

Design and Fabrication of Smart Shelf System

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Abstract—In order to solve an issue that most stores have, this project will use a load cell to measure weight and communicate the weight input to a HX711 converter, which converts the signal to a digital number. The digital value is used to notify the consumer of the stock level. The owner of the shop will receive a notification on their cell phone every time the supply is low telling them to replenish. We have started using PIR sensors to utilize less electricity. Only motion causes a light bulb to turn on. We'll utilize a relay in this case, which uses energy from a power source to turn on or off switch connections. Retailers may employ smart shelves for a variety of purposes, including as better storage, better decision-making, informing the back-end system of the number of products already on the shelf, monitoring product levels, detecting theft, and finding missing items. If necessary, the network of shelves might communicate updated product inventories to shop owners, managers, employees, customers, warehouse personnel, or producers. As a result, there is no need to make an order or conduct a physical inventory count at the warehouse or storeroom.

Keywords—Smart Shelf, Shelf, IOT Based Shelf.

I. INTRODUCTION

Among the most encouraging applications of retail technology of the future of smart shelves. Advanced shelves system which are electronic devices attached to the shelf, are made to monitor the number of stocks in the shop. Manufacturers will get real-time usage stocks and sales figures for their products. The present global trend in embedded systems is advanced computing. It uses microprocessors embedded in everyday objects to allow communication between them. This concept centers on detecting the load on the shelves, which enables the user's mobile device to receive information about the amount of stock. We expand on this idea to address issues that arise daily, like neglecting to buy a certain grocery item. The shortage of inventory products in retail outlets, which results in dissatisfied customers who are one of the biggest constraints the grocery industry is currently facing. Smart shelf technology enables automatic stock availability monitoring and alerts retail establishments when inventory is getting lesser amount if products have been moved from predetermined places. IOT smart shelf could offer with helpful data on customer behavior and important insights on how to constantly enhance their in-store experience. Smart phones, wearable technology keep us connected, engaged, and aware of daily events taking place around the globe. An automatic to-buy list is generated using sensor and smartphone technology as part of our effort to put a mind in shelves. Retailers may make better-inform changes regarding stock management s and, communicate the quantity of products already on the shelf to the back-end system, detect theft, and locate lost items by using smart shelves.

II. LOAD CELL

Load cell is a sensing device in which it senses the amount of weight that an object has which will be analyzed and transmitted to a analogue to digital convertor. We can use this in a potential way in which it can be calibrated in a way that we can set the zero value which is done accordingly to our need. Altering the minimum value is done with the help of coding which we will be using on our system to improve any kind of work.

Types of Load Cell

There are 5 types of load cell available in our market. Based on the amount of load it should withstand they are classified as follows.

- Strain Gauge Load Cell
- Hydraulic Load Cell
- Pneumatic Load Cell
- Capacitive Load Cell
- Piezoelectric Load Cell

Programming a Load Cell

We can program a load cell in various languages that we are well known. Here we used C programming as a coding language to perform certain task which is required to the system. We can also use C++, Java, Python, etc. as programming a load cell. It will help us in various way that we can perform various tasks with this load cell. In this system we have used strain gauge load cell to calculate the weight in the rack on a store.

Potential Limit of Usability

We can use this load cell in a way that we can easily identify the weight of a product which are requires for various use. Based on the usage we can get load cell . Load cell is classified based on the limit that it can sense the weight of various products. It has a capacity to measure 11.3 Tons which can be measures in the load cell. In weighing bridge which is commonly used by heavy vehicle used hydraulic and pneumatic load cell for calculating their weight.

III. PROGRAMMING TECHNIQUE

Here we used C programming to calibrate load cell. We can use any kind of programming language to program load cell. Even we use C++, Java, Python, etc, programming language in this system. If we use other language than c programming, we might face some difficulties during the code progress. We must choose a familiar and a easy accessible programming language which will enhance the way of working in the system [9]. Programming a micro controller is a main task in which it will be acting as a main source of controller to the system. We must choose a good controller to get a good performance. Programming a microcontroller will have a set of things to check as the code should run properly before it is uploaded in the micro controller; it should be tested in a virtual platform for its accuracy [1- 2].

Relay

The program is made in a way that if any person comes near to the shelf PIR sensor detects their presence and it will be supplying power through relay to the light settings which will be a great attractive idea to make people buy those products.

Integrating Detection System

We can easily integrate the analyzing system in a way that will be using minimum amount of resource to detect and rectify the issue. By updating it with the newer variant we can easily identify where we need to replace the stocks. We must be updating with the newer variant of technology which will emerge with various benefits.

