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IoT based Refrigerator, Storage Room and FMCG Products Stock Monitoring with Email Alert

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Abstract - *As we are in the twenty first century, the busy life style makes the FMCG product market to grow as fast as money plant. The companies are gaining huge profit from these product sources. These products are one of the main ingredients in our day to day life. Kitchen is one of the places where intelligent appliances have been used and also a place for lots of wastage of food and high consumption of energy. Nowadays grocery shopping has become a very big task. All the people who work are busy and find no time for grocery shopping. Our project provides a solution for this problem. It is capable of sensing and monitoring the FMCG and it can also remotely notify the user about scarce products via android application. It also facilitates the purchase of scarce items by sending an email to the vendor for those items.*

Key Words: **FMCG products, scarce products, Android application, email.**

1. INTRODUCTION

Home automation makes our daily life easy and more comfortable. In addition to this, communication between people and machines make life easier. There is really a great demand for the remote control and monitoring of any system. Both research and industry have focused on the development of the Smart Home Environment. Nowadays customers have a wide variety of choice to choose from while selecting FMCG products. The producer has to innovate additional values to the product so that the product continues its presence in the market. The Internet of Things requires connectivity to large number of heterogeneous devices. In recent times, the rapid growth of IOT devices in smart home environment envisioned a wide range of novel services and applications. Kitchen is one of the most important place which consists of many appliances that provides better services to the household. The main focus of our project is creating a smart fridge. The modern living and the fast growing environment doesn't allow the user to keep a track of the food items inside the refrigerator. The environment of smart home or the networked home doesn't have a good provision for security to protect the outflow of data from the house. The smart refrigerator also called internet refrigerator, is used to monitor the items inside it and notify about scarce products. Saving energy when possible is also a feature of the smart refrigerator, etc. The idea of connecting home appliances to the internet is seen as the future and is highly regarded as the next big thing. Although great efforts have been put to develop the smart refrigerator, the current or the existing technology is still not cost effective. Wastage of food due to lack of monitoring and timely usage of refrigerated foods is a common problem. United Nations Development Program states that about 40% of food in India is being wasted. And also about 20% of food bought ends up being thrown away. Food management in homes as well as restaurants, with the help of a smart refrigerator that monitors the quantity, quality and shelf life of the stored food and generates user alerts, hence proactively controls wastage of food all through the comfort of your phone. The idea of connecting home appliances to the internet or the smart home environment has been seen as the future and is highly regarded as the next big thing.

2. OBJECTIVES

1. Refrigerator food management and wastage prevention can be done by:
   - **Quantity monitoring**: Assess the quantity and provide timely updates and reminders of immediate usage or restocking.
   - **Quality monitoring**: Quality of vegetables and fruits can be monitored and alerts can be generated on the onset of spoilage.
2. Send email for items to be order.
3. The user can be alerted of the updates on his phone and can take steps to prevent food wastage or can place orders to restock the food in the fridge.

3. THE PROBLEM STATEMENT

Grocery shopping these days has become a job. The client needs to continuously monitor groceries at home and also has the work of managing coupons, maintaining shopping lists, etc. A big proportion of the grocery shoppers would thus have an interest in an additional convenient, quicker grocery shopping option. Nowadays life for everyone has become so hectic and time consuming, at such time we require a smart system at our kitchen also. To put on records and observing all the grocery at home is difficult. Most of the time we remain in wrong belief that we have enough grocery in our kitchen but we have to face empty bottles at the time of emergency when the requirement is must that gives us inconvenience. And to avoid this, some

time we buy more than enough grocery & store it at our home for many days, which is also an inconvenience can cause damage to grocery. Both this situations are problems. System that can give continuous level measurement and can notify us about low level of content is required to avoid these problems.

4. METHODOLOGY

The system comprises of sections where the sensors are placed. Light Dependent Resistors (LDR) sensors, IR sensor, smoke sensor and pressure sensor are placed along a counter which can be used to sense the quality and quantity of contents. These sensors are fitted in Refrigerator compartments, which sense objects, shelf life and quantity of objects and if no object is found, they produce "No Object" signal or "No Quantity" signal which is fed to further stage. They can be used to detect the milk and soft drinks containers and to sense the presence of vegetables in the refrigerator. Whenever the contents inside the refrigerator goes below the predetermined threshold values are degraded in quality, or if the product is on the verge of expiry, a trigger is generated which is being transmitted in the form of message to the user on the android app. With the permission of the user, an email will be sent to the vendor regarding the purchase order.

