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## SMART SHOPPING CART

ADARSH K<sup>1</sup>, DYUTHI N SUDHEER <sup>1</sup>, SREERAG S <sup>1</sup>, THEJUS C K <sup>1</sup>, Dr. REEDA KUNHIMANGALAM<sup>2</sup>

<sup>1</sup>DEPARTMENT OF EEE, COLLEGE OF ENGINEERING THALASSERY, THALASSERY, KERALA 670107

<sup>2</sup> ASSOCIATE PROFESSOR, DEPARTMENT OF EEE, COLLEGE OF ENGINEERING THALASSERY, THALASSERY, KERALA 670107

### Abstract

One of the main issues in today's supermarkets is waiting in the long queues to get our products billed. Our idea is to create a shopping cart which will reduce the hustle in shopping malls. The proposed project will reduce the time spent in the billing section and create a user friendly environment. Our main objective is to provide a permanent solution to the problem of longer waiting time in the billing queues by facilitating billing on the trolley. By reducing the man power and other expenses we can create a user friendly consumer experience and also at the same time take care of shoplifting and other malicious activities. We are using a load cell to take the weight of any said product using barcode scanning facilities. Product name and price are to be displayed on a screen to inform the user about the current status. Customer places the product on a platform supported by the load cell to confirm the item. Weight of the product is also recorded for convenience. The list is confirmed by the employee at the checkout and the customer is provided a perfect shopping experience.

**Keywords:** smart shopping, load cell, barcode scanner.

### 1. Introduction

A supermarket is a place where customers come to purchase their daily use products and pay for that. So there is a need to calculate the products sold and generate the bill for the customer. When we go to shopping mart for shopping, we have to first select the right product. Also, after that, it is hectic to stand in line for billing all the goods. Hence, we are proposing to develop a smart shopping cart system that will keep the track of purchased products. We are using a load cell to take the weight of any said product using barcode scanning facilities. Product name and price are to be displayed on a screen to inform the user about the current status. Customer then places the item in a separate chamber. Weight of the product is also recorded for convenience. This list is then sent over to the checkout computer using wireless means and the consumer is billed as he walks to the exit.

## 2. Related works

One of the papers describes the implementation of a reliable, fair and cost efficient Smart Shopping Cart using Wireless Sensor Networks. Such a system is suitable for use in places such as supermarkets, where it can help in reducing man power and in creating a better shopping experience for its customers [1]. There have also been attempts to completely automate the trolley itself. One such project deals with a microcontroller based trolley which is totally automatic. It follows the customer while purchasing items and it maintains safe distance between customer and itself. Only customer has to hold the barcode side of the product wrapper in front of barcode scanner. Then corresponding data regarding product will be displayed on display [2]. Barcodes are not the only identification mark for a product. Advanced coded information like a QR code or an RFID can also be integrated into this project for better results. One paper introduced this idea by implementing a smart shopping cart system that will keep the track of purchased products and also online transaction for billing using RFID and ZigBee. The system will also give suggestions for products to buy based on user purchase history from a centralized system. In this system, every product in Mart will have RFID tag, and every cart will be having RFID Reader and ZigBee attached to it [3].

## 3. Methodology

First scanning the barcode of the item to be purchased is done. Product name and price are displayed. Customer should place the scanned item on the load cell for confirmation Weight of the product is also recorded. Customer can also remove any unwanted product from the cart by scanning the barcode again and this product will be removed from the recorded list. At the checkout this list is confirmed by the employee. The customer is provided a perfect shopping experience as the proposed system is user-friendly.

### A) *Troubleshooting the Load cell*

To check the functionality of a load cell we require a multimeter and a voltage source. The first step is to check the input and output resistance. To measure the input resistance, connect the red and black wire from load cell to the multimeter and set to ohms. To measure the output resistance connect green and white wires from load cell to the multimeter. Comparison of these values is made with the datasheet from manufacturers to see if they closely match each other. Similarly, check the load cell for accuracy by measuring the millivolts signal from the input leads. With no force applied to the load cell, the value should be zero. Apply a calibrated dead weight as specified in the calibration certificate and compare the values again.

### B) *Calibration program*

Calibration of the load cell is the process of converting the voltage output of the device into a value corresponding to the weight of the object. For this, an object of known weight is first placed on the Load cell and the value is entered into the program. This calibrated value is used to identify the weight of all the objects placed after the test product by detecting the variation of output voltage.

### C) *Simulation*

Proteus V8 is used for simulating the output of our project. Due to the unavailability of the key hardware components required for our project, we were unable to proceed further with the real time implementation. Therefore we switched our entire project into a simulation with the hopes of trying to recreating the exact output we required.

Load cell itself was not available in the Proteus software, so we went forward and created a simple load cell of our own using resistors in a Wheatstone bridge configuration. HX711 is not readily available within the components section, so we used a simple instrumental amplifier to amplify our output by sacrificing the conversion mechanism inherent to the HX711 module. The load cell is then connected to an Arduino within the simulation program and a crystal display is used as an output to observe whether the program is working correctly. As the Barcode scanner is technically an input device, we decided to replace it with a number pad within the simulation.

