

IOT BASED RETAIL STOCK MANAGEMENT

A Smart Shelf

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Abstract: In present time, IoT is a concept that is used everywhere and every time. Mostly in western countries, IoT is a concept which is used in day to day life for applications such as home automation. In India, most of the businesses are based locally as small-scale businesses which are mainly manufacturing and retailing units. But there is very less interaction of technology and small-scale entrepreneur. For a manufacturing unit and retailer, supply and demand is a big issue to manage. Sometimes, there is demand for a product but no sufficient supply of product and sometime there is sufficient supply of a product but there is no demand. Similarly, for a retailer continuously checking for stocks is a challenging task. In this project, we propose that IoT can be used to perform tasks like checking that which product is in demand, which product has no demand, which product has ample quantity, which product has insufficient quantity, so that retailer can get a clear idea which product to order and which not before the stocks run out.

Index Terms - Internet of Things (IoT), Sensor, Shelf.

1. INTRODUCTION

Today, internet plays a major role in every field. Internet is a network where many devices and networks are interconnected. Today, in this time we can't even imagine the world without internet. It has the power of making everything possible. In this era, we will find no person who has never used internet in his/her lifespan. Internet has the power to connect two persons living at two ends of world with each other. This power of internet has brought the whole world connected at one point. If we see the statistics, after the introduction of internet to common person and in corporate world, the world has changed tremendously. There are several revolutionary changes brought into businesses after emergence of internet in businesses. Also, with the common man, now with power of internet in his/her hand, he/she can now connect with each and every one intended and can do any operations be it related to money transfer, communication, file sharing, etc. within some seconds and with minimum cost. Thus, Internet plays a major role in each and everything that is happening over the globe, across countries and across continents.

The concept of a network of devices was discussed as early as in 1982, where at Carnegie Mellon university they invented modified coke vending machine. It was the first Internet connected appliance. It was able to report whether the stock of coke cans is full or not and whether the cans are cold or not. Doesn't this sound amazing? Yes, it is. Like such we can also imagine two cars driving on a road, these two cars cannot see each other but they are coming towards each other. By the time, the respective drivers will recognize the threat this two cars will hit each other. Instead of this to happen if these two cars can communicate with each other and tell each other when they will cross each other, so that either they both will decrease their speeds or will change their routes. This would be a miracle. But this is possible with IoT which stands for Internet of Things.

IoT (Internet of Things) plays an important role in this changing technology-based world. IoT is a collection of devices, electrical appliances connected with sensors to each other for exchanging data. As we discussed earlier, IoT is a field which can change the way we live our everyday lives. IoT can change the pace of life with help of Automation, Artificial Intelligence and Machine learning.

Therefore, there are several advances made in this field. An IoT based system takes input from various sensors sends it to cloud storage, analyses the data and gives output which can be accessed on any device from anywhere. In our project, we are using IoT for a retail store management which will help the retailer to monitor and manage the stock in his shop.

2. EXISTING SOLUTION

Currently, in every retail store/supermarket the employee of the store manually checks all the product stock – like how much stock is left on shelf, how much stock is available in inventory. After checking the inventory, the retailer places his order for particular product to any supplier of his choice. After the order is placed, it takes many days to receive the order at retail store. This whole process takes almost a week to complete and if there is high demand for that particular product, at that time there will be guaranteed loss of retailer. Also, this will affect retailer's business revenue if this happens more often.

The other available solution is RFID tags.^[2] RFID tags are placed on the product which are scanned by RFID readers while billing. According to working of RFID tags and its readers, the circuit for every individual product needs to be feeded. When the product is scanned, its quantity is deducted from total quantity. But this also does not allow the retailer to monitor his stocks in advance. Also, this is an expensive as well as complicated solution as RFID tags need to be placed on every product to be billed.

3. PROPOSED SOLUTION

The proposed system is to build an IoT based system that will help the retailers/store managers to efficiently monitor and manage the stocks for their store. The purpose of this system is to maximize the revenue of retail store by integrating the IoT

technology for efficient stock management and automating the process. This system will also help the retailer to determine which product will be out stock soon and which product to order. With the help of this system, the retailer will need less man power to manage and monitor the store. In this paper, we present this IoT solution which will bring revolutionary change in traditional way of retail stock management.

