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IoT Based Inventory System for Stock Management

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Abstract – *With the advancement of information and communication technology, life is getting simpler in all aspects. The rapid increase in the number of users on the internet over the past decade has made the internet as a part of human life. Home Automation using the Internet of Things (IoT) is a system that uses a smartphone device or pc to control basic home functions with the help of sensors connected to the internet and features automatically through internet from anywhere around the world. In this paper, we present an efficient system for managing the kitchen inventory. By implementing Inventory System we can always have real-time values and records of our grocery stocks. And we don't have to memorize grocery stocks the way we did it by traditional ways. The idea utilizes the load cell and HX711 load cell amplifier interfaced with NodeMCU, to measure grocery container value and see this data in the user's smartphone or pc with the help of cloud service.*

***Key Words*: Internet of Things (IoT), NodeMCU, Load cell, HX711 Load cell amplifier,**

1. INTRODUCTION

Internet of Things is the addition of the current internet to do communication and inter-networking between various device also known as "Thing". This technology will permit surplus of devices connected across the internet for communicating and sharing huge data. Home Automation is a new pivot point for innovation in the Internet of Things. Researchers have done huge research on home automation technology. In home automation, Kitchen plays an exceptional role in home automation. One of the technologies is IoT in the Inventory system for stock management. To organize stocks of grocery is very difficult to maintain especially in busy schedule these days. Lacking proper planning results to visits grocery stores frequently which is boring tasks [1].

In this paper, we proposed a system which will always be updated us about the stocks present in our grocery container in the kitchen. So we will always have a track on our grocery. We are using a Load cell to measure the weight of grocery containers which contains food items. Load cell gives us data in analog form. A load cell is connected with HX711 Load cell amplifier and 24 – bit ADC which gives us load cell output in digital form. The weight measured by a load cell of grocery container can be displayed on smartphone, tablet or pc and can be accessed from anywhere from the world through the internet. When the load cell measure value of grocery container and if the weight is below the threshold value, then the notification will be sent to smartphone or pc.

The main objective of this paper is to make a weight measurement system and display this information on a smartphone or pc to observe and organize the kitchen stocks.

2. LITERATURE SURVEY

Apoorva Verma et.al, in "Smart Shelf for Smart Kitchen", has proposed the Smart Shelf is capable of measuring grocery items. The Smart Shelf consists of two different sections, weight sensing and level sensing. Level sensing section consists of fixed size container having RFID tag defining container size with product description, RFID tag reader and an ultrasonic sensor for measuring the level of the content of the container. Weight sensing consists of the RFID tag with similar container specification and content identification, RFID tag reader and weight sensor measuring all contents on the shelf [1].

Xiaojun Jing and Peng Tang, in "Research and Design of the Intelligent Inventory Management System Based on RFID" proposed a system in which RFID is integrated along with ZIGBEE. ZIGBEE focus on sensing indicator in limited area and RFID can identify the character and location of some sensing node [2]. The main disadvantage of RFID is that it has a limited detection range. Also if multiple loads are on the same palette than it is difficult for the RFID reader to read signal precisely [3].

S. Jayanth et.al, in "Inventory Management System using IoT". In this paper, the Ultrasonic sensor is used to measure the inventory. The Ultrasonic sensor is used to measure the time taken for a pulse to travel from the top of the container to the surface of the filled container and return back. The time is used to determine the distance from the top of the container to the surface of the inventory. If the value is less than the threshold value than email is sent to the supplier [3].

Jyotir Moy Chatterjee et.al, in "Internet of Things based system for Smart Kitchen" described Smart Kitchen using IoT system with multiple sensors, which includes weight sensor, gas sensor and temperature sensor. The gas sensor is used to detect the leakage of gas in the system, the weight sensor is used to detect the weight of the cylinder. A temperature sensor is used to detect the current room temperature. The threshold value is set into the kitchen, when it crosses the values it will send a notification to the user, about the weight of a gas cylinder and also leakage of the gas cylinder. The server can communicate with the user through an android

device. Through email and SMS server can send a notification to the user which will display on the Android devices [4].

M.K. Sangole et.al, in "Smart Refrigerator using the Internet of Things(IoT)" has proposed a system in which load cell is mounted below the vegetable tray in the refrigerator that continuously measures the weight of vegetables in the tray. Since the weight of the vegetable tray goes below threshold weight, it senses the less presence of the vegetables. A low signal will be generated corresponds to it which will be sent to the user on the mobile app [5].

