Grocery Management With IoT

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Abstract- *We are seeing and experiencing the rapid advancement of technology within the world. As the speed of Internet of Things (IoT) is emerging and is habitual for remote monitoring and sensing of the environmental parameters with the utilization of sensors that's acquainted to wireless sensing of real time data and transfer them in to the specified form and forward this sensed information over the system cloud via 'Network Connection'. The structure of sensing-monitoring framework is formed on the mixture of universal sensing units, controlling framework for information acquisition, manipulation and aggregation and internet based platform for setting an efficient monitoring. Within the future our homes are going to be more and more equipped with sensing and interaction devices which will make new multimedia experiences possible. This paper provides an insight into the event of an IoT based prototype to watch the grocery levels at homes and supermarkets. From the point of view of the food industry, the information obtained exposes research avenues to research the food consumption patterns geographically, economically and ethnically.*

Keywords- food monitoring; grocery management; Internet of Things; sensors

I. INTRODUCTION

Food monitoring helps ensure quality and safety because it requires food to be handled in specific ways. Implementing monitoring processes should include people who are often tracked to spot potential issues and concerns over the security and quality of food products. IoT or Internet of Things has become a really popular choice for everybody . This is mainly due to the straightforward availability of internet, which helps us in some ways . Almost in every administrative or monitoring work internet may be a must thing. The kitchen may be a vital place of a home and cooking is one among the day to day activities. The usual difficulty during a kitchen during cooking is finding the things to be out of stock. The growing popularity of automated systems indicates the demand of the household devices to be smart and automated to support us in our daily activities. The kitchen is one ideal place where automation at various levels are often done. Daily kitchen activities include stocking clique in reference to necessary dietary regiment, likes, and needs, tastes etc.

The proposed thought is conceptualized on an amalgamation of the Internet of Things with Wireless Sensor Networks. It plans to build up a constant framework that comprises of load sensors and wireless transmission modules connected to a central node. The central node is liable for processing the information received from the load sensors. By transferring this information to an online data stream it very well may be utilized for further investigation. This implementation in the kitchen and supermarkets is useful to keep a track of the monthly consumption of groceries. As a marketable product, the implementation will help to keep a record of items sold or consumed.

II. RELATED WORKS

RFID technology has been used in refrigerators to recognize goods with RFID tags [1, 2]. They provide an aid to reduce products close to expiration dates and ease the cold storage management. In order to withstand the low temperatures of the cold storage, the tag needs to be robust and thus making such an implementation expensive. The paper [2] focuses specifically on enhancing the operational efficiency of a restaurant kitchen. The plastic label weld on the container can be damaged when exposed to water and detergent thereby reducing visibility and hence efficiency. Also, the RFID has problems with metallic containers and liquids. Hence, for accuracy, it is restricted only to plastic containers containing fresh products. In order to inform the design of sensor setup, existing works on kitchen sensor setups were reviewed. Patterson et al. [8]placed RFID tags on various kitchen appliances (knife, cup, etc.), ingredients (mild, jelly, etc.), and other objects (pill box, phone, etc.). An RFID reader mounted to the wrist of the user senses these tags. Kranzet al. [5] developed an augmented kitchen that includes a special knife that provides 3D force and torque measurements, an XSens inertial sensor system, microphone input, a sensor-enabled cutting board with integrated accelerometer, which is placed on four load cells, and a camera mounted above the working area. Pham et al. [9] added accelerometers to kitchen utensils to recognize activities in their augmented kitchen. Chen et al. [3] provide a kitchen with weight sensors under their counter and stove to support healthier cooking by analyzing the weight of added ingredients. Another literature published on this topic mentions different ways in which the inventory status can be monitored. In one configuration, the containers are 'active', each one possessing its own microcontroller and wireless communication link [4]. In another configuration, the containers are 'passive', distinguished only by a unique barcode or radio frequency identification (RFID) tag. Barcodes can be tampered easily and hence cannot provide accurate results. This particular implementation is specific to Tupperware containers and could falter when other plastic or metal containers are used.A smart cabinet, using load sensors mounted on the racks inside it has also been implemented [6,7]. This drawer-based system also uses RFID tags, RFID Antennas, and a RFID receiver. It provides an accurate method to sense the inventory levels in real-time, however, the physical implementation of the cabinet is a drawback. Manufacturing of such a cabinet increases the cost of the system. It also requires the customers to modify the design system. It also requires the customers to modify the design of their kitchen in a permanent way in order to get the benefits of this service. The use of an unidirectional antenna for the RFID receiver also adds on to the cost, rendering the overall implementation expensive [6].