Due to the decreased complexity in the program in the absence of a conversion module, we were able to create a simple program to create the output of our project in the form of voltage. A Bluetooth module was used to replace the Wi-Fi module first decided to be used in the project.

The Bluetooth module used was the HC05 which was available as it is in the simulation program. The module was connected to the output of the Arduino UNO which led to the input of the Crystal display. An android app called Arduetooth, which was specifically designed to obtain the data from and control the Arduino was installed in an android device so that we can communicate with the circuit remotely.

Program for the Bluetooth module was created separately at first and tested for any errors. This program was later merged with original program for the Load cell and the data was successfully transferred to the Android software denoted as an output for Sensor 1.

#### D) *Final product visualization and creating a 3D model*

Creating a finalized product was nearly impossible in the current scenario, so we used a 3 D modelling software to visualize the output. Blender (2.93.0) was a free modelling software we were already familiar with, so we went forward with the idea. The finalized model of the smart shopping cart had two compartments, one for weighing the product and the other for placing the confirmed product. A barcode scanner and a big enough screen is provided on a convenient place so that the consumer has a seamless shopping experience. Low poly models were used to create the 3D model.

#### 4) **Hardware Implementation**

Hardware part of the project up to the installation of the weight measurement system has been completed. Load cell well was connected to the HX711 module and the amplified output was fed into the Arduino UNO. An LCD display was connected to the output side.

After uploading the developed program and confirming the results, the entire load cell configuration was transferred to a tray to simulate a shopping cart, which was unavailable at the moment.

Barcode scanning and cloud service part of the project couldn't be completed because of the unavailability of the hardware components such as the USB host shield and the Wi-Fi module. Therefore, that part of the project along with the load cell configuration was switched over to the proteus program to stimulate an overall output.

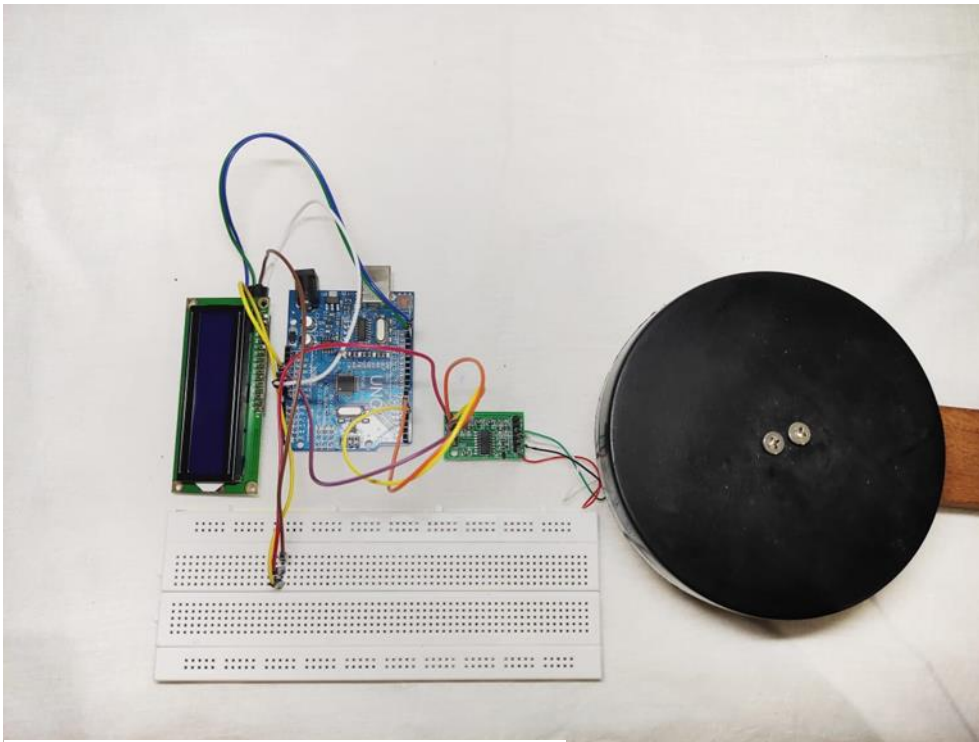


Fig 1: Hardware

## 5) Simulation

Simulation in Proteus was done in three steps. The first one included the designing of a simple load cell using four resistors. The program required for this was rather simple and was compiled with much ease.

```
AnalogReadSerial | Arduino 1.8.3
File Edit Sketch Tools Help
AnalogReadSerial
#define loadcell A5
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  int sensorValue = analogRead(loadcell);
  Serial.println(sensorValue);
  delay(500);
}
```

Fig 2: Program

The second part of the simulation was the interconnection between an android device and the Arduino UNO. The HC05 Bluetooth module was connected to the Receiver and transmitter terminals of the UNO along with the LCD display as an output device so that the same output can be sent over to the android device by placing it as a receiver. The program for the HC05 module was compiled separately and added to the original program of the load cell and this new program was uploaded into the Arduino UNO.