4. IMPLEMENTATION METHODOLOGY

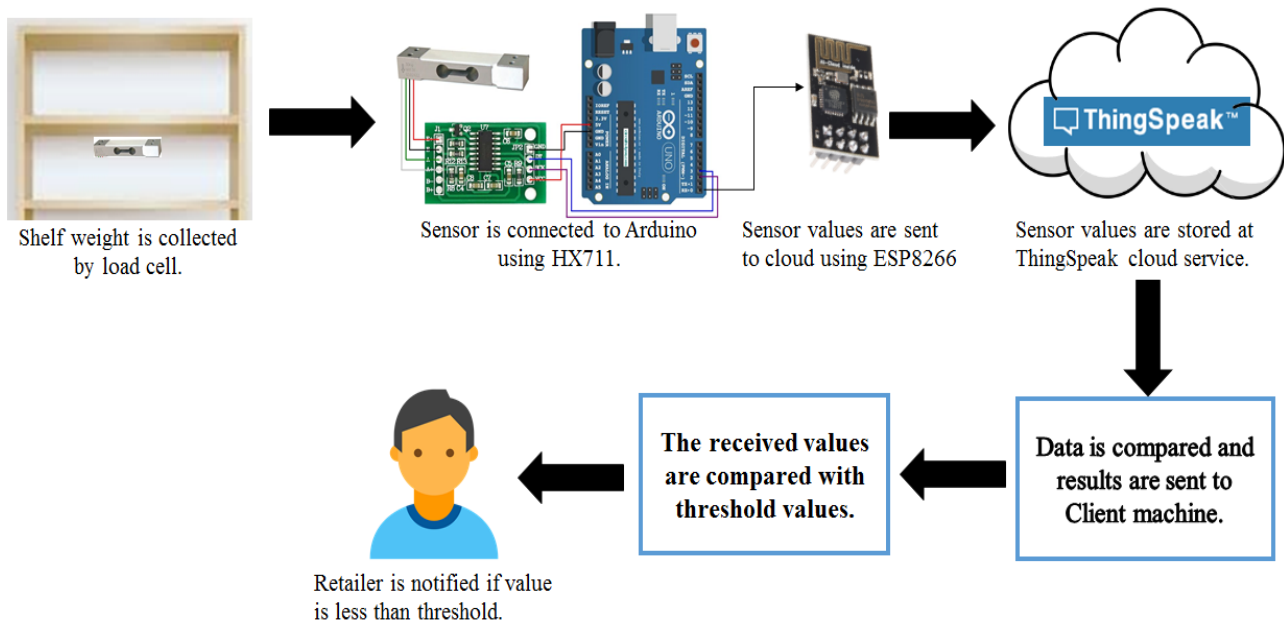


Fig.1 system architecture

The fig above shows the general structure of implementation methodology. The total working of project is divided into three stages. 1) Data Collection - In data collection, sensor values are collected from shelf. 2) Storage on cloud - In this stage, the sensor values are sent to cloud using ESP 8266 Wi-Fi module and are stored at ThingSpeak cloud service. 3) Data retrieval on UI - At this stage, the stored data values are retrieved on client machine and displayed on the User Interface. The further detailed description of each stage is as follows:

4.1 DATA COLLECTION

Here, we will use load cell CZL601 in order to collect the weight from the rack of the shelf. The load cell is a component, that takes input as a force and gives output in the form of electrical signals. The rack will be stacked up with the products that is meant for sale in the store. We will do this by fixing the load cell on the shelf and then fixing the plate on top of the load cell. The plate that is fixed on the top of the load cell will be used for keeping the products. The load cell will be connected to Arduino UNO using HX711 (Analog-to-Digital converter). It converts the analog electrical signals to digital signals. No programming is needed for HX711 as all the controls of HX711 are through the pins. HX711 is also a load cell amplifier that helps us in reading the output values of the load cell. By connecting this HX711 to Arduino, we can get accurate weights.^[1]

