

Automated Grocery Merchandising System

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Abstract: *This is an embedded based project. An embedded system is a fusion of software and hardware and perhaps other mechanical parts designed to perform a specific function. This system is very essential to develop and implement in today's world for eliminating the corruption prevailing in the fair price shops(FPS). The main aim of this project is to make the system more secure, reliable and efficient. To make our system more effective and user friendly, we have thought of using an app to transmit and receive signal from the microcontroller.*

Keywords: Microcontroller Arduino, Weight Sensor HX711, Bluetooth module HC05, Servo motor S3003, EM18 Reader module and Loadcell

1. Introduction

The Public Distribution System(PDS) is a fair price shop which is being funded by the government. It provides the commodities at a very cheaper rate than the normal rates available in the market. The people who are falling into the category of below poverty line can get the access to these kinds of shops. For buying any product/item from these shops, people need to show a identity card and they get access to the commodities available in the fair priced shop.

The problem in the PDS is that there is a long queue and it takes a lot of time for the people to get their commodity. Also, there is a lot of corruption happening in this kind of system. Thus, to reduce the corruption and the time consumption this kind of system is being introduced.

This system contains a microcontroller based vending machine that gives out the grocery items once the RFID card is read. The customer will be provided with the vended product once the card is scanned & input is given.

The system is divided into many parts:

The first part deals with the scanning of RFID card which provides unique identity to the individual.

The second one is the programming unit which is implemented using the microcontroller.

The third part is the display unit which displays information and delivers the required item based on the information sent from the microcontroller to a container which would be kept down. That container would be attached with the weight sensor or load sensor to detect the exact amount or quantity of that item to be vended.

The Container in which the items are kept would have an opening & door would be shut exactly after the amount of

quantity given as input by the customer through the RFID is met.

Lastly the payment mode can be either by inserting coin or by swiping the debit/credit card etc or by the means of Net banking / Paytm which will support the cashless transaction. Coin method is also known as the token Mechanism wherein it reads the number of the coins inserted which in turn triggers the machine to dispense the selected item.

There will be option of swiping the card if required which acts as ATM.

Cashless transaction will be supported using the Paytm or any apps for payment.

Programming has also been done in python which will help in showing the login credentials i.e. exactly at which date and which time which user used the machine which would be of a major help for the machine owners in maintaining a database.

2. Literature Survey

Special product vending system and method

Author: David Kaehler, Joseph Long

A remote exchange station for the computerized distributing of merchandise and enterprises offer items, and moreover administers aimlessly extraordinary items, bundled in the size and state of distributed items however containing limited time prizes. At the point when an extraordinary item is administered, the chosen item is moreover apportioned, without the need to take part in a different exchange. In one exemplification, uncommon items are blended with items in the remote exchange station's stock, and the administering of an exceptional item is distinguished by an optical, RF, or other locator, inciting the consequent apportioning of the chose item. In another epitome, the items and extraordinary items are put away in isolated inventories, and an uncommon item is apportioned on order in light of a pseudo-arbitrary

number generator in a related controller. In another exemplification, the remote exchange station is a data stand distributing advanced items. Apportioning of an extraordinary item is pseudo-arbitrarily decided and the exceptional item is chosen from among accessible items.

