Reader

RFID stands for Radio-frequency identification. It refers to a technology, where digital data is encoded in RFID tags and decoded by an RFID reader using radio waves. RFID is like barcoding in which data from a tag is decoded by an RFID reader device. The RFID technology is used in various applications like inventory management, door lock system, access to restricted areas, etc.

EM18 Reader is a very popular RFID module that can read the ID information stored in the RFID tags. The RFID tags store a 12-digit unique number which can be decoded by an EM18 reader module, when the tag comes in a range of the Reader. This module has an inbuilt antenna that operates at a frequency of 125 kHz and a 5v DC power supply is required to power it up.

It gives a serial data output and has a range of 8-12cm. The serial communication parameters are 8 data bits, 1 stop bit and 9600 baud rates.

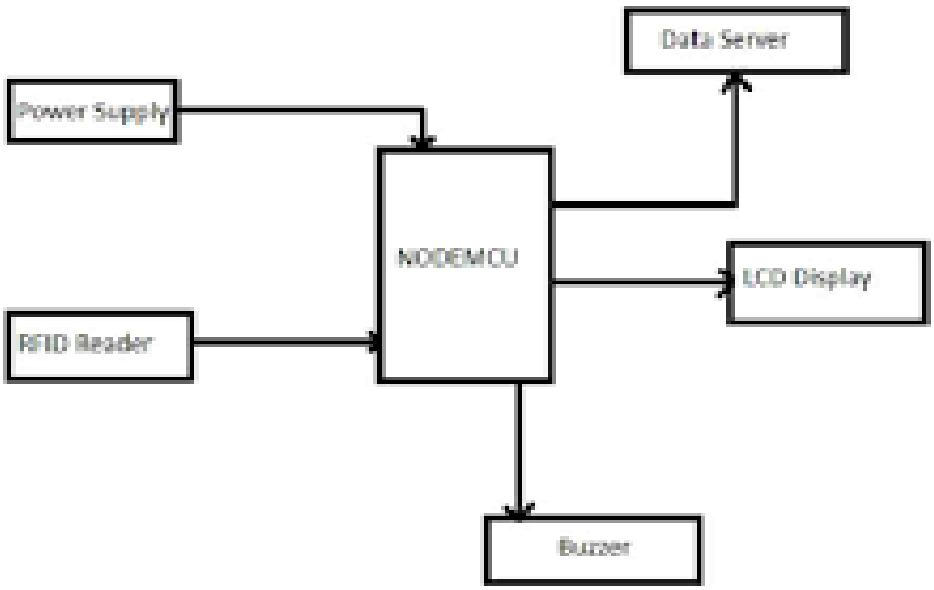
Pin description:

VCC: 4.5- 5V DC voltage input
GND: Ground pin
Buzzer: Buzzer or LED pin
TX: Serial data Transmitter pin of EM18 for RS232 (Output)
SEL: This must be HIGH for using RS232 (LOW if using WEIGAND)
Data 0**:** WEIGAND data 0
Data 1**:** WEIGAND data 1

Features of EM18 RFID Module:

- Operating voltage: +4.5V to +5.5V DC
- Current consumption:50mA
- Operating frequency:125KHZ
- Operating temperature: 0-80 degree C
- Communication Baud Rate:9600
- Reading distance: 8-12 cm
- Antenna: Inbuil

Details of working and process



The NodeMCU is interfaced with all the remaining components. Once the microcontroller is powered up with the use of a 9v battery it is initialized and set to the basic settings, now the system is ready to proceed which means the RFID card and the tag can be scanned. Then the RFID card or tag is scanned the RFID reader fetches all the details from the scanned card or tag, and if the scanning process is successful the product details will be transferred to the microcontrollers memory and then will be transferred to the LCD module to be displayed on the LCD screen. Here the RFID module uses the SPI communication technique to transfer or to retrieve the data from the RFID card or tag. After the shopping is completed the entire bill details will be displayed on the LCD screen, each card or tag acts as a product, where the product details are pre-early set or dumped into the card. When the bill amount is paid, the shopping details will be sent via the sim900 gsm module to the prescribed customer's mobile number. The entire working process is implemented by the software called Arduino IDE. The Proteus simulation software is used to check the simulation results before the hardware implementations

Step 1: Start

Step 2: When the system is powered up, display the initial data.

Step 3: Scanning of the RFID membership card.

Step 4: If the membership card scan is successful fetch all the personal details & display it on the LCD. If not, scan the membership card once again. Loop repeats until the scanning process is successful.

Step 5: Now the product scanning process is ready. If the scanned product code is detected, display all the product details on the LCD screen. If not, the product has to be scanned until it gets detected. This process applies to each & every product.

Step 6: If a scanned product is scanned once again then that product is removed from the microcontroller's memory & in the ongoing bill.

