IOT BASED REFRIGERATOR FOR MONITORING STORED FOOD MATERIALS

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Abstract : Refrigerator is the most frequently used kitchen electrical appliance all over the world for food storage. Principally the appliance is used for various tenacities like storing vegetables, fruits etc. A simple Iot based refrigerator can be upgraded into a smart cost-effective machine using a smart refrigerator module which consist of sensors like load cell, gas sensor, camera module, etc. Iot based refrigerator looks at the status of the nourishment of food for e.g. weight, quantity, quality and freshness, etc. Significance of this work will be diminishing of food spoilage, reduce illness and make healthier lifestyle of modern age human being. The smart refrigerator is capable of sensing and monitoring its contents and also provides advantageous features. The smart refrigerator is equipped with the ability to control (ON/OFF) remotely by the user from IoT webpage via Wi-Fi module (internet). Iot based refrigerator is designed to sense the food products that are stored in it and notify to the user when the products are scarce. The basic functionality of the Iot based refrigerator is to maintain, with less effort, any food items which one wishes to purchase when the items are unavailable. As a result, the user is notified every time if any items are finished. The load cell triggers a notification of the less vegetables to user as soon as the applied pressure is below threshold kg. IR proximity sensors monitor the ice tray. Additional functionality includes the ice ready indication, power saving, smell detection, etc.

IndexTerms - IoT Technology, sensors, Wi-Fi, load cell.

I. INTRODUCTION

Refrigerator is the most frequently used kitchen electrical appliance all over the world for food storage. Principally this appliance is used for various tenacities like storing vegetables, fruits etc. A simple Iot based refrigerator can be upgraded into a smart cost-effective machine using a smart refrigerator module which consist of sensors like load cell, gas sensor, camera module, etc. Iot based refrigerator looks at the status of the nourishment of food for e.g. weight, quantity, quality and freshness, etc. Significance of this work will be diminishing of food spoilage, reduce illness and make healthier lifestyle of modern age human being. The smart refrigerator is capable of sensing and monitoring its contents and also provides advantageous features. The smart refrigerator should also be able to remotely on-off control and intimate the user about products that are scarce through wifi connection (internet) on user's mobile android application. Iot based refrigerator is designed to sense the food products that are stored in it and notify to the user when the products are scarce. The basic functionality of the Iot based refrigerator is to maintain, with less effort, any food items which one wishes to purchase when the items are unavailable. As a result, the user is notified every time if eggs are finished. Automation is the most essential piece of A recent survey conducted by national level organizations have found that the food wastage in India is at a staggering 40% and 20% of all food stored in the refrigerator gets thrown away due it getting stale, and the main reason being that users aren't aware of that food item being stored in their refrigerator or when those items will go stale. And such an amount of wastage of food in country like India needs to be reduced since a lot of our population lives in poverty and most of the nation face shortage of food. And small change in reducing the wastage may lead to greater change.

our life in the present time. Automation accommodated home enables us to control IoT devices such as Light, entryway, fan, AC, fridge, and so on. A Refrigerator is the most frequently used kitchen electrical appliance all over the world for food storage. Smart refrigerator looks at the status of the nourishment of food for e.g. weight, quantity, quality, and freshness, etc. The significance of this work will be, to remove rot sustenance, lessen sickness and make a more beneficial way of life for current age individuals.

In this present era, a human being is used to deal with technology that we can say it as the internet of things (IoT).

A. OVERVIEW OF THE EXISTING SYSTEM

In the Existing system, we find many types of smart refrigerator which are very expensive, that can't be afforded by everyone and has a lot of complicated functions. Refrigerators when not maintained properly generate lot food wastage due to lack of timely usage and monitoring of food items stored. A person has to constantly monitor the quantity of items stored, so they don't run out of items. Also the existing system doesn't focus on reducing the cost for masses and uses high end technologies like ultrasound and infrared to monitor the grocery present inside. And also may tell the recipes to cook based on the items stored inside.