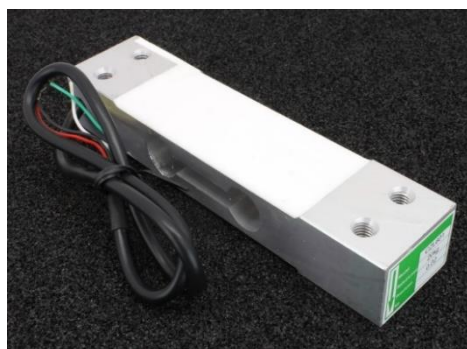


Fig.2 load cell czl601



Fig.3 plate fixed on load cell

4.2 STORAGE ON CLOUD

Once the correct readings are collected, the readings are uploaded to the cloud. Here, we are using ThingSpeak cloud service for storing data that is collected by the sensors. ThingSpeak is open-source cloud that is used to store as well as retrieve data using API keys. It provides a testing platform for all types of IoT projects. It also provides service for analysis and visualization of the data with help of MATLAB. There are separate channels for each project. The channel contains fields that individually stores the values that it has received from the sensors. The values that are collected by the sensors are stored on the channel using “Write API Key”. For retrieving the values that are stored in the fields “Read API Key” is used.

For uploading the values to the cloud, we are using Wi-Fi module ESP 8266. It allows Arduino to connect to the wireless network. The ESP 8266 is a Wi-Fi module with TCP/IP stack support. The Arduino receives the values from sensor and it processes these values to send to cloud server. The ESP 8266 uses AT commands to connect to Wi-Fi network, to establish connection with cloud server and to send data. This AT commands are used to control Wi-Fi settings of ESP8266. This setting includes setting Wi-Fi mode of operation, get a list of Wi-Fi networks, connect to a Wi-Fi network, etc.

Once the connection is successfully established, the ESP 8266 will continuously send the values that it has received from the sensors to the ThingSpeak’s fields after a specified period of time. Here we are sending the value to the cloud after every 15 seconds, so after every 15 seconds, the updates will be sent.

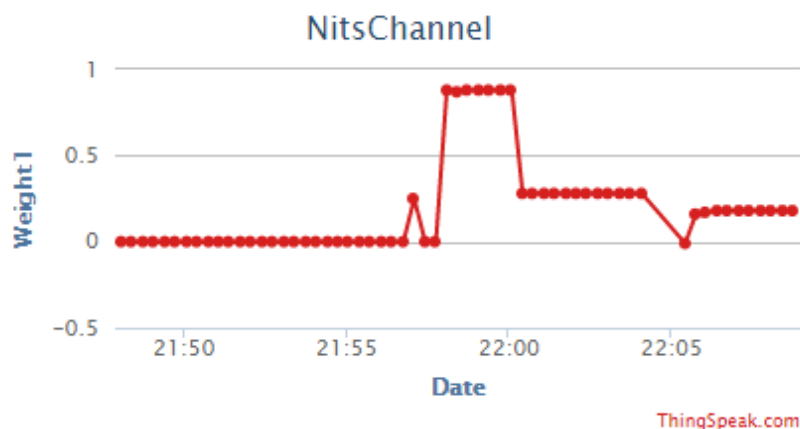


Fig. 4 graphical representation of stored data value

4.3 DATA RETREVAL ON UI (USER INTERFACE)

The main purpose of the project is to automatically notify the user about the available stock. For this, we have designed a simple UI (User Interface). The user interface is designed using “Python Programming Language”. The user interface notifies the user about the stock available in the shelf. It alerts the user when the product is about to get out of stock. This is done by dynamically setting the threshold value of each product. The threshold value is set for comparison. Here, the value will be the weight in Kilograms. The current value of the products in the shelf will be compared with the threshold value that was set by the user. If the current value gets below the threshold value or equal to threshold value, this means that the product will soon get out of stock. So, the user will be notified regarding it on the UI by giving an alert message. We have also provided the provision for ordering the product directly from the UI by adding Place Order button on the UI. This button will open the browser with the G-mail’s compose mail page. By mailing the quantity of the product, the product stock can be ordered. After successfully stocking up the product in the shelf, there will be no alert message displayed in the UI.