The output of the load cell and this value was therefore displayed on the LCD screen. Making the virtual Bluetooth module the same as the Bluetooth of the Laptop, we were able to connect the ArduTooth software to our circuit. The output value of the Load cell and the barcode was displayed on the Android device. Barcode scanner is simulated using an input device like a Number Pad readily available in Proteus.

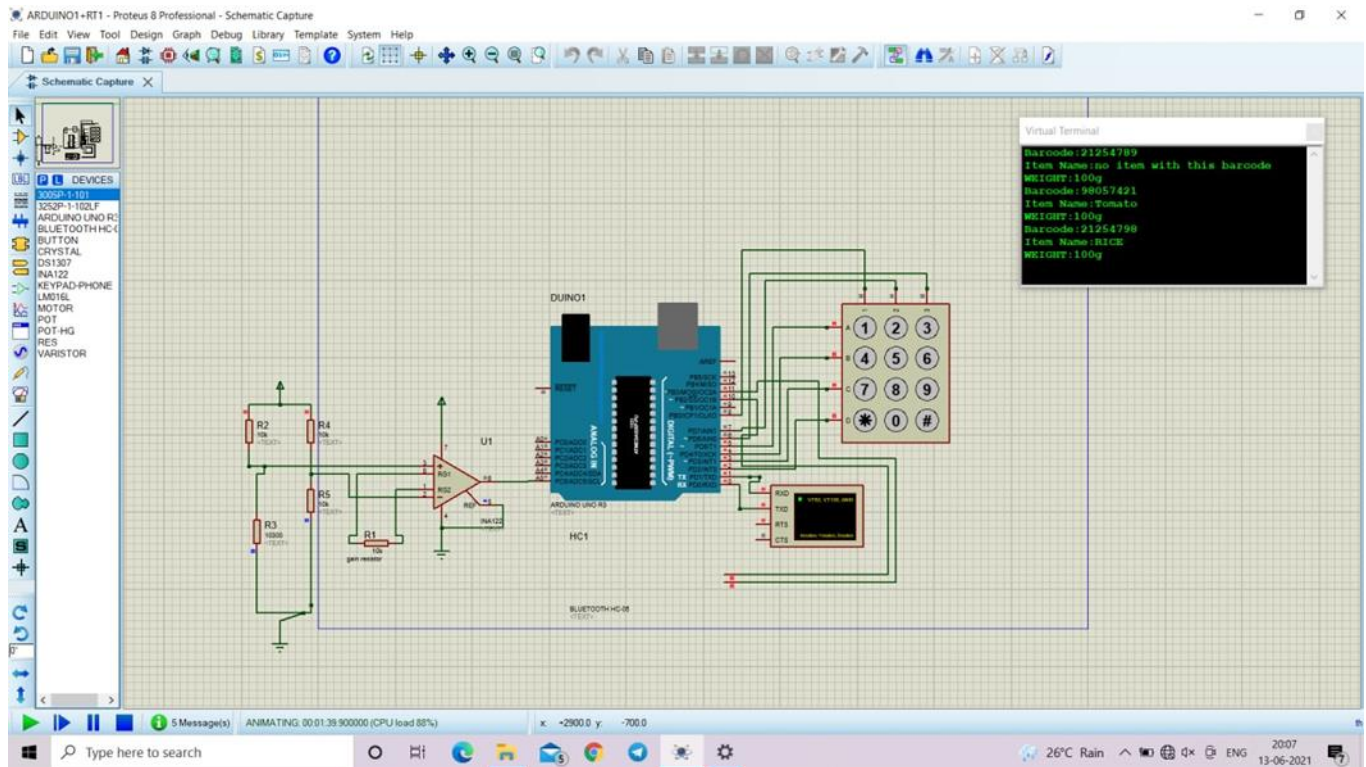


Fig 3: Simulation

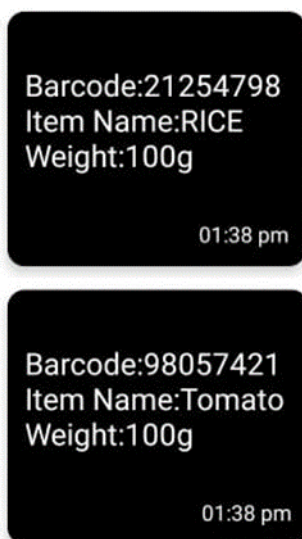


Fig 4: Results

## 6) Conclusion

Each product in the shop will be provided with a Barcode stickered on to it. The product is first scanned using the Barcode Scanner and the Barcode number will be displayed on the LCD screen provided on the cart itself. The scanned product is then placed on the section of the Cart with the Load cell and then the weight of the product is displayed on the LCD screen. Using a Bluetooth module, this information is simultaneously sent to a nearby android device in which the data is received through a Bluetooth data reading application. The project intends to reduce the human labor and unnecessary hassles at the shopping malls by partially automating the process of billing.

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