B. Overview of the proposed system

The proposed system uses Wi-Fi module and Arduino UNO board. The collected data will then be sent to the cloud storage. The system uses odour sensor or also known as analog gas sensor. This sensor can sense a mixture of gasses

produced by the vegetables or fruits stored in the refrigerator that slowly becomes rotten. It is very important in maintaining the freshness of the contents inside the fridge.

The purpose of the system is to control the quantity of the food inside the refrigerator. It will alert the user whenever their storage inside the fridge is low in quantity. User will be alerted by receiving a notification through an application. Besides that, they can also monitor the condition of the food through an IoT platform. However, this Smart Refrigerator System also has another big purpose which is to maintain the quality of the food kept inside the refrigerator by using odour sensor as mentioned before which can also reduce food spoilage. As a conclusion, most previous related works use sensors as a function to detect the quantity of the food stored inside the refrigerator.

1) *Advantages of the proposed system*

- No need of human intervention as automatic Functioning performs the proper operation without any supervision.
- Complete automated operation.
- One-time installation.
- Low maintenance cost.

II. LITERATURE SURVEY

There is a great deal of the smart refrigerator research in the literature .Many researches have been done in this field one such system was proposed by ShoumingQiao et.al proposed a refrigerator based on the technology of RFID. A refrigerator will gather information about food items in a refrigerator and according to the food inside the refrigerator, it can provide recipes [1].

Emily Moin proposed a system that uses the barcode scanning method of getting information about the packing of the food item and communicates with the system through RFID. This system though help in monitoring of packed food materials but it couldn't serve for the spoilage of opened food that is kept without any packing[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]. Folasade Osisanwo et.al gives a brief idea about a system uses RFID tagging. The refrigerator is provided with a Wi-Fi system to transmit data to the user [4].

Therefore this lead to the development of the proposed system which is smart refrigerator which is also known as internet refrigerator which has been programmed to keep track of the stock inside the refrigerator and notify the user when the food items are rotten and thus helping in avoid wastage and this kind of refrigerator is often equipped to determine whenever food items needs to be replenished.

III. OBJECTIVES

- To provide user-friendly interface that causes the user able to be aware of ON/OFF state of the refrigerator from Iot web pages.
- The user must be able to get notification on mobile app when the quantity of vegetable is less in the tray.
- The user must be notified when the system detects odour of rotten vegetables or fruits.
- The system should be able to detect the presence of ice tray and notify the user with the information.

IV. METHODOLOGY

Collecting sensor data and data from IoT server: Temperature, Gas, IR and Load Cell sensors are used to measure parameters inside refrigerator. Wi-Fi module is used to read data from IoT cloud server.

- **Load Cell:** To measure the weight of vegetable tray.
- **IR Sensor:** Used to detect presence of ice tray in the compartment.
- **Gas sensor**: To detect odour of rotten vegetables.
- **Temperature Sensor:** To detect temperature inside the freezer.

Processing Received Data: Arduino microcontroller is used to process the received data. The microcontroller gives the controlling signal to control the operation of the refrigerator.

Controlling Refrigerator Operation: Driver and relay circuit is used to control the operation of the microcontroller.

Sending Messages to the User Mobile Application: HC05 Bluetooth module is used to send data to the user mobile. An android application is used in user mobile to receive and display the messages.