5. BLOCK DIAGRAM

5.1 The general block diagram

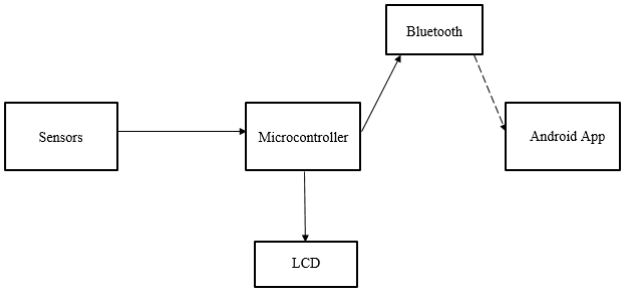

Fig -1: The general block diagram

The fig1 should the general block diagram of the entire project. It consists of 5 modules: sensors, microcontroller, LCD, Bluetooth module, android app. The first module as shown in the figure, is sensors. The sensors are IR sensor, LDR sensors, smoke sensor and force sensor. The different sensors are placed in different locations. For example the LDR sensors are used for keeping a track on the eggs, and it is placed near the egg tray, the IR sensor is used to check if the vegetables are in stock and will be placed in the vegetable tray, etc.

The renesas microcontroller is the second module. RL78 is the microcontroller that is being used. All the sensors are connected to the microcontroller using the jumper cables. This microcontroller accepts the data or the sensed output from the sensors. The received data is displaced on LCD for the reference of the user and at the same time it is sent to the Bluetooth module. The Bluetooth module used here is HC-05, which accepts the data from the microcontroller and transfers it wirelessly to the mobile which has the android app application installed and an email is sent to the vendor.

5.2 The main block diagram

Many embedded systems have substantially different designs depending upon their functions and utilities. The microcontroller located at the center of the block diagram forms the control unit of the entire project. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided by the sensors. The heart of project is microcontroller. Along with the microcontroller RL78 we have LCD, Bluetooth, LDR sensor, IR sensor, smoke sensor and force sensor.

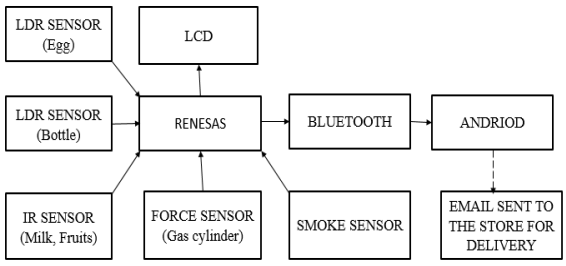

Fig -2: Detailed block diagram

This system uses two LDR sensors, where one is used to monitor the stock level of the eggs, and other for the bottles in the fridge. The IR sensor is used to sense the quantity of milk and vegetables, whereas the pressure sensor should be placed under the cylinder which indicates the level of gas present in it. The smoke sensor is used to detect the presence of smoke in the kitchen. If any item is removed, the sensor will send the sensed data to the microcontroller. Once the microcontroller receives the data, it checks it with the threshold value after checking, it triggers the status on the LCD. If it is below the threshold level then it immediately sends an email to the supermarket. Once the supermarket receives the mail the items will be delivered. The android app can be operated in manual mode as well as automatic mode. In manual mode an email will not be sent to the supermarket even if the FMCG products are below threshold and in auto mode the order will be placed as soon as the products are below threshold.

6. FLOWCHART

First the sensors checks for the initial values. It then checks if the food items picked from the inventory tray or if there is

any smoke in the kitchen or if the cylinder is below the threshold value and takes the present values. Once the present values are read it is then compared with the set threshold values. If these present values are above the threshold values then no action is taken place. And if they are below the threshold value then an email will be sent to the supermarket.