3. PROBLEM STATEMENT

To manage grocery stockings these days is very hard especially with a busy schedule. The traditional system involves manual tracking of grocery items which results in visiting departmental stores several times a month for buying grocery items. For the whole family to manage grocery stocks manually is even more tedious. In this system weight of grocery container will be displayed on the user's smartphone and if the weight goes below threshold value it will send notification of stock replenishment.

4. PROPOSED SYSTEM

This section describes the working of the model. Each Load cell is mounted on the bottom of the grocery container with physical support. When we place a grocery container on the top of the Load cell, deformation of resistance of Load cell takes place. Change in resistance provides an electrical value change. So Load cell measures the weight of the grocery container in analog format. HX711 is interfaced with a Load cell which is 24 – bit ADC and an amplifier chip help us to see a Load cell data in digital format. To send a Load cell data over the internet, NodeMCU is used. NodeMCU is interfaced with HX711. NodeMCU contains ESP8266 Wi-Fi chip which will send a load cell data over the internet. We are sending our load cell data over Thingspeak cloud service. So we are seeing the weight of our grocery container in Thingspeak cloud service. Furthermore, we can also send our load cell data to Blynk cloud for displaying our grocery container weight in Blynk application. And if the value of a grocery container goes below a threshold value than Blynk application will notify users by sending a notification in the user's smartphone. Also to store the weight of grocery container in the database, we are using google spreadsheet which is hosted by our website – http://mystocks.cf

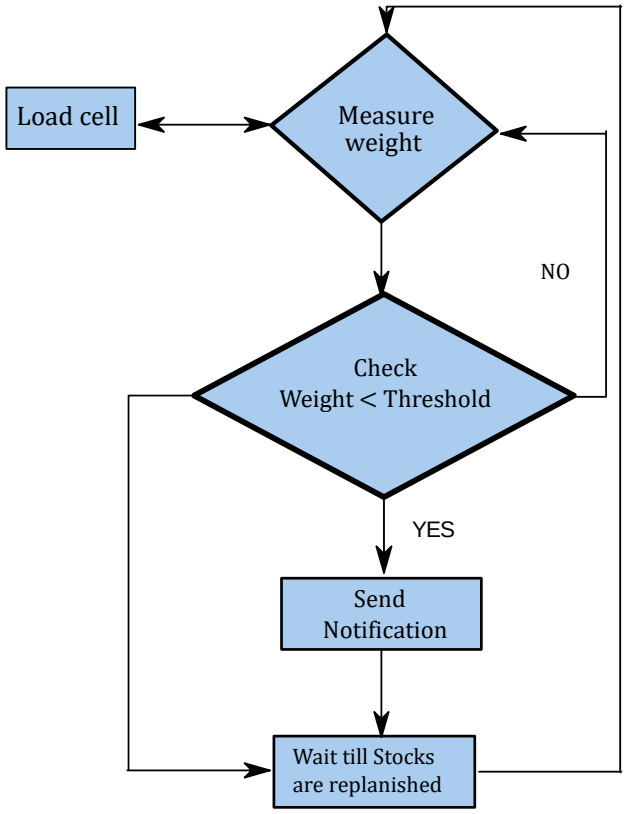


Fig -4.1: Flow chart of the proposed system

5. BLOCK DIAGRAM

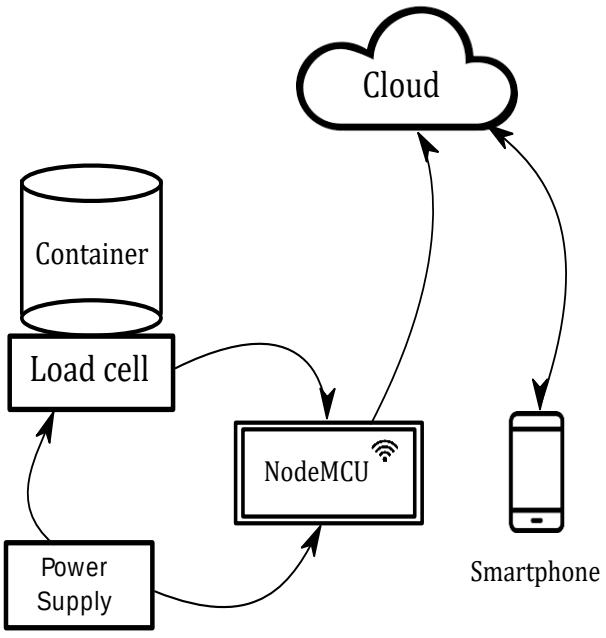


Fig -5.1: Block diagram of the proposed system

6. HARDWARE DESCRIPTION

NodeMCU (Wi-Fi Module)