Benefits Of the System

It has a variety of advantage from which we will be getting benefit. We can easily integrate the system and by adding various sensors we may get a good performance of the system. [14-15] It will also make the system to be more reliable to the user[11].The advancement on the sector, and it will be a good reference for the further development [8].

IV. MICROCONTROLLER CONNECTIVITY

The microcontroller has an important role in automating certain things which can make our work easier, and we can do our job in more effective way. We can also integrate the traditional warehouse system to be more efficient and it can allow various jobs to finish work in an easier manner. Implementation of IOT will help us to build a better and more effective system of identification and maintenance of the products [3-13].

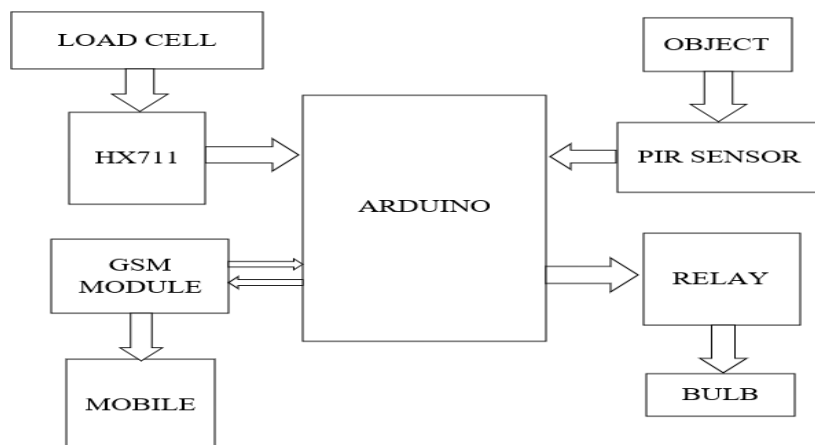


Fig 1. Process Flowchart.

Analysis Of the System

The system should be gone through various analyses, and it should perform in various working conditions. It must go through tough condition and make decent progress to that working condition. Going on with those conditions will help us to make changes accordingly in which we can make the system more effective and more endurable.[15]. **Fig 1** Shows Process Flowchart.

V. BENEFITS OF MICRO CONTROLLED AUTOMATION

Several businesses and solutions have developed as a result of smart shelf technologies, primarily for supermarket and drugstore retail. There is, however, no overview of the technologies that are employed or the application scenarios to which they may be put to use. By analysing the current state in various smart with improved system, their individual application aspects, the various technique underlying them, the related advantages, disadvantages, by planning future development, during expert interviews with solution providers. Automation can be made in an area where there is a reputation for a job. The job could be a cycle in which we do a certain task to make the work in a steady progress .we make a system in which it will be responsible in doing those automation in replacing the manpower with sensors, actuators , microcontrollers, RFID,etc.[6]

VI. POTENTIAL DRAWBACKS OF THE SYSTEM

The system can make a job easier, and it will be leading to the increase in the production and maintenance of the process rate. Even though it has various advantages it can also have some drawbacks. In a process of making a good and active system with the modular data for data transition can easily from one module to another by various transmitting devices like Bluetooth, ethernet, Wifi, etc. Transition of data paves a major role in the system for its effective performance which will be integrating system to perform in a better manner. Such a system will provide precise work and analysis to the person who works on the system to improve the working standard and efficiency of the work output. It would lead to the use of full utilization of each resource available for work (man, material, machine). Any misuse of any part of the system could cause a variety of problem to occur in the process in which we must be debugging those things manually, it could be both hardware and software. In this hardware can be easily replaced with the new one but software will be difficult to alter as the entered values must be checked for its accuracy and for precise use of the data collected[16-21].

VII. FUTURE WORK

The smart shelf system has a various advantage in which it can be used in a way to make change in grocery shops in which manual way to check the stocks will be eliminated with the help of IOT and we can easily automate this in further process. By analysing the current state in various smart with improved system, their individual application aspects, the various technique underlying them, the related advantages, disadvantages, by planning future development, during expert interviews with solution providers. Our findings demonstrate that existing solutions can handle a wide range of application situations, from shelf detection to compliance of verification to creativeness, process optimization [4]. **Fig 2** Shows Prototype.



Fig 2. Prototype.

VIII. CONCLUSION

The installation of the system in the shops will be a great advantage by which reducing manpower and error caused due to the miscalculation which is a common thing which causes the use of excess resource and manpower. We can manage to send the requires number of stocks which need to be filled in the appropriate racks of a particular product. The effective use of the system can lead to improvement in the growth of the store. Using a simple process would help us to understand the flow and in case any error occurs we can easily solve. By making it easier will help us to make more preparation to deal with the other problem. This also got an addition al feature to attract the people who visits the market.

It could be a new method to attract people to buy product by using PIR sensor to detect people and a relay to supply the lights.

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