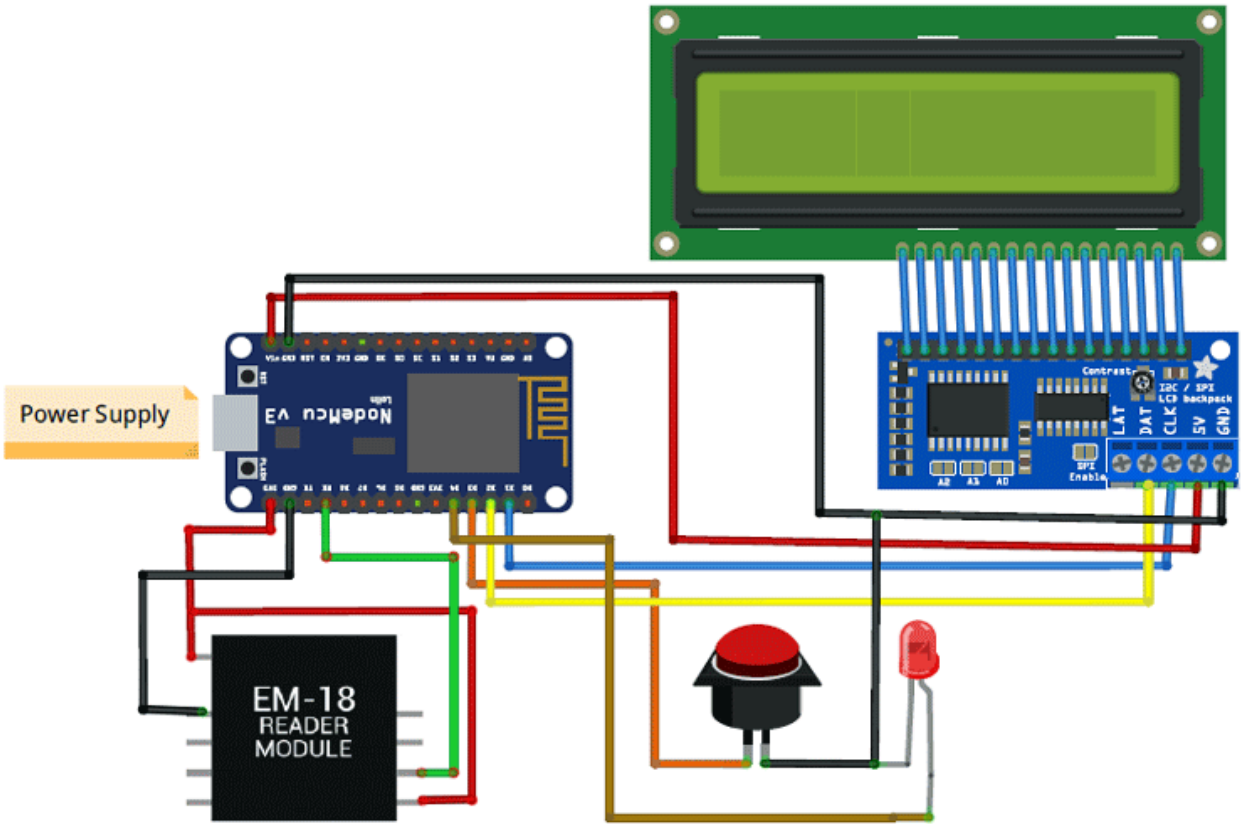
Step 7: Finally, to end the shopping, the shopper has to scan the Membership card. If the card is successfully scanned, then the complete bill summary is displayed on the LCD.

Step 8: Immediately after the bill amount is deducted from the card, an SMS is sent to the prescribed shopper's mobile phone via a GSM module regarding the shopping details.

Step 9: Stop.

Step 10: Repeat the entire process if another membership card is scanned & detected.

Circuit diagram:



Advantages

- RFID ID Tag and reader should not be in LOS to make the system work.
- Unlike barcodes, tags can store more information.
- RFID technology is versatile in nature and hence smaller and larger RFUD devices are available as per application.
- Tags can be read only as well as read/write unlike barcodes.

Application

- Super markets
- Shopping centers
- It can be utilized in dress showrooms
- The application is used in jewelers' shop with some modification.
- Library management system

Future improvement

- Development of project can be done in many ways, where RFID tags can be replaced by RFID by RFID-stickers which are small, low cost.
- Security can be improved by counting the numbers of items or placing weight sensors within the cart for tallying the weight and getting all the types of product names when cart is passed through a particular aisle using camera module.
- Multiple RFID tags can be read using a single RFID reader for a greater number of products which are added in the cart.
- There can be voice assistant included.

Conclusion

In conclusion, these types of systems are prime examples of how technology can be applied to solve simple problems around us. These small problems may seem to make no difference in short term but when though about collectively, make much larger difference.

Hence, by using RFID based smart shopping cart and billing system the shopping can be made easy for the customers as well low cost and does not need any special training. This project is a small step towards combating that obstacle and promoting sustainable development of our nation.

Reference

1. Papers:

- Mr. P. Chandrashekhar. Prof., e.t.a.l, “smart shopping cart with billing system through RFID and Zigbee” S.A engineering college
- Swati zope, prof. marutilmkar, “rfid based bill generation and payment through mobile” international journal of computer and network.

2. Links

- https:/www.arduino.co
- https:/www.wikipedia.org

Project diary:

Semester – V

	Week No.1	Week No.2	Week No.3	Week No.4
Activities planned	Final discussion on topic of capstone project	Making list of required components	Collection of components	Mounting of components
Activities executed	Designing of components	Arrangement of components	Mounting of circuit	Mounting of circuit
Reason for delay if any	Scarcity of components	Some mistakes while arrangements	Problems in components	Replacement of some components
Corrective measures adopted	Checked the value of components	Checked whether they are in working manner	Recessed the circuit design	Adopted proper instructions while mounting the circuit
Remark and Signature of Guide				

Semester – VI

	Week No.1	Week No.2	Week No.3	Week No.4
Activities planned	Testing of circuit	Testing of circuit	Programming	Programming
Activities executed	Preparation of report	Prepare methodology	Description of every component	Format based report execution
Reason for delay if any	Checked whether report is in proper manner	Some mistakes were occurred in report	Rechecking of every detailed content	Analyze the report
Corrective measures adopted	Took guidance from our mentor	Again, rechecked every content of report	Make some changes according to requirements	Synthesized in systemic way and finalized
Remark and Signature of Guide				