Smart Grocery Monitoring System using Smart Sensors and IoT

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*Abstract--*Innovation and development aim to provide comfort and ease to our day-to-day life. The idea of home automation is potentially because of the applications of the internet of things. The kitchen is the center of our day-to-day living. Kitchen and grocery automation is important with daily schedules getting hectic. Manual monitoring of the grocery is a time-consuming and tedious task. This paper describes smart grocery management system that uses smart sensors to monitor the grocery levels in the kitchen with the help of IoT. This system helps users by keeping a track of grocery items and reordering them whenever required all by itself. The basic idea is to detect the grocery levels in the container and intimate the user through notification whenever required. The system consists of smart sensors, and microcontrollers and is connected to the internet via wifi, which helps it to communicate with the user. A smart grocery management system is a smart and new way of grocery shopping that redefines the approach toward grocery shopping.

Keywords- Internet of things (IoT), home automation, grocery, smart sensors, smart kitchen, smart containers.

I. INTRODUCTION

The Internet of things (IoT) describes physical objects with sensors, processors, and other technologies that can connect and exchange data with other devices over the network. The invention of the concept of IoT has provided comfort and ease to human life. It aims to provide automation to make everything smart. IoT has its applications in several fields such as home automation, agricultural, transportation, health care systems, infrastructure applications, military applications, etc. The idea of IoT can be extended to home grocery management systems for simplifying the process of tracking and monitoring the groceries in the kitchen.

Managing groceries manually is a tedious task. In this hectic world with busy schedules, people don't have the time to keep a track of the grocery levels. Moreover, it is difficult for working partners in metro cities to look after the household needs.

If they don't check into the grocery levels and continue using the grocery items, few items finish off without their knowledge and affect the cooking and healthy eating process. This leads to frustration and anger. In addition to this it is difficult to maintain a shopping list, go out for shopping, stand in waiting queues at cash counters, etc. Today's hectic schedules demand a smart system to monitor our grocery needs to ensure that we have enough groceries in our kitchen.

A smart grocery management system helps the user to get proper track of the household grocery and reorder grocery items whenever required, all by themselves. This system is developed using smart sensors which track the quantity of the grocery items, at regular intervals and send the signal to the server along with the quantity data. The data is compared to a threshold value and if the received data is less, a notification is sent to the user and at a single click, the item is reordered.

II. RELATED WORKS

Javed et al. in "The Development Of IoT Enabled Household" describe a camera-enabled system to detect the product by scanning their bar codes and weight sensors and if the product's weight is below a threshold level the user is intimated [5]. "Smart Kitchen Management System Using IoT" developed by Chopade and Nighot (2019) also uses a camera to detect the grocery items in containers and weight sensors to check the availability of products [6]. "Smart Pantry" by Ahir et al. (2019) uses load cells to track the weight of grocery items. It also provides valuable information about the consumption of grocery items and eases storekeepers to expect and replenish their grocery items [7]. The smart kitchen shelf proposed by Manikandan et al. (2020) in "Home Grocery Management System Using IoT" can communicate automatically to the family head via the internet when groceries containers are below the minimum level [8].

Akshay Pendbhaje et al. proposed a system using load cells to measure the grocery weight and a raspberry pi microcontroller board that tracks the availability of groceries in the kitchen. It also searches for better options of e-commerce sites with lower prices to order the product and displays the list on the user's smartphone from where the user can order and procure those items [9]. " Smart Kitchen Containers As A Part Of Smart Home Appliances Using IoT And Android" by Lakkanagavi et al. describes smart containers developed using raspberry pi and infrasonic sound sensors to keep a track of the quantity of commodities in the container on regular basis and to send the signal to the server along with the quantity [10]. "Smart grocery management system using internet of things" by Chetal. S. Patil et al. also uses ultrasonic sensors to detect the quantity of grocery items with Arduino Uno as a microcontroller [11].

Objective Of The System

1) To raise the level of automation in the existing system i.e less human intervention is required with maximum features.

2) To automatically maintain inventory status for the purpose of updating the grocery items.

3) To be simple to operate, easy to handle, and user-friendly.

