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INTELLIGENT REFRIGERATOR

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ABSTRACT
In Rapid improvement in technology tend to use smarter devices in day-to-day life, one such device is refrigerator. In the modular kitchen and shops refrigerator plays a major role in preserving food items. Wasted food due to spoilage is a critical resource issue. Once food products are purchased and set aside in a refrigerator, the users do not alert about their food items expiration date which sometimes causes the spoilage. Combining the idea of smart kitchen evolution, the smart refrigerator is developed. Sensing module in smart refrigerators consists of load cell and odor sensors while control modules, these modules work together to determine the rotten/spoil odor and notify the user about condition and quantity of food via an SMS or an email. There is a need for more efficient way to monitor the amount of food materials left for the coming days and in case of shop it is necessary to avail the required quantity. The propose of Intelligent Refrigerator system is to detects the shortage of food items, by transmitting the quantity of available food items to the users through mobile application. It gives an alert to the users to place an order if the weight falls below the threshold value.
Keywords: Mobile Application, Home Automation System, Load Cell Sensor, Threshold, Temperature ,humidity sensors.

1. INTRODUCTION

Refrigerator is used on a Large Scale. It is a very important home appliance which consists of daily home essentials that are used by humans. Throwing away food is like stealing from the table of those who are poor and hungry, a lot of food inside the refrigerator gets spoiled as people are unaware of the expiry date of packed food and quality of vegetables that are kept from many days inside the refrigerator and due to lack of concentration on such home appliances those stuffs are not used by the people at the right time and after they are spoiled, they get wasted and are thrown away which leads to food wastage. The said model being designed is a smart refrigerator which communicates with the user information the communication is about the products in the refrigerator and this communication is done using various sensors.The existing system requires GSM module which has a drawback of injecting it into every system so it has to be purchased separately for every system which directly increases the product cost. The system being designed uses a technology called INTERNET OF THINGS, "This Technology called IOT is making our life easy by transforming our surrounding

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objects into an ecosystem of information that will enrich our lives. From refrigerators to parking space to houses, The IOT is digitizing more and more things in our everyday world, which will likely make IOT a multi-trillion-dollar industry in near future". The various sensors used to monitor the system are IR sensors, Pressure Sensors and gas sensors respectively. These sensors are used to achieve objectives like Quality and Quantity Analysis. The third mostimportant aspect of this system is to shelf monitor the system with the help of barcode detection on the packaged products. All these sensors are connected to the Arduino microcontroller to fetch the current status of the refrigerator. As the system uses IOT, it becomes easy for all the systems around the world to get updated fast anywhere, at any time and at anyplace.

2. LITERATURE SURVEY

Aurel-Dorian Floarea et.al proposed a next-generation refrigerator connected to the IoT,a fridge that is revealed as an IoT object and connects with the things kept inside gathers data about the process this data into significant information that is later gone on through an IoT stage to its users[1].Shouming Qiao et.al proposed a refrigerator based on the technology of RFID. A refrigerator will gather information about food items in a refrigerator and according tothe food inside the refrigerator, it can provide recipes[2].Suhuai Luo et.al proposed a system used for better nourishment and health of human life. It is planned for managing things kept in the refrigerator and inciting its users with cooking techniques depending upon what kind of item is available [3].Kebande et.al proposed a refrigerator system that indicates how vulnerabilities can be abused and recognized possible countermeasures as a course that can secure touchy and basic data in an IoT-based condition[4]. Deepti Singh et.al proposed work on refrigerator system with intelligence, which can sense the weight of the food items placed in the refrigerator and sends a notification to the user's mobile through amobile app when the weight goes below the threshold value [5]. Emily Moin proposeda system that uses the barcode scanning method of getting information about the packing of the food item and communicates with the system through RFID [6]. Folasade Osisanwo et.al gives a brief idea about asystem uses RFID tagging. The refrigerator is provided with a Wi-Fi system to transmit data to the user. Shama Mubeena, N. Swati has proposed a system," The Design and Implementation of a Wi-Fi Based UserMachine -Interacted Refrigerator" [7], which uses Wi-Fi for wireless communication. It demonstrates monitoring of fridge and notify user through mail id. B. Ramesh, J. Lingaiah has proposed the system," Raspberry Pi Based Interactive Home Automation System through E-Mail" [8]. This system uses Email rather than Bluetooth to send notification to user as it is not efficient. It also uses LEDs to indicate switching action. Nishchol Mishra, Dr. Sanjay Silakari has proposed a model in "Predictive Analytics: A Survey,

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Trends, Applications, Opportunities & Challenges" they have mentioned the classification and regression as the two main objectives of predictive analytics [9]. Where the classification, classifies the things according to the predefined class and uses numeric variables for data attributes. And Regression is used to study the relationship between the variables. Jessica Tran et al, has proposed a system, "Automated Demand Response Refrigerator Project" in which they gave a dashboard to view the sensor data and control the refrigerator remotely [10]. 3 Soundhar Ganesh S, et al, in their paper," Raspberry Pi Based Interactive Home Automation System through Internet of Things" used Raspberry pi to interface the internet with embedded systems [11]. Carson Kai-Sang Leung et al, in "A Machine Learning Approach for Stock Price Prediction", has proposed a deep learning approach for structural support vector machines (SSVMs) to perform classification on complex inputs [12].

