IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

IOT BASED INTERACTIVE SMART REFRIGERATOR

Shalini K J[1], Poornavi S R[2], Sahana D K[3], Sheik Thamanna[4], Spoorthi Y D[5]

Department of Electronics and Communication Engineering,

B.G.S Institute of Technology, B.G Nagara-571448, Nagamangala (Tq), Mandya, India.

Abstract: Refrigerator is the most frequently used domiciliary/kitchen electrical appliance all over the world for food storage. Kitchen is one of the most prominent zones of intelligent appliances, one of those devices is refrigerator. The Internet of Things (IoT) refers to the set of devices and systems that interconnect real world sensors and actuators to Internet. Principally this appliance is used for various tenacities like storing vegetables, fruits etc. Smart refrigeration module is designed to transfigure any existing refrigerator into a smart cost-effective machine using sensors. Smart refrigerator compares the status of the food for e.g., Weight, quantity etc. Significance of this work will be removable of food spoilage, reduce illness and make healthier lifestyle of modern age human being. The provision of recipe suggestion based on the vegetables present in the basket is carried out through a basic machine learning algorithm which classifies the vegetables based on the colors which in turn suggests a particular recipe. It will be smart enough to notify the current status of food items through an android app on our mobile phone.

Key Words Smart refrigerator, android application, internet of things

1.INTRODUCTION

According to FAO study, every year around 1.3 billion tons of food is wasted all over the world. The cause of food wastage includes domestic wastage by consumer's refrigerator. This is because of poor planning, bulk purchases and spoiled foods. People, overburdened with work at the expense of their health needs a smart appliance which would be capable of maintaining a healthier lifestyle and requires no extra time and effort. One such appliance is refrigerator which is most widely used to store food. Today, the internet is integrated in our daily life to such an extent that without it life seems unlikely. The Internet of Things (IOT) is an extension of internet connectivity into physical devices and everyday appliances. In this modern human being is used to deal with technology or we can say it as IOT. The IOT define a use of intelligent connected devices and systems to leverage data gathered by embedding sensors and actuators in machines and other physical objects. Recently, smart kitchen always comes to mind whenever we talk about the Internet of Things or also known as Cloud of Things. The reason is the kitchen is the largest producer of waste and second largest user of energy in the home. As we look around ourselves technology, like cell phones, kitchen, appliances and many more. Here we study about smart refrigerator, because people are very busy in day-to-day life style. Usually, they do not really have time to look after their healthy habits and diet; since we are capable to deal with the technology, we can design a smart refrigerator system that helps us to maintain a healthier lifestyle without putting any extra effort and time. In this project we had propose smart refrigerator which leads to healthier lifestyle. With the improvement of people's living standards and the accelerating pace of people's life. The refrigerator is playing an increasing important role in our daily life, it has brought great convenience to people's live as more and more food are put into the refrigerator. However, it also brings some issues with the food in the refrigerator continues to increase, first of all if you can't eat these foods in time, then the food is very easy to expire, followed by the traditional refrigerator is difficult to figure out which food are surplus, which food has been used up. So, it is important to produce a smart refrigerator.

2. OBJECTIVE

The objective of this project is to design a prototype that will allow a user to track food items in order to reduce waste and improve shopping efficiency. The system will remind the user about the nearly finishing items and helps to book/purchase those items accordingly.

The objectives of our work are:

- Quantity Analyses: Notifies the user about the low quantity of the daily consumed diet (e.g., Egg, milk, vegetables).
- Online purchasing options: The android application is provided with online purchasing of required food items.
- Recipe suggestion: Based on the vegetables present in the refrigerator, a recipe is suggested.
- To know the weight of any package of vegetable or goods is also possible

