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Enhanced Refrigerator with Quantity and Quality Quantity Monitoring (ERQQM)

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Abstract: ***The 'ENHANCED REFRIGERATOR WITH QUALITY AND QUANTITY MONITORING (ERQQM)'aims in designing a refrigerator which will monitor the quality and quantity of food kept in it and notify its users about the same. Existing systems use RFID or Barcode scanner to keep track of the stock. The existing systems are expensive. The proposed system can be embedded into a refrigerator along with sensors.***
The core functionality of the ERQQM is to assess quantitatively and qualitatively the contents in the refrigerator. As a result, the user is notified every time restocking has to be done. This is done using the RFID module or the barcode scanner along with load cell, odour sensor, and temperature sensor. Further research and collection of data on the gases emitted from the deterioration of stock and also on improving efficiency is being done and can be implemented later.
Keywords: Refrigerator, Internet of things (IoT), Arduino board, Arduino IDE software, Sensors.

I. INTRODUCTION

A refrigerator is the most frequently used electrical appliance all over the world for food storage. Many smart refrigerator variants have been developed, but none of which has been cost effective. Some of the major developments were from Samsung and LG. These refrigerators were an unsuccessful because the consumers had seen them as an unnecessary product and due to the high cost (more than $20,000) and the problems solved were obscure. Electrolux's Screen fridge is equipped with a computer and touch screen built into the refrigerator door and does not consume existing storage space. This refrigerator is also connected to the Internet. Besides using the refrigerator to send e-mails or to surf the Internet, the homeowner can also use it to select, buy and order food without leaving the kitchen. The fridge will ultimately include a scanner able to read the electronic tagging found on all food and liquid packaging in the future. This way, the refrigerator can keep track of the stock of food that has been bought or to be purchased. The modern living in a fast-paced environment doesn't allow the user to keep track of the food items inside the fridge. Although efforts have been put to develop the smart refrigerator, the existing technology is still not cost effective.
The ERQQM is designed to convert any existing normal refrigerator into a smart and low-cost machine using sensors. The ERQQM notifies about the quantity and quality of stock in the refrigerator. Significance of this work would be alerting the spoilage of food, reduce wastage of food and create a healthier lifestyle for its users.
The ERQQM can be controlled by remote users, it can be turned on and off and also notifies its users about the scarcity of frequently used products using RFID. It also facilitates the ordering of scarce items by intimating (a) predefined grocery vendors through SMS or through an online portal. The load cell helps in monitoring quantity and quality. The grocery on degrading has found to be losing weight and the load cell will sense it.

II. LITERATURE SURVEY

We have drawn conclusions based on our survey. Earlier, the refrigerators were made smart by integrating storage with media. LG, Electrolux, Samsung, and Whirlpool made refrigerators that had a TV screen, MP3 player, and touchpads embedded into them [2]. Their main objective was to make the kitchen a place of cooking and entertainment. These refrigerators were considered an unnecessary expense and failed the market. They could not monitor the quantity or quality of the stock.
In this paper [6], the authors offer us several food related data sets and they monitored the stock quantity with these data sets such as UNIMIB 2016, food-101, UNICT8899. They have a large data set which can be help keep track of the stock.
Image scanning has been used to monitor the stock [7]. The installation cost is high and integration is very complex.In the paper [8], the refrigerator monitors the stock using photodiodes with high sensitivity. This is a drawback as photodiodes might be interfered by light from an external source. The paper uses Node MCU as an interface to communicate between the refrigerator and the user.
The food quantity is monitored using RFID scanner and GSM technology [9]. This system is cost efficient. Quality of stock hasn't been monitored here.