3. METHODOLOGY

The architecture of proposed system of Smart fridge

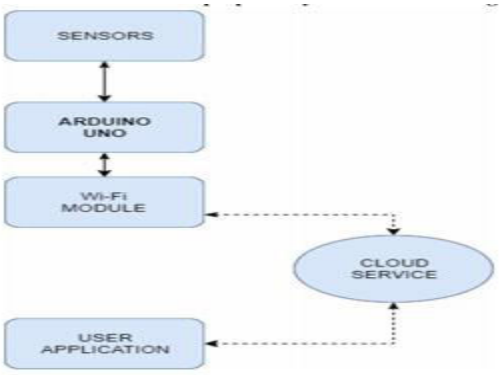

Fig.1 Block diagram of proposed system

The Fig1 shows the basic structure of the methodology which is being used. The purpose of the proposed system is to control the quantity of food inside the refrigerator as well as quality. A series of sensors get input to Node MCU which process the information and sends it to Wi-Fi module for data transmission from where data is put in the cloud service through wireless communication and the data can be accessed from cloud to mobileRecently, with the explosive increase of automobiles in cities, parking problems are serious and even worsen in many cities.

The Load cell is a pressure transducer that senses the force and generates an electrical pulse and gives analog output. Load cells are mounted to the bottom of the tray where bowls or utensils containing vegetables, fruits, milk, eggs, cheese, meat are placed and the bowls are named. For each type of items, a threshold value of weight is fixed. This analog output of weight is made digital by A-D converter present already in the microcontroller board and this digital output is given to microcontroller input pins and the data is monitored and uploaded to firebase. If the weight value drops below the threshold value for example 150 g, through the cloud the user is notified and permission is asked to order online in order to refill and feedback is collected in order to stop the notifications if the product is ordered. If the user grants access the app redirects to an online grocery store or the user can allow the app to send messages to the contact like a grocery store

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owner. Using the LM35 series sensor temperature and DHT22 humidity are recorded and sent to the app via cloud. Using these data user can sense defects in cooling or lower temperature of the fridge if needed to store some foods which require appropriate temperature and humidity for storage.

HX711 HX7ll Amplifier has five input wires such as RED, BLACK, WHITE, GREEN and YELLOW. Here Yellow wire is an optional ground wire and other are come from the load cell. Sometimes yellow is replaced by a larger black wire, foil or loose wires. 5

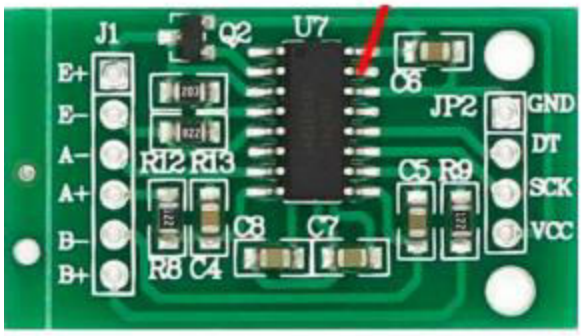

Fig2: HX711 Board

3.3 Load Cell A Load cell measures and weight of the thing which is resting on it. It produces the output as analog signals which intern passed into the HX711 Board.

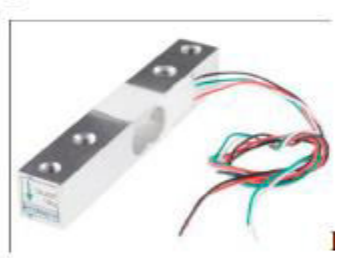

Fig3: Load Cell

4 .DESIGN & IMPLEMENTATION

Fig4: Implementation of system

This project uses ESP32 as a microcontroller. The project has two modes Auto Replenish Mode and Normal Mode. 2. It uses Load Cell along with Load Cell Amplifiers HX711 for measuring the amount of food in the fridge. This data is then sent to the android app. 3. When the food is found to be scarce it is automatically (Auto Replenish Mode) ordered by app. The user can set the food ordering to manual (Normal Mode) /automatic (Auto Replenish Mode) mode. 4. It has a DHT11 sensor for measuring temperature inside the fridge, a water sensor for measuring the water level inside the water container and a water temperature sensor for measuring the temperature of water inside the water container. Smart Refrigerator system is having NodeMcu as a microcontroller board with inbuilt wifi. As the proposed system is on IOT we must have internet connectivity to connect it to IOT cloud. In our case we are

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using Blynk IOT platform. LCD is used to display messages and alerts. As soon as the system starts it will initiate the internet connection and connect to the cloud. Controller will read the weight from the load sensor. Current weight used to compare with the LOW threshold weight which is set by the android app. As soon as the current weight goes below the low threshold weight system will sent alert to android app and also show message on LCD. Alert will be with Amazon link. At the same time controller will read the smell sensor. If there is rotten food then smell system will send alert to the user application and show it to LCD as well. MQ6 sensor used as a smell sensor.

5. CONCLUSION

We have given a smart refrigerator application. The proposed smart refrigerator can enable prosperity. It is planned for regulating things set away in it. What's more, besides, through the intelligent refrigerator people can save some money with less effort. We are certain that such kind of smart refrigerator will be a basic part in future smart homes. The possibility of the insightful fridge is obviously more coming to than educating the customer about the substance of the fridge. The smart refrigerator is conservative and easy to use. He conversion of traditional refrigerator to smart and intelligent is done using NoducMCU and IOT and the module detects the shortage of food items and notifies the user and uploads the data to cloud service along with data of fridge temperature and humidity. This system is cost-effective and can be used for any fridge just consuming some space in the fridge. The future work can be implementation of amazon web services like image recognition software to detect what's inside the fridge by mounting a camera and using image processing algorithms of the software which returns user the item name along with lot other details. Using Google API for speech recognition which uses natural language processing algorithms and recognizes commands by strong neural networks and gives response

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