Application no: US7451892B2

Date: 1997-03-21

Link: <https://www.google.com/patents/US7451892>

3. Methods/Approach

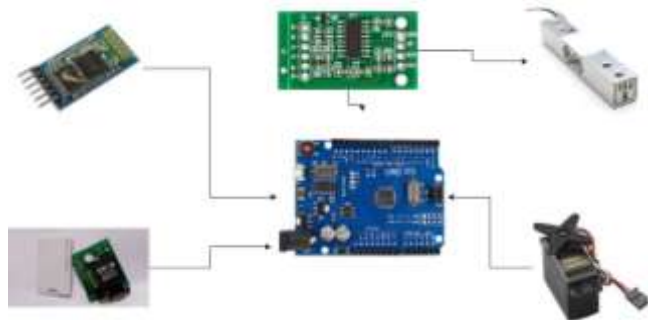


Figure 1: General Block Diagram

The Figure 1 shows the complete working block diagram of the Automated Grocery Merchandising system. Arduino UNO is interfaced with EM18 reader module, HX711 module for the load cell, Bluetooth module(HC-05) and servo motor s3003. As the power supply is given to the EM18 reader module and the Bluetooth module is connected to the mobile app, a message will be displayed on a mobile app asking the user to login with the RFID card. As the user swipes the card against the EM18 reader module, if the card is detected then another message is displayed i.e. Found Card with ID number and login successful with that person's unique name. The system will show the available quantity in kilograms. It will ask for the user to give the input in grams. There will be a small opening in the system through which the quantities will fall and it is closed by the wings of servo motor. As the user gives the input, the servo motor which is attached with the system which will rotate its wings towards 90 degrees so that the desired quantity can fall from the gap. A loadcell will be kept exactly downside in such a angle that the quantity will be measured properly. The weight measurement will start. As the weight is measured that is if the input weight is 255 and the measured weight is also 255 then the servo motor will come back to its original position i.e. 0 degrees, thus the gap will be filled by the wings attached with the motor. Thus, the user can take the desired quantity from the compartment downwards.

4. Block Diagram Description

4.1 Microcontroller Arduino

Arduino alludes to an open-source hardware stage or board and the product used to program it. Arduino is intended to make gadgets more open to specialists, originators, specialists and anybody keen on making intuitive articles or situations. An Arduino board can be bought pre-gathered or, on the grounds that the equipment configuration is open source, worked by hand. In any case, clients can adjust the

sheets to their necessities, and in addition refresh and disseminate their own particular renditions.

- Operating Voltage: 5V
- Flash Memory: 32 KB (ATmega328) of which 0.5 KB used by bootloader
- SRAM: 2KB(ATmega328)
- EEPROM: 1KB(ATmega328)
- Clock Speed: 16Mhz
- Pin: Digital I/O pins 14



4.2 Bluetooth Module HC05

Bluetooth is an innovation for remote correspondence. It utilizes serial correspondence to speak with gadgets. It speaks with microcontroller utilizing serial port (USART). For the most part, it associates little gadgets like cell phones, PDAs and TVs utilizing a short-go remote association with trade reports. It utilizes the 2.45GHz recurrence band. The association can be point-to-point or multi-point where the most extreme range is 10 meters.

- Bluetooth protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK(Gaussian Frequency Shift Keying)
- Emission power: ≤ 4 dBm, Class 2
- Sensitivity: ≤ -84 dBm at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Power supply: +3.3VDC 50mA



4.3 Weight Sensor HX711

This module utilizes 24 high-accuracy A/D converter. This chip is intended for high-accuracy electronic scale and configuration, has two simple info channels, programmable pick up of 128 incorporated enhancers. The information circuit can be arranged to give a scaffold voltage electrical extension, (for example, weight, stack) sensor demonstrate is a perfect high-accuracy, minimal effort inspecting front-end

module.

- Differential input voltage: $\pm 40\text{mV}$ (Full-scale differential input voltage is $\pm 40\text{mV}$)
- Data accuracy: 24 bit (24 bit A / D converter chip.)
- Refresh frequency: 10/80 Hz
- Operating Voltage: 2.7V to 5VDC
- Operating current: $<10\text{ mA}$



4.4 EM 18 Reader Module

EM-18 RFID reader module utilizes a RFID reader that can read 125 KHz labels. In this way, it can be called as a low recurrence RFID reader. It gives out a serial yield and has a scope of around 8-12 cm. There is a worked in radio wire and it can be associated with the PC with the assistance of RS232.