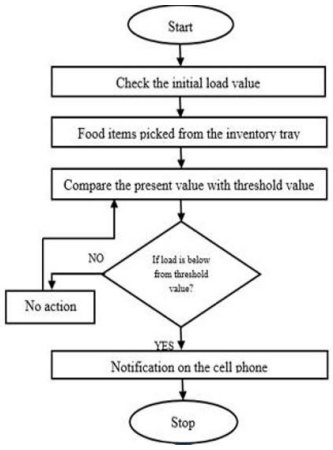

Fig-3: Flowchart

7. HARDWARE AND SOFTWARE COMPONENTS

7.1 Hardware components

1. Microcontroller RL78**:** The microcontroller used in this project belongs to RL78 family. It has 64 pins and works on CISC architecture. It has a RAM of 4KB and a ROM of 64 KB.

2. LDR sensor**:** An LDR is a sensor which has a resistance that changes when the light intensity that falls upon it.

3. LCD: An LCD is a flat-panel display or other electronically modulated optical device which uses the light-modulating properties of liquid crystals combined with polarizers.

4. IR sensor: An infrared sensor is an electronic device that emits rays in order to sense some aspects of the surroundings.

5. Force sensor: Force Sensing Resistors are a polymer thick film device which exhibits a decrease in resistance with an increase in the force applied to the active surface.

6. Smoke sensor: MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.

7**.** Bluetooth HC-05**:** It is a MASTER/SLAVE module which is configured only by AT COMMANDS.

7.2 Software components

1. Cube suite+: CS+ integrated development environment provides simplicity, security, and ease of use in developing software through iterative cycles of editing, building, and debugging.

2. Renesas flash programmer: This provides usable as well as functional support for programming on-chip flash memory of Renesas microcontrollers

3. Eclipse: It is an integrated development environment (IDE) which is used in computer programming. It main use is for developing Java applications.

4. Android App: Android App is a software designed to run on an Android device or emulator. The term also refers to an APK file which stands for Android package.

8. RESULTS

The fig-4 shows the final setup of the entire prototype, which shows the microcontroller at the center which has sensors connected to it via jumper cables. The LCD is for displaying the status of the products i.e., if vegetables or daily essentials like milk, eggs, etc. are below predefined threshold then it will be indicated on the LCD. User will get indication on our app for which the data is transferred using a Bluetooth module. The mobile app is used for placing the order of the required products.

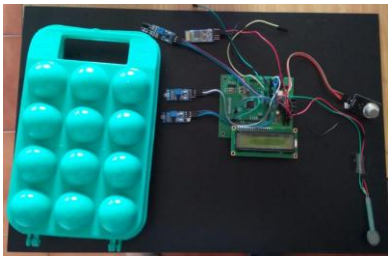

Fig-4: Final model setup

9. APPLICATIONS & ADVANTAGES

9.1 Applications

1. Kitchen is one of the main application.
2. Can be used in medical stores.
3. Can be used in warehouses.
4. Can also find its application in the cold storage section of supermarkets.
5. Can be used to know consumers preference towards product.

9.2 Advantages

1. Automated ordering to grocery stores – on daily/ weekly/ monthly basis.
2. It saves time, completely automatic control through microcontroller.
3. Manual operation has been reduced to major extent.
4. Less man power required.

5. No extra accessories are required as it uses internet.
6. Online shop via internet is possible
7. The Smart refrigerator is cost effective, economical and it is user friendly.
8. It can be operated in both manual as well as automatic mode.

10. CONCLUSIONS

Our project is able to remotely notify the user about the low contents inside the refrigerator. It also facilitates purchase of the scarce FMCG products from an online vendor. An email regarding the order of the scarce items is sent to the vendor from the android app. This module helps to prevent wastage of food as the user is constantly aware of the contents in the refrigerator and can proactively take measures to prevent wastage. This will also provide ease to those people who forget how much food is left in their homes when they go to grocery shopping. These people can just take out their mobile phones and will know instantly how much food is left. Additionally, our system also provides comfort to those people who find it difficult to go to grocery shopping due to physical disability or busy schedule. The system detects which food items are finished and with the permission of user places an automatic online order to replenish the finished food items. In this way, user is aware about how much food is left in the refrigerator and cabinets. Thus, the user is better able to save food from being expired and hence can prevent food wastage.

11. FUTURE SCOPE

In the future, image processing can be performed on the photographs of vegetables in the vegetable box. With the assistance of various sensors such as odor sensors, we can detect about the presence of the expired food. We also can embed the smart meter in the refrigerator to control the electricity consumed. For project demo concern, a prototype module has been developed. Going further, with change in technology most of the units can be embedded along with the controller on a single board in order to reduce the size of the system.

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