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Smart Refrigerator using IoT and Android

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Abstract: The kitchen is seen to be the heart of both traditional and contemporary residences. It's a place where people prepare their meals and where families gather to eat. Since the refrigerator is in the center of everything, it is crucial to our daily activities. The goal of this project is to transform an ordinary refrigerator into an intelligent one by enabling it to order food products and to establish a virtual environment where the user and the refrigerator may interact.

Keywords: ordering food, notifying the expiry date

I. INTRODUCTION

Almost everything will be connected to the Internet, in the near future including not only PCs, laptops, and cell phones but also common household appliances with their own Internet Protocol (IP) addresses, including coffee makers, freezers, washing machines, microwave ovens, juicers, televisions, heaters, and cooling devices. Researchers have been imagining refrigerators that might alter how we live since the first smart refrigerator was released in the 1990s. When food items like milk, eggs, jam, or sauce run out, the smart refrigerator checks its inventory and, using a GSM module sends an SMS observation to the user's chosen mobile phone number.

The consumer is then asked, whether they want to make an order for that specific food item, through a text message. An order is placed for that item at the specified grocery store, if the user responds "Yes," by SMS along with the requested delivery time. The fridge will stop looking for the item if it does not get a directive from the user. Only after the user puts the item back does it start scanning again. The number of eggs, milk, and other commodities can also have a threshold level set so that similar action can be conducted when the stock falls below the threshold,.

II. OBJECTIVE

With a smart refrigerator, you can easily monitor and control the temperature, humidity, and other settings using your smartphone or other connected devices. You can also create shopping lists and order groceries directly from the refrigerator's touchscreen or through a mobile app. Smart refrigerators are designed to be energy-efficient, which means that they use less power and can help you save money on your energy bills. They also often have features like energy usage monitoring and automatic defrosting, which can help further reduce energy consumption. They come with a variety of features that help you manage your food, including expiration date tracking, recipe suggestions based on the ingredients in your fridge, and even the ability to suggest meals based on your dietary preferences.

Some smart refrigerators come with features like alerts for open doors and power outages, as well as the ability to remotely lock and unlock the fridge. These features can help improve the safety of your home and prevent food spoilage.

OVERALL, A SMART REFRIGERATOR CAN HELP YOU SAVE TIME, MONEY, AND ENERGY WHILE ALSO IMPROVING YOUR FOOD MANAGEMENT AND HOME ENTERTAINMENT OPTIONS.

III. RELATED WORK

With the development of technology and people's busy schedules, intelligent technologies that help simplify life are increasingly used. A successful and healthy way of life is promoted by At-home smart kitchen appliances. Among them is the refrigerator. The suggested system keeps track of the components within and remotely tells the user of the number of things using an Android app. The control module processes the sensor data after it is acquired and makes it available to the user's Android app by uploading it to the cloud. The smart refrigerators offer the option of online shopping for limited-edition items inside in addition to monitoring item quantity. Classification of the veggies based on their colors and then offering a specific dish is used to provide recipe suggestions based on the vegetables that are currently in the basket, all of this is done by a simple machine-learning algorithm. The outcome validates the viability of the suggested system.[1]

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In recent years, home automation systems have attracted a lot of academic interest. It enables us to live comfortably, and our standard of living progressively improves. There has been a discussion of the many approaches utilized in this system. Modern-day home automation systems use a smartphone with an android application to monitor and manage the appliances that are present. This study reviews various communication methodologies, including GSM, IoT, Wi-Fi, and Bluetooth. These techniques' advantages and disadvantages, as well as their qualities, have been discussed. Based on the information in this paper, the user can select the most appropriate methodology for establishing an effective automation system in accordance with their unique needs and requirements.[2]

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This article connects smart meter devices using fault-tolerant design to mobile, cloud, Internet of Things, and machine learning technologies with a focus on usability**.**
We have created a smart meter with a mobile app, an integrated display, and a cloud-based data lake, based on a study with an end customer**.** Daily energy prediction with Machine Learning techniques and energy status labelling with Hidden Markov Models are implemented after deployment in four Brazilian families with various profiles. Smart meter data can be used for prediction and information extraction that benefits both customers and enterprises. [4]

Modern technology is advancing quickly, which encourages us to employ smart devices in our daily lives. A refrigerator is one such item. In both restaurants and modular kitchens, refrigerators are essential for preserving food items. It is necessary to avail the quantity required for the forthcoming days and also keep an eye on how much food is still in the refrigerator. The suggested model measures the number of food items still in the refrigerator as well as their temperature to the users using a mobile application. It tells the user about the shortage of food and also the temperature of the refrigerator. By which the wastage of energy also can be saved due to automatic control.[5]

A smart home requires all of the household appliances to respond to voice or mobile device commands from the user. Automation was carried out utilizing radio frequency (RF) and machine learning prior to the development of the Internet of Things (IoT). However, unlike RF-based and other automation techniques, IoT is inexpensive, simple to implement, and allows for device control from any location. For the purpose of sensing and monitoring smart lighting and switching, this paper presents a live IoT-based working model. [6]