- Read distance 10cm
- Current $<50\text{mA}$
- Operating frequency 125khz
- Parameter Value
- Operating Voltage 5v



4.5 Servo Motor S3003

A servo is a kind of engine that is frequently utilized as a part of apply autonomy. The situation of the motor can be controlled accurately which makes it extraordinary for guiding remote control vehicles and robots. Not at all like a standard motor a servo requires a flag to advise the engine how far to turn. Most servomotors have a 3-wire interface. One for input voltage, one goes to ground and one for control signal. The flag that controls the servo is a progression of heartbeats, with the length of the beats deciding the edge that the servo will move to. If the flag is ceased the servo will lose its position. This is called Pulse Width Modulation, frequently abbreviated to PWM. The Futaba S3003 Standard Servo is intended for use in remote

controlled autos and vessels, however can likewise be utilized as a part of different applications.

Servos are controlled by sending an electrical beat of variable width, or pulse width adjustment (PWM), through the control wire. There is a base pulse, a greatest pulse, and a redundancy rate. A servo engine can typically just turn 90 degrees in either bearing for a sum of 180-degree development. The engine's nonpartisan position is characterized as the position where the servo has a similar measure of potential revolution in the both the clockwise or counter-clockwise bearing. The PWM sent to the engine decides position of the pole, and in light of the length of the beat sent by means of the control wire; the rotor will swing to the coveted position. The servo engine hopes to see a heartbeat each 20 milliseconds (ms) and the length of the beat will decide how far the engine turns.



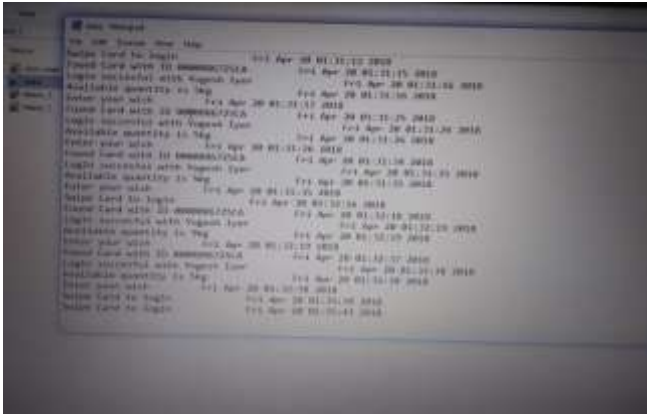
4.6 Load Cell

Load cell is a sort of transducer which plays out the usefulness of changing over power into an electric yield which can be estimated. Load cell can be discovered at the core of any measuring machine or electric scales. This sort of transducer is exceptionally precise which gives client required data that is hard to get by other innovation attributable to certain business factors.

It is fundamentally a gadget that measures strain and afterward changes over power into electric vitality which fills in as estimation for researchers and laborers. The strain estimation by load cells helps in keeping up honesty of the unit under strain and secures individuals and gear adjacent.

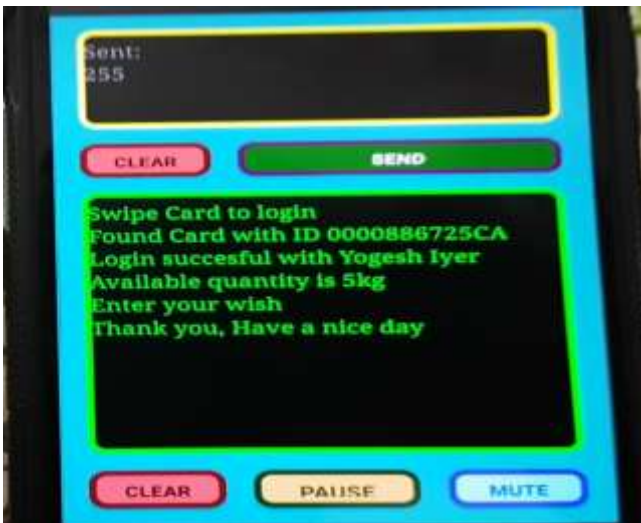


5. Login Credentials



To get the login details we have done this programming part in python. It will show which user has used the system at which date and at which particular timing. All date is saved in notepad. It will be useful to the owner for creating a database.