5. RESULTS

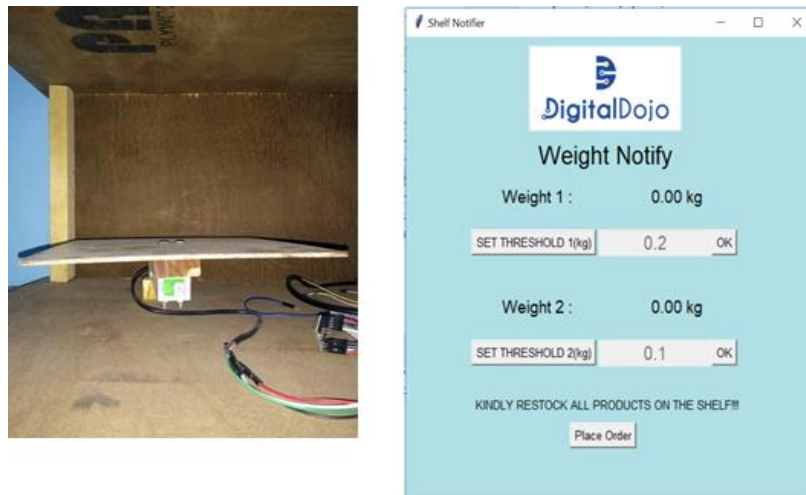


Fig. 5 empty shelf

Here in Figure number 5, we see that the shelf is empty. There are no products kept on the shelf. So, we clearly see the weight 1 field in the UI shows 0.00 kg. As, we are not using shelf 2 in this demonstration, the value of the weight 2 will be 0.00 kg.

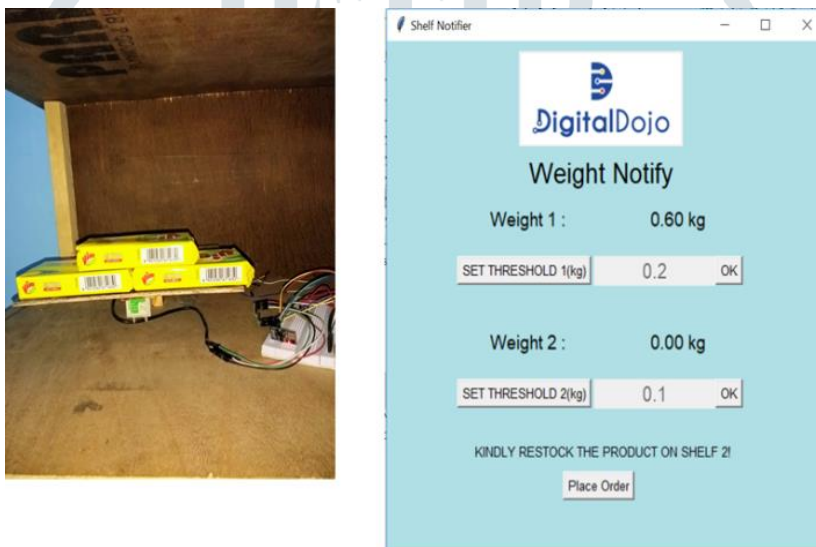


Fig. 6 shelf with weight above threshold value

Here, we have kept 3 bars of soap weighing 200 grams each, so the total weight present on the shelf is 600 grams or 0.60 kg. The same weight is reflected in UI and as the weight of shelf is above set threshold value, it is showing alert message for shelf 2 only.