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

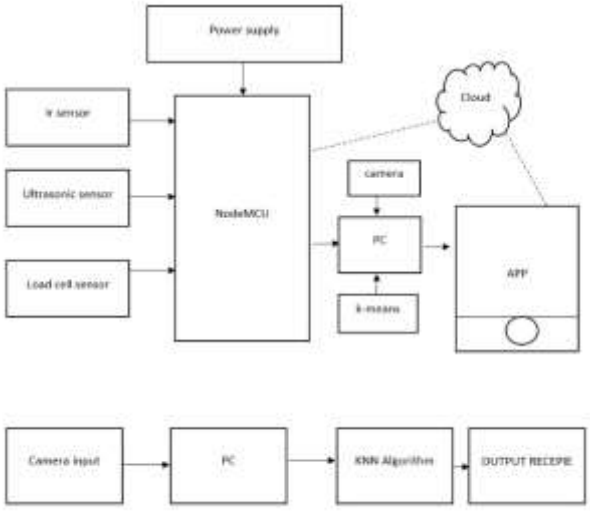
International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

3. METHODOLOGY

The advancement of human beings' electronics and busier lives continues to use smarter gadgets that can make life simpler. A safe and productive lifestyle is the product of smart kitchen appliances at home. One such refrigerator is the fridge. The proposed system controls the ingredients within it and notifies the user remotely with an android application of its quantity of objects. The data obtained from the sensor is analyzed by the control module and sent to the cloud so that it can be accessed from the android application of the user. The smart refrigerator also offers the facility of online shopping for the scarce goods inside with quantity tracking of goods. The provision of a recipe recommendation based on the vegetables present in the basket is carried out by a simple machine learning algorithm that classifies the vegetables based on the colors, recommending a specific recipe in turn.



The user is provided with an android application which displays the quantity of items present inside the refrigerator. The food items like eggs, milk and bread are monitored using IR sensors, Ultrasonic sensor and load cell respectively. The calibrated sensors continuously read the data and compare them with threshold values. The controller classifies the sensors value as below or above the threshold and stores the same in an online cloud platform. The continuously updated data is retrieved in the mobile app designed using android studio. Based on the data displayed in the app, user is allowed to order the required items from online store with a single click. A recipe suggestion feature is provided. A camera module is attached above the vegetable tray, present inside the refrigerator. When the user clicks on a particular button a request through MQTT client is sent to the camera module which captures an image of the vegetables. Color and number of edges from these images are extracted and K-means classifier algorithm is applied on them to identify the vegetables. K-means is a type of clustering which partitions n data into k groups in which each data belongs to the group with nearest expectation. The identified vegetables are retrieved in the app and the combination of these vegetables is used to suggest a recipe.

SOFTWARE REQUIREMENTS

- Python
- Arduino Idle
- C++
- Blynk

PYTHON

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

ARDUINO IDE

Arduino first and foremost is an open-source computer hardware and software company. The Arduino Community refers to the project and user community that designs and utilizes microcontroller-based development boards. These

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

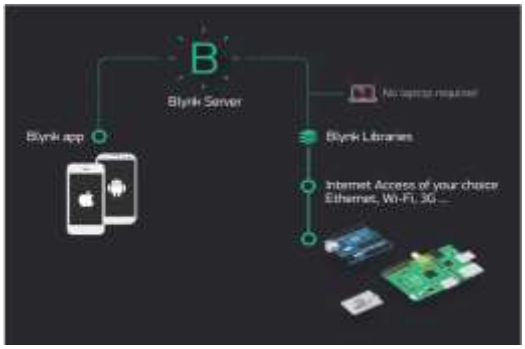
Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

development boards are known as Arduino Modules, which are open-source prototyping platforms. The simplified microcontroller board comes in a variety of development board packages.

BLYNK

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.



There are three major components in the platform:

Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.

Blynk Server - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.