6. App Result



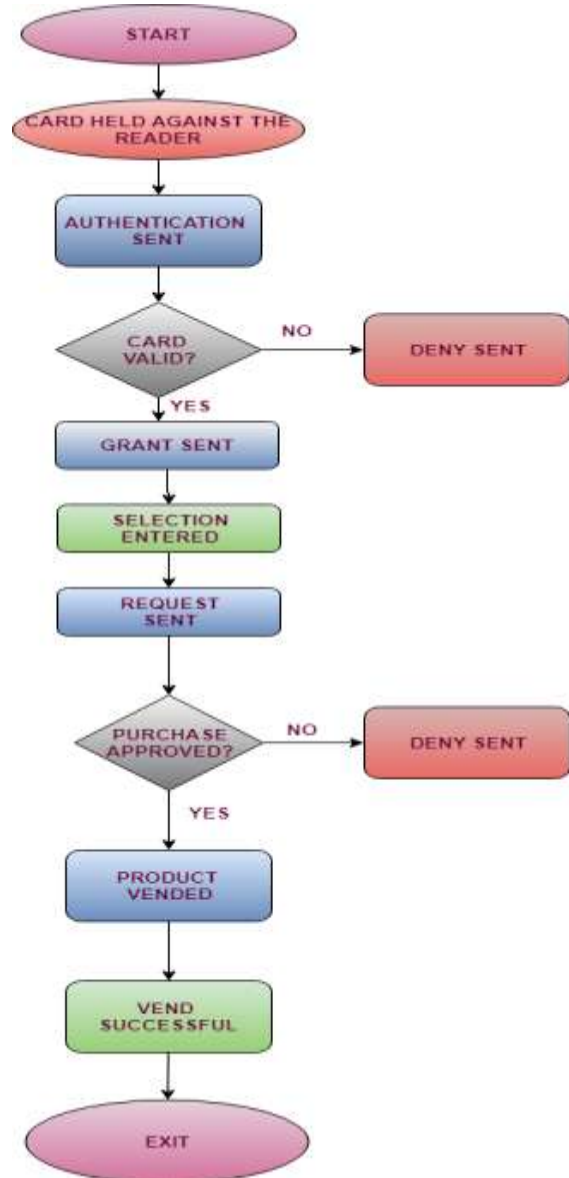
This App is useful in receiving and sending information via Bluetooth module HC-05.

7. Advantages

- **Practical technique:** It will be the incentive for the cash that individuals will love in the wake of executing this framework as it would be gainful to them in every one of the methods.
- **Enhanced use of assets:** The best use of the asset is being made in this undertaking.
- **Less work:** The impedance of the human has been wiped out as the framework is completely programmed and from now on the debasement will be diminished in the districts where it is being polished all the more i.e. the fair priced shops, shopping centers and so forth.
- **More exactness in estimating the amount:** The shopkeepers or the merchants don't generally give the precise sum or amount of thing being requested. They for

the most part give out less amount in spite of the fact that being checked in the pillar adjust.

8. Flowchart



9. Conclusion

- Thus we can now fully automate the system in which there were lots of people required to do one particular task.
- This is a secured way for transactions and also the corruption will be eliminated.
- Work will now become a lot easier than it used to be.

10. Future Scope

We will replace Arduino with Esp32. Esp32 has a feature of wifi and Bluetooth built-in itself. Hence, we would be able to control the system using website or an app with database updation in app/website itself. Thus, making the system quite user friendly and more GUI based. Also fingerprint sensor will be attached in this system making it more secured. Thus, the efficiency will increase. Therefore, we will now be able

to completely eliminate the corruption prevailing in the Fair Priced Shops (FPS).

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