NodeMCU is a Wi-Fi SoC (System on chip) produced by Espressif systems. It is based on the ESP8266 – 12E Wi-Fi SoC module. It is a highly integrated chip design to provide full internet connectivity in a small package. It can be programmed directly through a USB port using the Arduino IDE. By simple programming, we can establish a Wi-Fi connection and define input/output pins according to our needs, turning into a web server and a lot more. NodeMCU is a Wi-Fi equivalent of ethernet module. It combines the features of a Wi-Fi access point and station plus microcontroller. These features make the NodeMCU extremely powerful tool for Wi-Fi networking. It can be used as an access point and/or station, host a web server or connect to the internet to fetch or upload data.

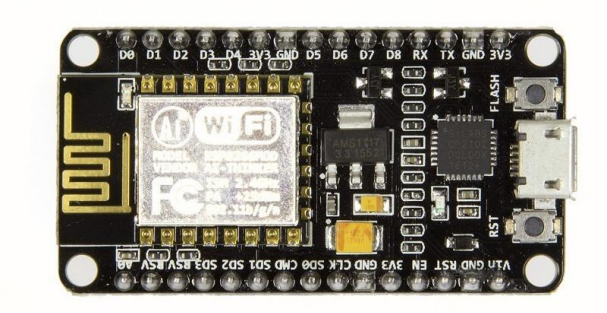


Fig -6.1: NodeMCU (Wi-Fi Module)

Load cell

The load cell is a transducer that converts mechanical energy (weight) to an electrical output. The magnitude of electrical output is directly proportional to the applied force. The strain gauge load cell works on the principle that the strain gauge deforms when the material of load cell deforms appropriately. Deformation of the strain gauge changes its electrical resistance by an amount that is proportional to the strain. The change in resistance of the strain gauge provides an electrical value changes that are calibrated to the load placed on the load cell.

Fig -6.2: Load cell

HX711 Load cell amplifier module

HX711 load cell amplifier module is a 24 high precision analog to digital converter which amplifies the low electric output of the load cell gotten from the mechanical energy (weight) and converts it to a digital form. HX711 also contains high integration, fast response, immunity and other features.

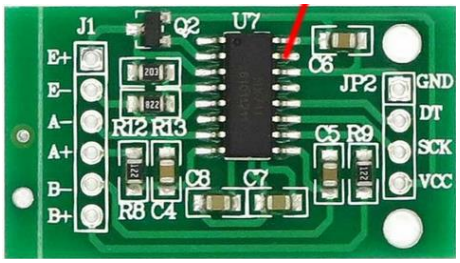


Fig -6.3: HX711 Load cell amplifier module

7. RESULTS

Finally, the prototype of the proposed system is created. The proposed system was tested for its functionalities. It was observed that the proposed system worked effectively.

A. Hardware Setup.

The hardware setup of the load cell along with HX711 & NodeMCU is shown in figure 7.1