III. METHODOLOGY

Modernizing the kitchen storage becomes a necessity when you have tight schedules. A smart grocery management system helps people to keep a track of grocery items and to reorder it whenever required. This system consists of smart sensors that monitor the quantity of grocery items. The output information from the sensors is given to the microcontroller which processes it. If the quantity of the grocery item is less than what is desired, the user is sent a notification to inform about it, and with a single click, the user can reorder the item. All the details about the quantity of the various grocery items are stored in a database from which they can be retrieved any time through a mobile application.
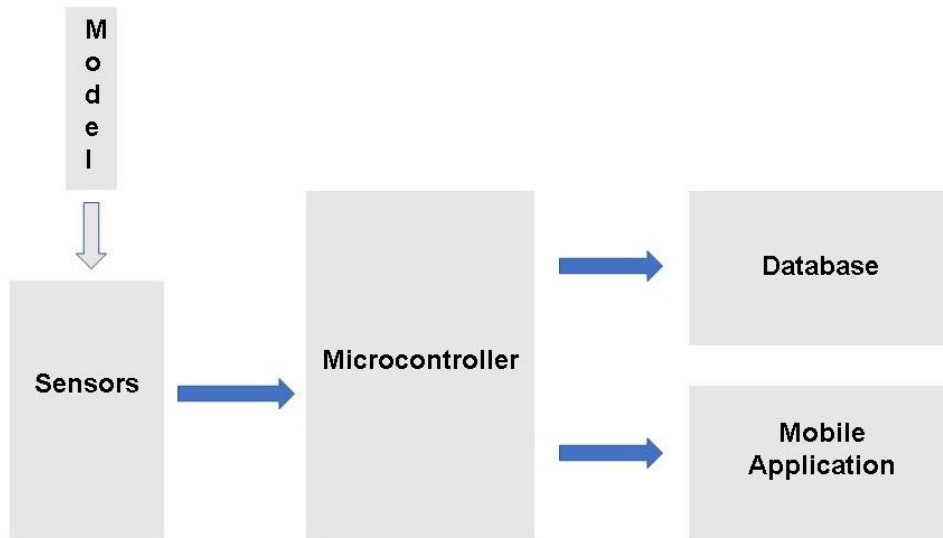

Figure 1 : Block Diagram.

The system consists of-

1) Smart sensors: The first and foremost task is to detect the quantity of commodity items. This can be done through smart sensors. These sensors measure the quantity of items and generate an output which is then processed by the microcontroller. Here two types of sensors can be used-

i) Ultrasonic Sensors- Ultrasonic sensors convert ultrasound waves to electrical signals. They are used for quantity detection by level measurement. These ultrasonic sensing elements generate high-frequency sound waves after which an echo is generated that is received back by the sensor. The distance to an object is measured by measuring the time interval between sending the signal and receiving the echo. Once the ultrasonic wave is launched, the timing begins and as soon as the ultrasonic receiver receives the reflected wave, the timing stops. Based on this principle the sensors measure the level or depth of the grocery material in the container and the analog voltage is given as output. The microprocessor then changes this output voltage into computerized information which is further processed.

Figure 2: Ultrasonic Sensor

ii) Weight sensors- Weight sensors are a type of transducer, specifically a weight transducer. It converts an input mechanical force such as load, weight, tension, compression, or pressure into another physical variable, in this case, into an electrical output signal that can be measured, converted, and standardized. As the force applied to the sensor increases, the electrical signal changes proportionally.

Based on this concept, the weight sensors measure the weight of the grocery items and generate an electric signal which is then provided to the microcontroller for processing it.

Figure 3: Weight sensor

2) Microcontroller: A microcontroller is a compact integrated circuit that is designed to do a specific operation. A microcontroller includes a processor and input/output (I/O) peripherals on a single chip. The data from the sensors is provided to the microcontroller which processes it. The microcontroller converts the electric signals from the sensors to useful information. This helps to identify the quantity of grocery items. If the quantity of items is less than a certain minimum threshold, the user is notified. The microcontroller is connected to the wifi through which the collected data reaches the database. Arduino Uno and raspberry pi are widely used microcontrollers in grocery management systems.

3) Database: The output from the sensor is connected to a microcontroller which senses data and sends it to the database. After each monitoring, the resultant weights are stored with their time stamps. This stored data can be accessed anytime through the mobile application.

4) Mobile application: The mobile application is used to set the threshold value and ordering amount for each item. when the quantity of data item is less than desired quantity, the user is notified through this mobile application. It also helps to access the data for the present quantities of grocery items in the kitchen, ordering history, usage of items, etc.
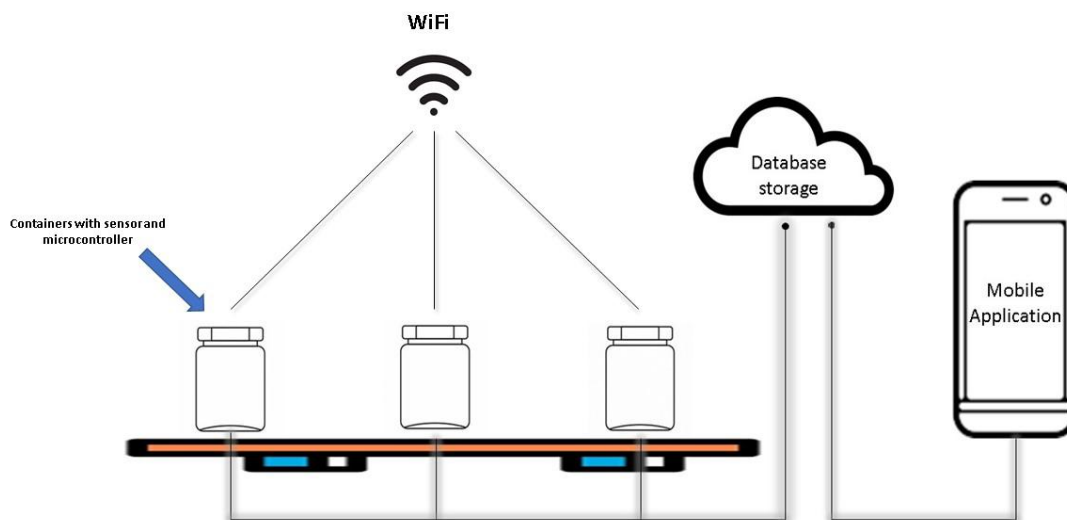
Figure 4: Smart Grocery management system