Here, the term "smart" also contributes to the generation of the electricity bill by minimizing the labour required by humans to calculate all relevant factors. Nevertheless, not everyone is aware of how power functions and how bills are created. So, the primary goal of this project is to inform each user of how their usage of individual appliances affects their electricity cost. Also, this project enables remote smartphone control of the home appliance for the user. In light of this, a smart system has been created for utilizing controlled and efficient charging. In most homes, it might be challenging for elderly or disabled persons to reach the switch and turn it on or off. Thus, the application created in this article will meet the demand.
In order to obtain the voltage and current readings that will be utilized to generate bills, current and voltage sensors are required. The Arduino UNO receives the sensor data using I/O ports and then generates the bill. [7]

In order to create the IoT-based system for monitoring the temperature of vaccine storage freezers, for the best temperature alert system the goal of this study is to examine several AD approaches. The Message Queue Telemetry Transport (MQTT) Communication Protocol is used in conjunction with additional specifications, including a sensor PT-100 and a Node MCU microcontroller, to implement the proposed system. With a score of 0.9999, MCD has the highest area among the three AD approaches that were applied and assessed, which are (OCSVM), the minimum covariance determinant, and the histogram-based outlier score (HBOS). With values of 1 and 0.99, respectively**,** when compared to other AD techniques, MCD also has a balanced value. The result of this paper is an Internet of Things system that can provide alarms in the event of irregularities, and gauge and track the refrigerator used for vaccine storage, and temperature. [8]

Domestic food waste is a very serious problem that affects the entire planet since it wastes energy in significant ways. Individuals frequently forget to eat food they bought before the expiration date, or they occasionally buy too much food and discard it thereafter. The purpose of this study is to suggest a system called Desired Before Expired (DBE) to help consumers avoid food waste. The program aids in organizing comparable food types in a refrigerator, maintains track of food expiration dates, and automatically notifies the user when a product's supply is running short or before the purchased food expires. [9]

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Dependence on user-friendly smart systems is increasing in direct proportion to the expanding usage of technology across a wide range of fields. Our lives have been simpler with the introduction of artificial intelligence in these smart systems. There are a number of IoT-based smart refrigerator systems that offer self-monitoring of contents, but they are not yet optimized for runtime or data security. As a result, a novel design is executed with equipment that is integrated at the hardware level with more complex software. A new smart refrigerator system was attempted to develop that is capable of automatic self-checking and self-purchasing by combining IoT technology with little human participation and smart mobile device applications, carried out on a mobile phone through the Blynk application. The suggested system runs routine checks and then awaits the owner's choice to either approve the system's request to repurchase these items over Ethernet or reject it. [10]

IV. BLOCK DIAGRAM

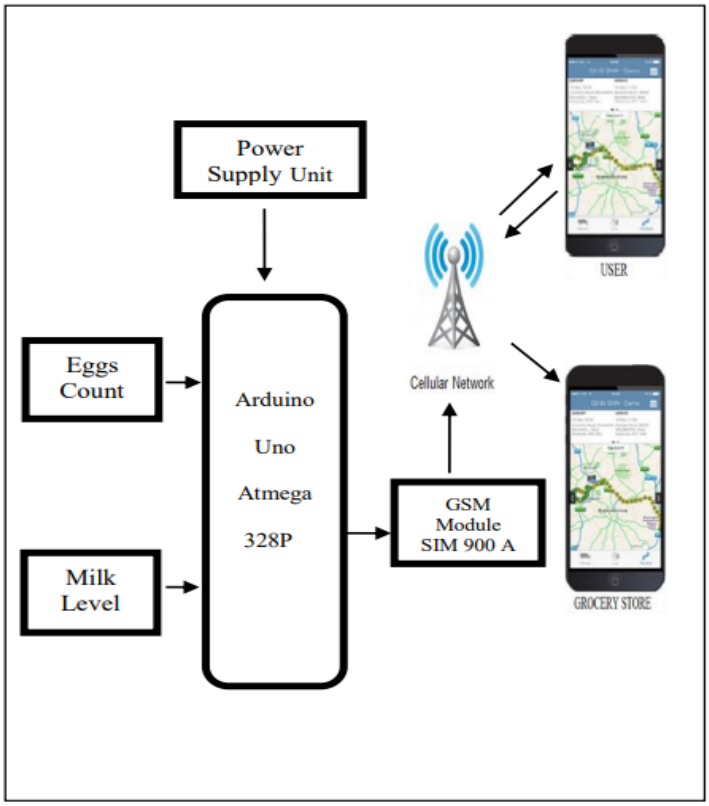

Fig 1.1 block diagram

V. IMPLEMENTATION

A. Eggs Count and Ordering

Using sound waves, an ultrasonic sensor measures the distance to an item. It uses a particular frequency to emit a sound wave, then it waits for the sound wave to return. The distance between the object and the sensor is determined by timing the duration between the sound wave being emitted and the sound wave being received, as shown in figure 1.1. With this variant, an HC-04 Ultrasonic sensor is utilized. Its maximum operating range is 400 cm.