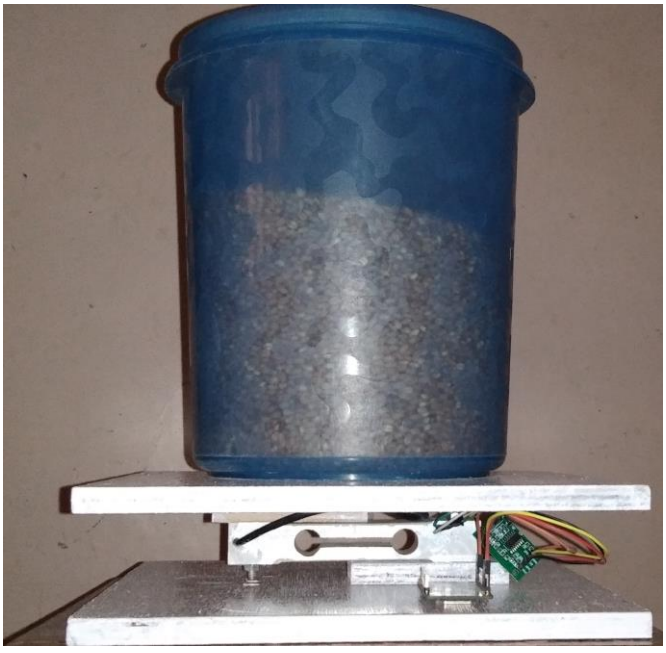


Fig -7.1: Hardware setup of the proposed system

B. Cloud Monitoring

The cloud monitor shows general insights of the data in the form of a line chart. A real-time advancing line chart can be analyzed for the load cell. The line chart of the load cell is shown in figure 7.2

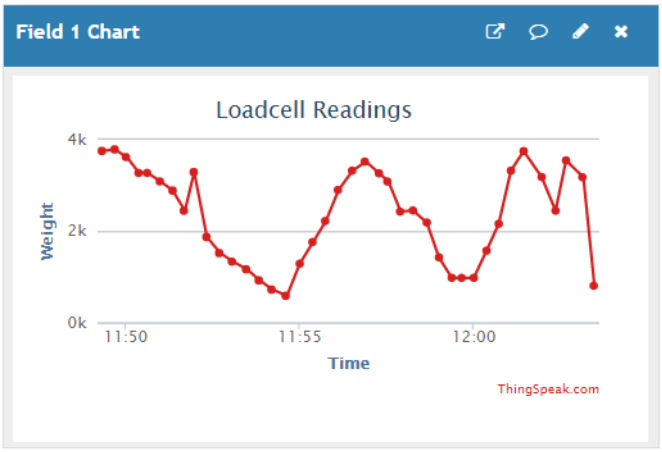
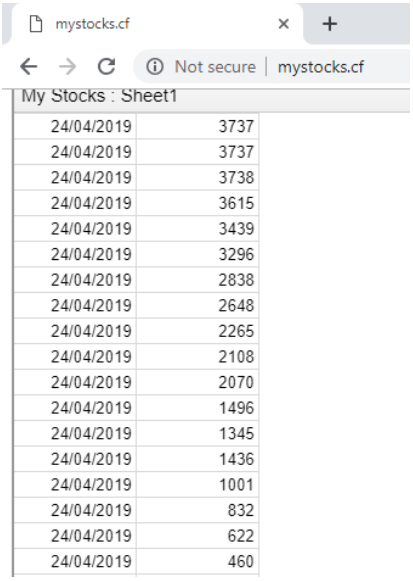


Fig -7.2: Line chart showing values of the load cell

C. Google Spreadsheet

We have stored our load cell value of grocery container in our google spreadsheet hosted by our website http://mystocks.cf We do so to have a database of our grocery items. The values of the load cell in the spreadsheet are shown in figure 7.3



24/04/2019	3737
24/04/2019	3737
24/04/2019	3738
24/04/2019	3615
24/04/2019	3439
24/04/2019	3296
24/04/2019	2838
24/04/2019	2648
24/04/2019	2265
24/04/2019	2108
24/04/2019	2070
24/04/2019	1496
24/04/2019	1345
24/04/2019	1436
24/04/2019	1001
24/04/2019	832
24/04/2019	622
24/04/2019	460

Fig -7.3: Google Spreadsheet showing the value of load cell

8. FUTURE SCOPE

In this proposed system we had created only one load cell prototype. Multiple load cell prototype can also be created in a similar way to identify differently grocery items in the kitchen. Also, a database using SQL can be created to have a past record of grocery items. Furthermore, an application platform can also be created to integrate all the things which include live tracking of multiple grocery items, database to see a past record of grocery items and if the grocery items are running out of stock, one-touch button is provided in the application to contact nearer grocery vendor by sending SMS of scarce grocery items.

9. CONCLUSION

It is evident that this system is super cost effective to identify and track usage of the grocery items. Using load cell needs to be mounted on the bottom of the grocery container. It is simpler and easier to mount. As the user can clearly see the real-time value of the grocery container, it is easy to track our grocery items. The threshold value is chosen so that grocery stocks are sufficient for use until the new stocks arrive. Because of the low cost, effective design and easy implementation, it can be implemented to support the smart home initiative and become an essential prototype.

10. REFERENCES

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