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III.METHODOLOGY

All The system comprises of sections in which the sensors are placed. It develops the solution around a concept of smart fridge equipped with an onboard processors and sensors and informs us through an application about the quantity and quality of the stock. Light dependent Resistors (LDR) sensors, odour sensors and load cells are placed along a counter which can be used to sense the quality and quantity of contents. They can be used to detect the level of liquid stock in the containers and to sense the presence of vegetables in the refrigerator. RFID transmitter and receiver are used to monitor the shelf life of contents. Whenever the contents inside the ERQQM goes below the predetermined threshold values or are degraded in quality, or if the product is on the verge of expiry, a trigger is generated which is then transmitted in the form of message to the user and a reordering list is created and sent to a predefined vendor though SMS or an online portal. Fig. 1 shows the proposed system block diagram.

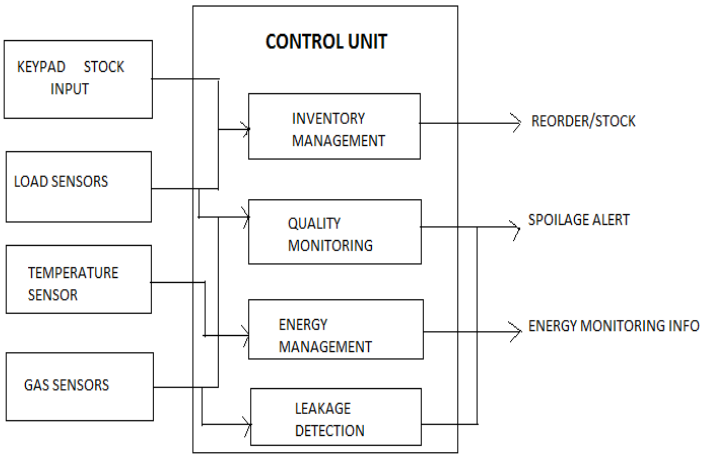

Fig. 1. The proposed system

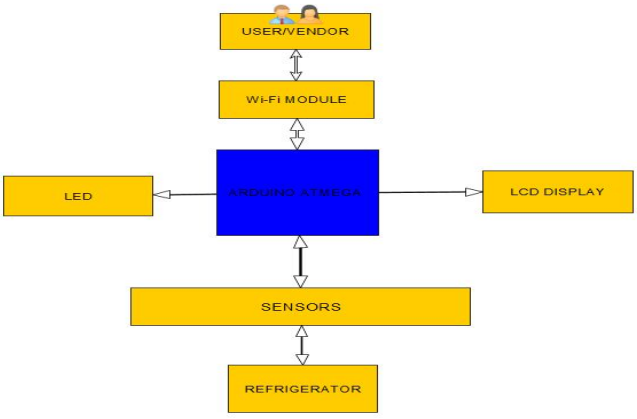

Fig. 2 Design Flow Control

TABLE I
LOAD SENSOR VALUES

ITEMS	QUANTITY (gms)	SENSOR VALUES(mV/V)
Vegetables	Empty Tray	0
	100	0.55
	350	0.68
	500	0.75
	750	0.83

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IV. RESULTS

Nowadays people are getting busy with their work so they don't have time to remember the stock in their refrigerator. Our system provides facility that if vegetables or daily essentials like milk, eggs, etc. are below predefined threshold then user and pre-defined vendor will get indication on their app and the order will be placed and the products will get delivered. If the stock inside the refrigerator is spoilt, the user will get a notification so as to not consume the product. This enables the user to monitor the stock and consume healthy food and reduce the wastage of food. When the door is kept open for a long time the refrigerator door gets closed automatically and if any hot vessel is kept inside the refrigerator, a notification is given to the user thereby improving the energy efficiency.

V. CONCLUSION

Our IOT-based Smart Refrigerator System with sensors has been designed, constructed and tested. This system can be used by every household in homes and public buildings such as hotels and restaurants. We can use this in various applications like home automation and restaurant management. The proposed smart refrigerator can enable health. It is designed for managing products stored in it. This module will be an important part of future smart homes and commercial applications. The concept of smart refrigerator is far more reaching than notifying the user about the contents of the refrigerator as it also monitors the quantity and quality of the stock in it. This module makes the refrigerator cost effective and user friendly. The Smart Refrigerator module is able to notify the user and control the functions inside the refrigerator. It also facilitates purchase of the scarce food items from an pre-defined vendor. The notifications and information inside the application that is sent to the user via android application.