The egg tray in this type has an ultrasonic sensor attached to it. It continuously produces sound waves that are reflected by the eggs in front of it and provide a specific distance. The Arduino may be programmed to allow for the pre-definition of various distance ranges so we can calculate the quantity and the presence of eggs. When a minimum threshold quantity is reached or if the eggs are depleted , we raise a signal. The GSM module and the User carry out the other operations.

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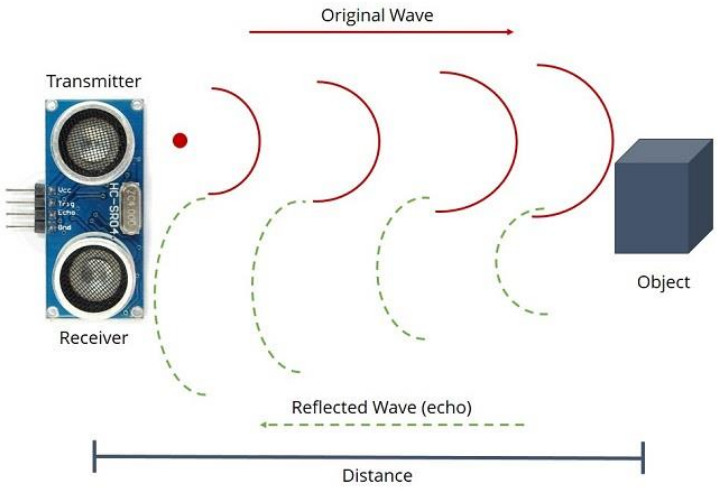


Fig 1.2(Fundamentals of ultrasonic sensors)

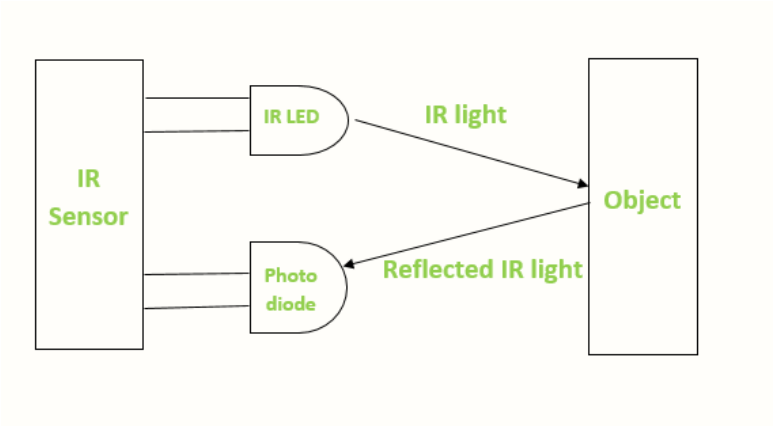
B. Ordering and Measuring Milk

In this part of the project, the idea of an infrared sensor is used as an object detection sensor.

An infrared photodiode and an infrared LED, often known as photocoupler vs optocoupler, make comprise an infrared sensor. If the object is there and within the IR receiver's designated range, some of the radiation that the transmitter releases will bounce back from it.

The sensor's output value is established by the strength of the signal that the IR receiver has detected. Its measurement range is 5 to 30 cm. The IR unit is fastened to the milk container's cap with its face turned inward so that it can gauge the liquid's depth inside. We establish a level based on the size of the container such that if the milk falls below it**,** a signal is raised when the reflected distance exceeds the threshold, and a similar ordering operation is performed. By specifying various threshold conditions at various levels, more liquids and solid food items can be added to this application's scope.

Fig 1.3 (IR Object Detection Principle)



C. The development of an interactive interface

Through the GSM module, the user can also make a request to the refrigerator to inquire about the stock that is now present in the refrigerator. This function can aid in maintaining household spending limits and limiting overspending on certain things while shopping.

The user can access information about the nutritional worth of veggies, associated Recipes, etc. stored in the smart refrigerator on demand by sending it a simple SMS. For instance, if a user texts the word "Potato," they will receive an SMS with the nutritional information and links to specific recipes from Google. To do this, we must build a database in Arduino for each of the required components.

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D. Android App for Reminding Expirations

When we place a certain food item in the refrigerator using Android Studio 6.0, a reminder application was created so that, we guard against spoilage by entering the item's expiration date and monitoring its freshness. The user can customize the reminder intervals to suit their needs. Three exercises were developed, and they are all interconnected. To change from one activity to the next, there is a floating button in the first activity**.** Including information about food expiration, such as the expiration date, time, and alarm title, is made easier by the second activity**.**

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