III. PROPOSED SYSTEM AND ARCHITECTURE

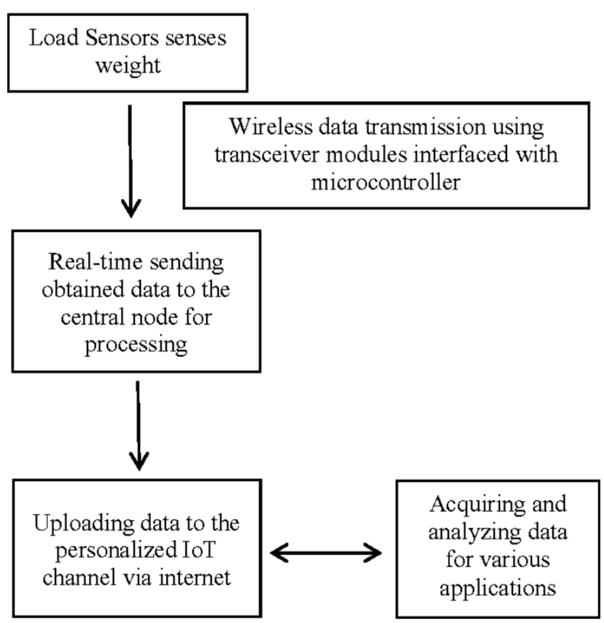


Fig. 1 System Implementation

The load sensor (RAPG Low Capacity Single Point Aluminum Load Cell) is utilized as a transducer to gauge the weight of the different basic food items. The resistive sort load cell, working on the guideline of piezo-resistivity yields the raw electrical signal corresponding to the (load) on the sensor. By utilizing an instrumentation intensifier (HX711), the raw electrical signal from the load cell is examined. The procured digital value is then processed by the microcontroller (Arduino) so as to transmit it through the wireless transceiver module (nRF24L01P). The information received by the central node (Raspberry Pi) by means of the transceiver, is then transferred to the customized IoT channel. This gained information would now be able to be further analyzed and used for different applications.

IV. LIMITATIONS OF THE IMPLEMENTATION

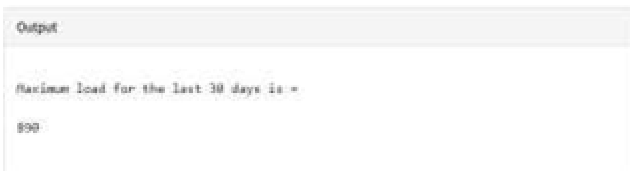
Load sensor: The low profile RAPG single point load sensor used in this implementation is bulky and therefore cumbersome to deploy in a densely populated storage area. As most kitchen designs require manual pick-up and placement of the containers, care needs to be taken while keeping the container on this sensor, since this can lead to the sensor output to deviate considerably from its expected value due to body weight being accidentally applied. The state-of-the-art fabricbased load sensors which have great precision are also gaining popularity. These could be used in place of the RAPG load sensor for an efficient implementation.

Thing Speak channel: Due to its ease of use for prototyping and the availability of numerous functions such as plotting graphs, histograms, averaging, etc. for statistical processing of the data, The IoT server of choice in this implementation is the "ThingSpeak" website. However, to truly realize the potential of the data obtained and to go beyond the conventional applications, it is recommended to setup a server on the Raspberry Pi (Central Node) itself. Machine learning algorithms can then be employed on the server to elaborate the usage patterns by applying monetary, ethnic, demographical or dietary filters to it. The data could be processed on the Raspberry Pi thus evading the need for sending the data to an external server for processing, hence saving time and improving reliability. It can be customized to a greater extent for developing the applications mentioned in the following sections of this paper.

V. RESULTS

Using the various MATLAB functions available on the ThingSpeak server, the following graphs are plotted. They depict the consumption pattern of salt in the house where the prototype was installed. Fig 2 provides a graphical interpretation of the consumption of salt with the weight (in grams) on the Y-axis and the date and time on the X-axis. It also displays the timestamp and the value of the last acquired measurement and the maximum and minimum value that was received on the server. The maximum amount of salt in the container as on 18th April is 860g and the minimum amount of salt recorded is 530g. Fig 4 shows a histogram plotted for a 30 day consumption period. This histogram indicates the number of measurements for different load values. Basic analysis such as maxima, minima, and averaging is done explicitly using the MATLAB interfaceas indicated by Fig 3, Fig 5 and Fig 6 respectively.