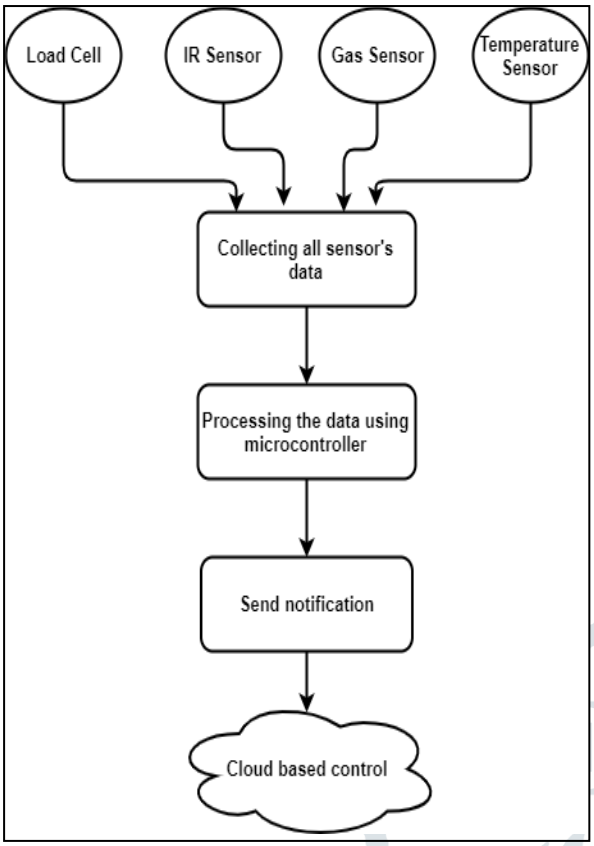

figure 1 : Process flow diagram for Refrigerator for Monitoring Stored Food Materials

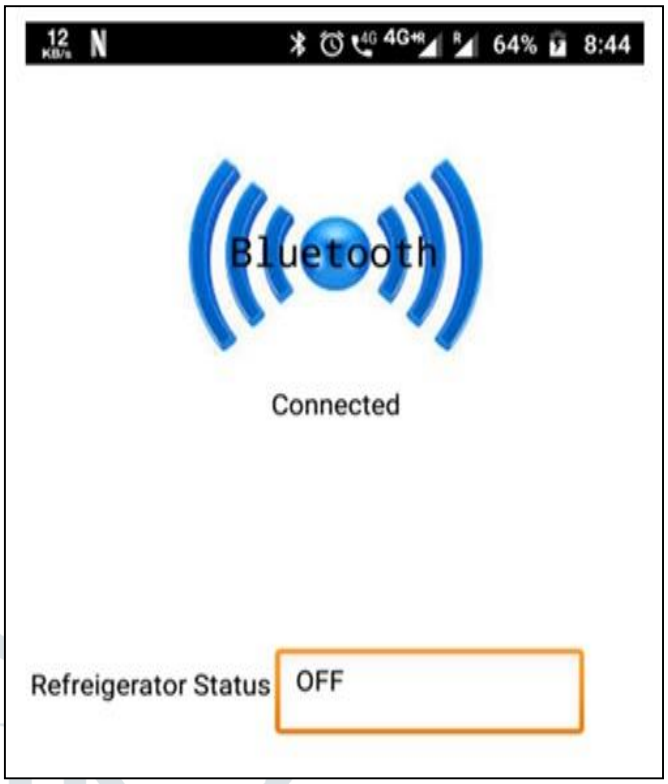

figure 2 : Refrigerator status when it is OFF

V. RESULTS

Data from refrigerator system will receive continuously and app will update it. If refrigerator is OFF, App shows the status of refrigerator as OFF , it disables visibility all other UI components.

If refrigerator is ON, App shows all the reading coming from the system one by one and it will update according to the received data.