At first, the user is required to log in to the mobile application. Using the mobile application, the labels for various grocery items, their threshold values, ordering quantities, product preferences, etc can be selected. Once this is done, the user can sit back and relax without worrying about monitoring the grocery containers. The sensors in the system measure the quantity of the grocery items (based on their height levels or weights). These sensors connect with the microcontroller which converts the electric signals from the sensors to useful data and makes calculations on whether or not it is required to reorder the product. The relevant information is sent to the database through the wifi where it is stored. If the quantity of the item is less than a predefined quantity, a notification is sent to the user. If the user wishes to reorder the product, at a single click the product is reordered. Moreover, the current stock amounts, the order histories, past quantities of items, etc can be retrieved from the database and can be viewed through the mobile application.

IV. CONCLUSION

In this paper, we have discussed the implementation of a smart grocery management system using IoT. The developed system effectively checks the status of grocery items and intimates the user through the mobile application if the quantity of grocery items goes below the minimum predefined quantity.

The details about the grocery items such as current quantities, order history, etc are stored in the database from where they can be retrieved and used. This system can be extended to ingredient maintenance in restaurants and inventory management in factories. The solution is user-friendly and simple to use. It helps to organize grocery shopping thus saving time and money. Using this system one does not need to worry about keeping track and checking the grocery containers in the kitchen. This eases our lives and is a step towards a smart home initiative.

The future scope of this system is for manufacturers to sell grocery products with built-in sensors. This will notify the company each time the product is about to finish, send a notification to the user to purchase the product again, and display the relevant advertisement. If the user insists, the product can be reordered with a single click. This will help companies increase their sales and ease the task for users to manage their grocery needs.

REFERENCES

[1] L. Atzori, A. Iera, and G. Morabito, "The Internet Of Things: A Survey." Comput. Netw., vol. 54, no. 15, pp. 2787-2805, 2010.

[2] Hong, S., Kim, D., Ha, M., Bae, S.. Park, S. J., Jung, W., Kim, J. E. (2010), "Snail: An Ip-Based Wireless Sensor Network Approach To The Internet Of Things", IEEE Wireless Communications, Volume 17, Issue 6, pp. 321-331.

[3] Kranz, M., Holleis, P., Schmidt, A. (2010), "Embedded Interaction: Interacting With The Internet Of Things", IEEE Internet Computing, Volume 14

[4] Andrea Zanella, Senior Member, IEEE, Nicola Bui, Angelo Castellani, Lorenzo Vangelista, Senior Member, IEEE, and Michele Zorzi, Fellow, IEEE "Internet of Things for Smart Cities", Icee Internet Of Things Journal, Vol. 1, No. 1, February 2014.

[5] A. Javed, K. Kanwar, M. Legrand, N. Miller, and S. Scherl, "Development Of IoT Enabled Household", pp. 1-13, 2016

[6] S.D Chopade and M.O.M Nighot, "Smart Kitchen Management Using IoT Technology", International journal of advanced research in computer engineering and technology, vol. 8(7), pp. 269-271, 2019.

[7] D.D. Ahir, M. Sarang, P. Kokpkar, S. Jadhav and S. Pathak, "Smart Pantry", International Journal of Science and Engineering Development Research, vol. 4(4), 2019.

[8] T. Manikandan, D. Tamil Selvan, R. Vaidhyanathan, B.Vigneshvaran and V. Nandalal, "Home Groceries Management System Using IoT", International Journal of psychosocial rehabilitation, Vol. 24, Issue 05, 2020.

[9] Akshay Pendbhajh, Prof.Sangeetha Rajesh, "IoT in Home Grocery Management", 4th Somaiya International Conference on Technology and Information Management, 2017, pp 44-49.

[10] Anup Aravind Lakkanagavi, Amulya H N, Apoorva N, Bhargav, Aryan Singh, Naveen N C, "Smart Kitchen Containers As A Part Of Smart Home Appliances Using IoT And Android", Journal of android and ios applications and testing, volume 4 Issue 2, Page 6-10.

[11] Chetal.S.Patil, Kanaksing.N.Pawar, "Smart Grocery Management System Using Internet Of Things", International Journal of Research in Engineering and Technology, Volume: 05, Issue: 07, 2016, pp 97-101.