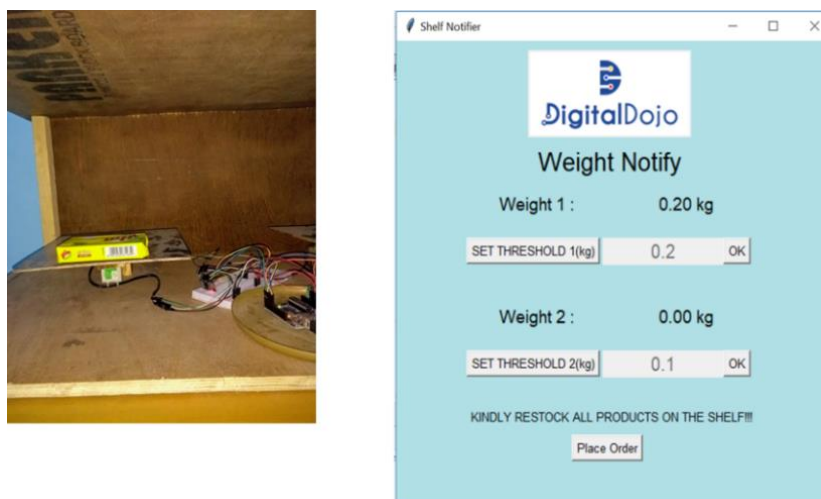


Fig. 7 shelf with weight equal to threshold value

Here, we have kept only 1 bar of soap weighing 200 grams, the total weight present on the shelf is 200 grams or 0.20 kg. The same weight is reflected in UI and as the weight present on the shelf is equal to the threshold value, it is showing alert message to restock the product.

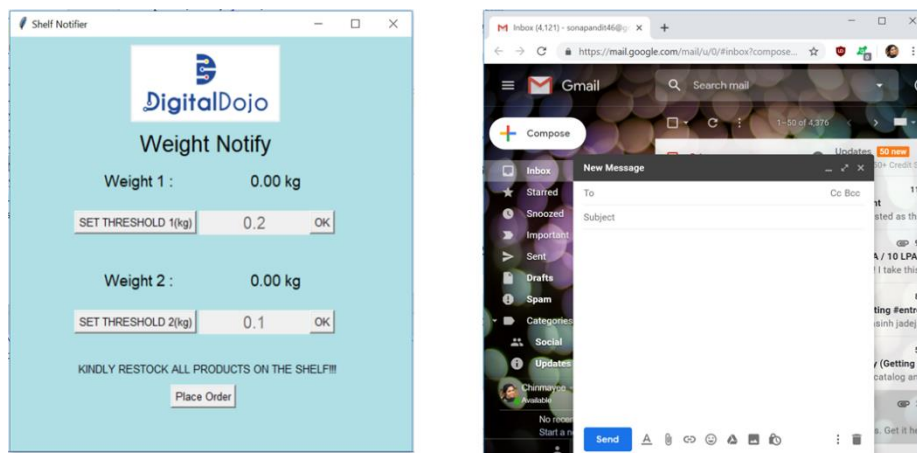


Fig. 8 demonstration of place order button

After clicking place order button, the compose mail window opens up in the Gmail.

6. ADVANTAGES

- No need of manually checking the stock available.
- Remotely monitoring of the stock is possible as the data is stored on cloud and it is easily accessible.
- Since, it does not require manual checking of the available stock, the retailer can hire less number of employees thus saving expenses.
- The retailer gets to know about stock quantity in advance, so that he can order the products early. Thus, supply demand chain can be maintained.
- By using this technique, the product stock can be maintained leading to growth in revenue of store.
- System is designed such that it can be used on current shelf also.

7. APPLICATIONS

- With little modification, it can be further used in a manufacturing unit to control the supply and demand problem and thus making the task of manufacturing efficient.
- It can be also used in inventory management in large warehouse where there are too many products to deal with and the monitoring is the prime task.

8. CONCLUSION

At current time, there is no introduction of technology and small-scale businesses. Mostly the stock management is done manually by continuously checking the stocks in racks and back store. In this process, if a product runs out of stock then the stock manager or retailer makes the list of products which are out of stock. Then according to this list, the order is placed. This whole process takes 4-5 days or even more. If in this period, there is a lot of demand to that product, then this results into loss of revenue for the retailer. If such situations happen more often then it can affect revenue of store on a large scale. Using this thesis, this problem can be solved. This thesis uses IoT technology for stock management and monitoring. The data values are stored at ThingSpeak cloud service. As the data is stored on cloud, it can be accessed anytime and anywhere. This also allows remote monitoring of the stock. When the collected weight of shelf gets below threshold or is equal to set threshold value an alert message is shown. This lets the retailer to know in advance, about stock quantity and thus retailer can place his order in advance. Thus, overcoming the drawback of existing system. This approach requires less manpower and increases the revenue of store.

9. REFERENCES

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