Fig. 2 Graphical representation of the channel data


Output

Maximum load for the last 30 days is =

890

Fig. 3 MATLAB Analysis on ThinkSpeak for Maxima

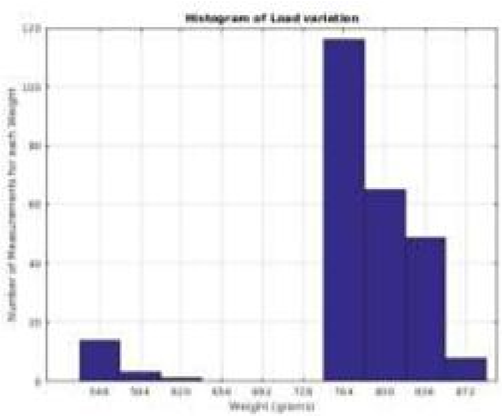
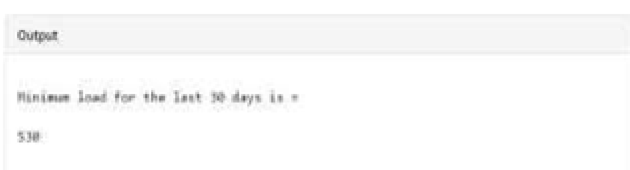


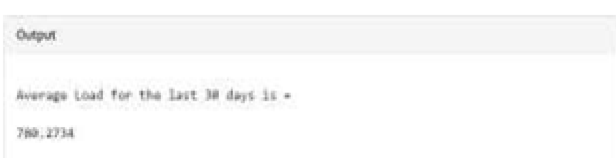
Fig. 4 Histogram of the channel data for 30 days


Output

Minimum load for the last 30 days is =

530

Fig. 5 MATLAB Analysis on ThinkSpeak for Minima


Output

Average Load for the last 30 days is =

780.2734

Fig. 6 MATLAB Analysis on ThinkSpeak for Average Consumption

VI. APPLICATIONS AND FUTURE WORK

1. Information accumulated from numerous sources can be examined to comprehend the utilization designs dependent on different geographic regions, financial areas or networks in the general public. This segment data could be essential in the improvement of the nourishment business.
2. The information could assume a significant job in the arrangement of more advantageous suppers based on the utilization midpoints recorded, contingent on occasional changes in the utilization design. AI calculations can be executed for prescient examination. This must be encouraged by intermittent warnings given to the client.
3. A 'Brilliant Kitchen' framework can be a creative execution that fuses intelligent administrations for checking of nourishment things kept. Utilization edges can be set, which on teaming up with the online shopping for food locales can computerize the shopping procedure and furthermore help maintain a strategic distance from the long lines at the money counter.
4. By utilizing the obtained information, it is additionally conceivable to deal with the normal utilization of some staple goods. This could additionally be used for planning the month to month cost on nourishment and different items.

VII. CONCLUSION

Internet's integration with everyday activities has provided us with the option of logging data for future access. It has also enabled the monitoring and analyzing the acquired information. This paper elucidates the development of a prototype for monitoring the grocery levels. A wireless sensor network is built with multiple nodes transmitting the weight of different grocery items. On uploading the grocery level over internet the acquired data can be remotely accessed. Implementation of a network of all the central nodes, can help aggregate the data from a large geographic area and further analyze it based on the application. With immense future scope, this system can be employed in kitchens, supermarkets and other storage spaces for smooth management of commodities.

REFERENCES

[1] Marcus St¨ander, Aristotelis Hadjakos, Niklas Lochschmidt, Christian Klos, Bastian Renner, Max M¨uhlh¨auser. "A Smart Kitchen Infrastructure", 2012 IEEE International Symposium on Multimedia.
[2] Beatriz Bordetas Bravo, Javier Cuadrat Fernandez, Mario Monsreal Barrera, Jesus Royo Sanchez. "Implementation

of RFID tags in food containers in catering business", ITG-Fachbericht 224 - RFID Systech 2010.

[3] J. Chen, P. Chi, and H. Chu. A Smart Kitchen for Nutrition-Aware Cooking. In Pervasive Computing, pages 58–65, 2010.

[4] Richard Voyles, Jaewook Bae, Bret Smith, David Kusuma and Ledu Nguyen, "Smart Tupperware: Active Containers for Kitchen Automation", SICE Annual Conference 2008.

[5] M. Kranz, A. Schmidt, A. Maldonado, R. B. Rusu, M. Beetz, B. Hornler, and G. Rigoll. Context-aware kitchen utilities. In ¨ Proceedings of the 1st international conference on Tangible and embedded interaction - TEI '07, pages 213–214, New York, New York, USA, 2007. ACM Press.

[6] Karuppiah Pal Amutha, Chidambaram Sethukkarasi, Raja Pitchiah. "Smart Kitchen Cabinet for Aware Home", SMART 2012.

[7] CF Hsu, HYM Liao, PC Hsiu, YS Lin, CS Shih, TW Kuo, JWS Liu2006 IEEE International Conference on Systems, Man and Cybernetics 5, 4276-4283

[8] D. Patterson, D. Fox, and H. Kautz. Fine-grained activity recognition by aggregating abstract object usage. In Ninth IEEE International Symposium on Wearable Computers, 2005. Proceedings., pages 44– 51. Ieee, 2005.

[9] C. Pham, T. Ploetz, and P. Oliver. A Dynamic Time Warping Approach to Real-Time Activity Recognition for Food Preparation. In Joint Conference on Ambient Intelligence, pages 21–30, 2010