HARDWARE REQUIREMENTS

- IR sensor
- Load cell
- Ultrasonic sensor
- NodeMCU
- Power supply
- PC with min requirement 4GB RAM 80GB hard disk

NODEMCU

The ESP8266 is the name of a micro controller designed by Expressive Systems. The ESP8266 itself is a self-contained Wi-Fi networking solution offering as a bridge from existing micro controller to Wi-Fi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro-USB cable, you can connect NodeMCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

ESP8266 NodeMCU WiFi Devkit

ULTRASONIC SENSOR

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules include ultrasonic transmitters, receiver and control circuit. The basic principle of work:

- Using IO trigger for at least 10us high level signal
- The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
- IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

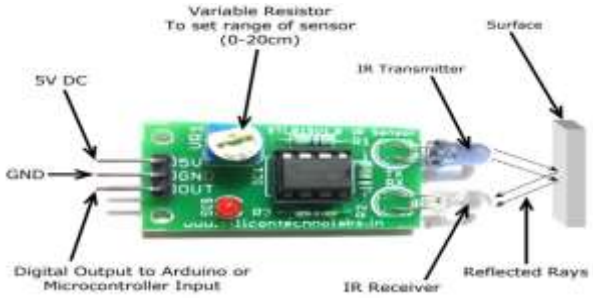
Test distance = (high level time * velocity of sound (340M/S) / 2

LOAD CELL (For weight measurement)

A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally.

IR SENSOR (For solid item quantity)

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems.



4. RESULT

This section shows the pictorial representation of results. A. Performance Analysis The work is carried out in the hardware and software interfaced environment. The performance of the system is evaluated. The Round Trip Time (RTT) is the time required for the data to travel from sensors to firebase database through the controller and back to the android application. The RTT is divided into four levels.

Level 1: Response of the sensors. Level 2: Processing by the controller. Level 3: Updation of data in firebase. Level 4: Retrieval of data in the app.

By observing data flow from sensors to android application through firebase database, we conclude that the time taken is practically more. So, a much faster approach is used to activate the camera module. MQTT protocol acts as a bridge between software tool and hardware component like camera module where the response is faster.

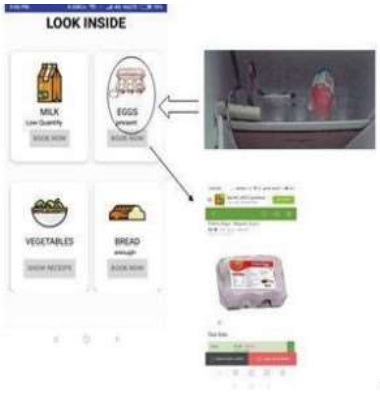


Fig. Presence or absence of egg is detected and notified through the app. In the case of absence, the eggs are booked through online shopping website.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

Fig. The level of the milk in the container is measured and sent to firebase and from firebase the data is retrieved in the app. In case of insufficient quantity, booking can be done.

5.CONCLUSION

The Smart Refrigerator module is able to remotely notify the user and control the functions inside the refrigerator. It also facilitates purchase of the scarce food items from an online vendor. The notifications and information inside the application that is sent to the user via android application. This module allows the user to indicate a placed order and the other users to acknowledge the placed order. The android application in this work provides real time updates even when the user is outside the house and suggests a recipe based on the vegetables present in the fridge with Machine Learning approach. We are sure that this type of smart working refrigerator will be important component in future smart homes. The concept of smart refrigerator is far more reaching than notifying the user about the contents of the refrigerator. Smart refrigerator is economically cost effective, and user friendly.