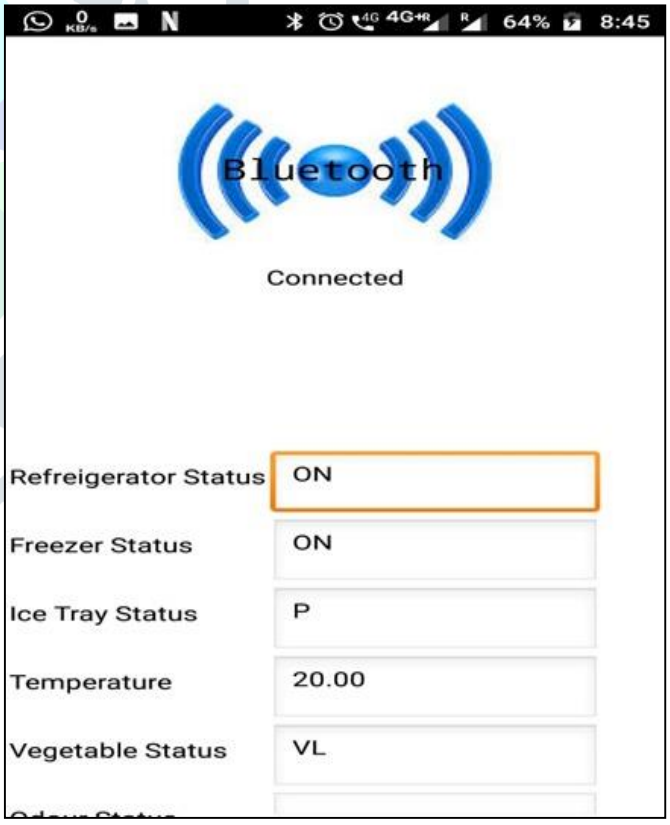

figure 3 : Refrigerator status when it is ON

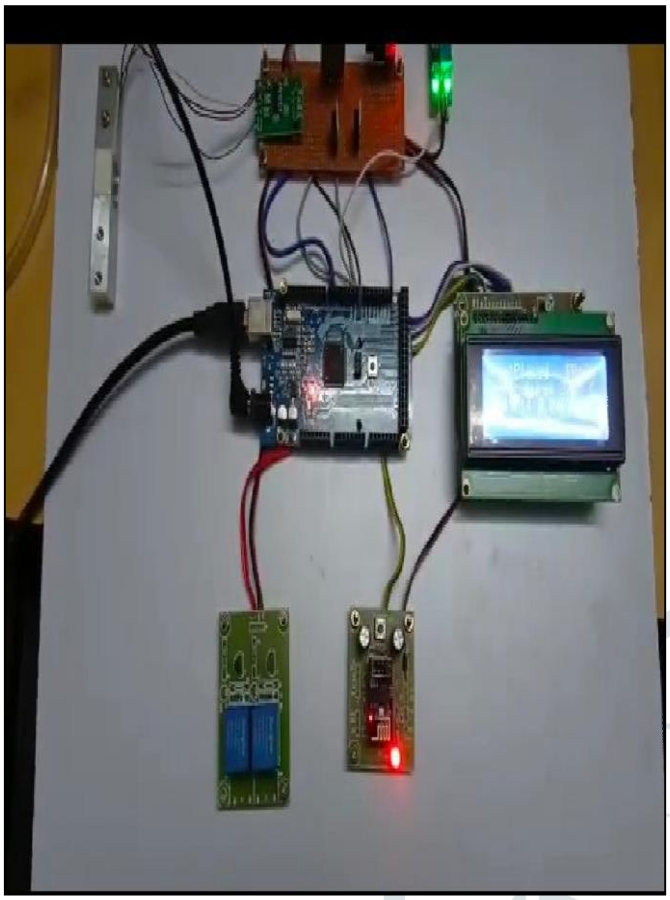

figure 4 : smart refrigerator

figure 6 : status displayed on lcd

figure 5 : Vegetable quantity status

figure 7 : odour smell detection

VI. CONCLUSION

The IoT based Refrigerator device can remotely identify the user about the low contents of food items inside the fridge. It is also able to remotely on-off control and notify the user about scarce products via wifi module (internet). This device also provides some advantageous like power saving, smell detection, ice-ready indication. This system can be used by every household in homes and public buildings such as hotels and restaurants. It is planned for regulating things set away in it. We are certain that such kind of smart refrigerator will be basic part in future smart homes.

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