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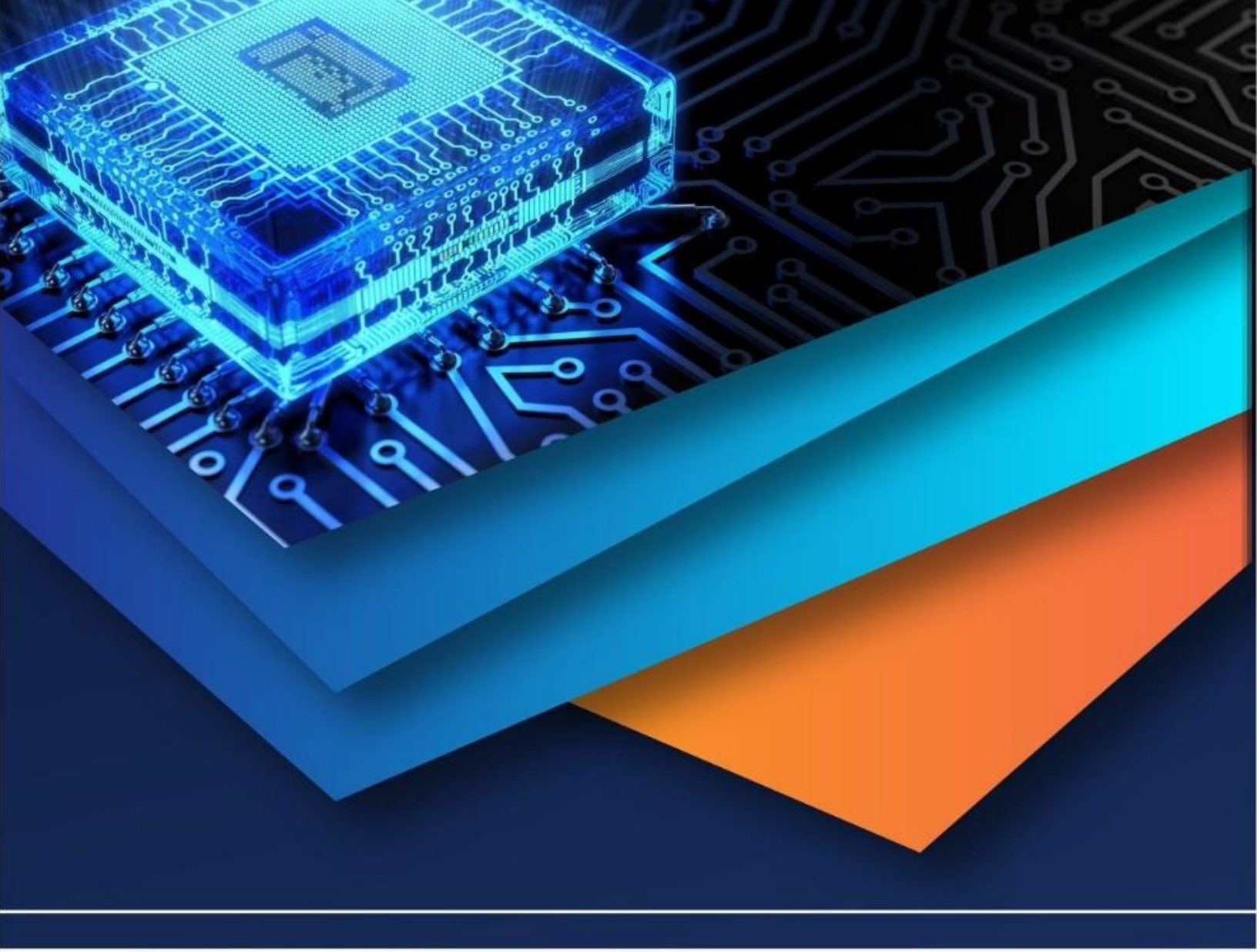

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