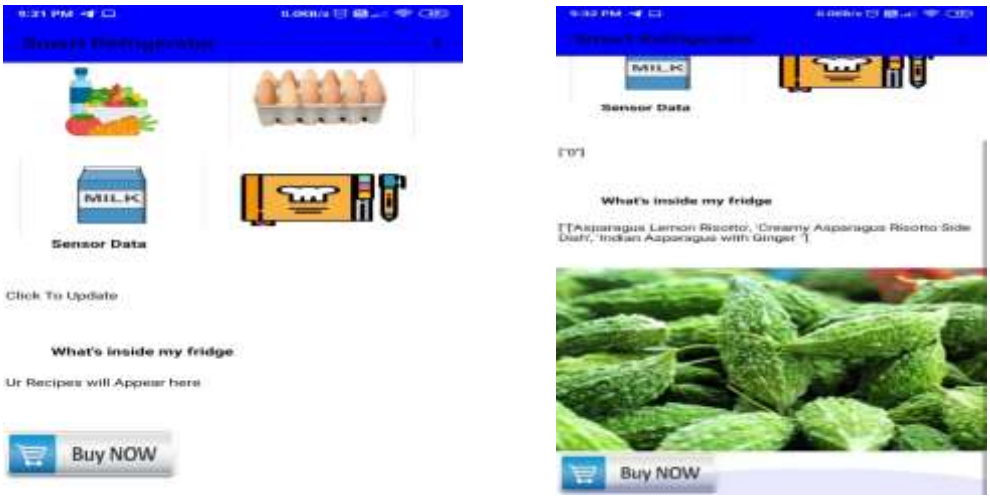


Fig. Vegetables in the tray are recognized based on their colors and respective recipe is suggested.

FUTURE WORK

The future smart fridge will use barcode scanner that will scan the expiry date products while keeping in the fridge. This gives alert to the user when any product in the fridge expired Ultrasound scanning technology built into the door will allow the fridge to 'swipe' and 'capture' the food on a plate before mealtime, meaning it can assess what type and amount of the food are waste.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 6, June 2021

DOI 10.17148/IJARCCE.2021.106112

REFERENCES

1. Aurel-Dorian Floarea; Valentin Sgârciu, “Smart refrigerator: A next-generation refrigerator connected to the IoT”, 2016 8th International Conference on Electronics, Computers and Artificial Intelligence (ECAI).
2. Shouming Qiao; Hongzhen Zhu; Lijuan Zheng; Jianrui Ding, “Intelligent Refrigerator Based on Internet of Things”, 2017 IEEE International Conference on Computational Science and Engineering (CSE) and IEEE International Conference on Embedded and Ubiquitous Computing (EUC).
3. Suhuai Luo; Hongfeng Xia; Yuan Gao; Jesse S. Jin; Rukshan Athauda, " Smart Fridges with Multimedia Capability for Better Nutrition and Health", 2008 International Symposium on Ubiquitous Multimedia Computing.
4. Victor R. Kebande; Nickson M. Karie; Antonia Michael; Semaka M.G. Malapane; H.S. Venter, " How an IoT-enabled “smart refrigerator” can play a clandestine role in perpetuating cybercrime", 2017 IST-Africa Week Conference (IST-Africa).
5. Deepti Singh, Preet Jain, “IoT Based Smart Refrigerator System”, International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Volume 5, Issue 7, July 2016.
6. Emily Moin, "Smart Refrigerator for Grocery Management", Technical Disclosure Commons, Defensive Publication Series, May 05, 2015.
7. Folasade Osisanwo, Shade Kuyoro, and Oludele Awodele, “Internet Refrigerator”, 3rd International Conference on Advances in Engineering Sciences & Applied Mathematics (ICAESAM’2015) March 23-24, 2015.
8. Haidawati Nasir, Wan Basyar Wan Aziz, Fuead Ali, Kushsairy Kadir, Sheroz Khan, “The Implementation of IoT based Smart Refrigerator System”, 2nd International Conference on Smart Sensors and Application (ICSSA), 2018.
9. Food and Agriculture Organization of the United Nations.Food Wastage Footprint: Impacts on natural resources. Retrieved Mar., 2017.
10. Wang Zhongmin, Yu Yanan,” Design of an Interactive Smart Refrigerator Based on Embedded System”, International Conference on Sensing, Diagnostics, Prognostics, and Control, 2018.
11. Hsin-Han Wu, Yung-Ting Chuang, “Low-Cost Smart Refrigerator”, IEEE 1st International Conference on Edge Computing, 2017.