

## Smart Refrigerator

Rishabh S. Khosla  
Dept. of Computer Technology  
Shah & Anchor Kutchhi Polytechnic  
Mumbai, India  
*prince.khosla100@gmail.com*

Pranul S. Chheda  
Dept. of Computer Technology  
Shah & Anchor Kutchhi Polytechnic  
Mumbai, India  
*chhedapranul1@gmail.com*

Smith R. Dedhia  
Dept. of Computer Technology  
Shah & Anchor Kutchhi  
Polytechnic  
Mumbai, India  
*s1.2dedhia@gmail.com*

Dr. Bhavesh Patel  
Principal  
Shah & Anchor Kutchhi Polytechnic  
Mumbai, India  
*principal@sakp.ac.in*

**Abstract:-** In last decade we have witnessed great development in area of refrigerator technology. In this paper we present the framework for smart refrigerator which enables automated purchase mechanisms with use of integrated sensing technology SMS mechanisms accompanied by online purchases followed by home delivery. Proposed smart refrigerator is efficient and effective since it involves minimum human interaction.

**Keywords:-** Load cell, Weight sensor, Bluetooth module, Arduino.

\*\*\*\*\*

### I. INTRODUCTION

Presently traditional methods are used to buy daily need product like groceries, vegetable fruits etc. In early days, these products were needed to be bought on day to day basis. With invention of refrigerator stocking of these items was possible. With the rapid technological developments, options for buying & preserving various commodity products was possible and made easy as compared to that of previous methodology. In this project we propose smart refrigerator using novel concept, by automating purchase process including home delivery. Previously people use to stand in long queues to call a person who lives far away. Then came the mobiles which enabled us to contact people who lived even across the continents. With the invention of Smartphone there were many apps that came along side promoting e-Business. E-Business or electronic business is the administration of conducting the business via the internet. This would include the buying and selling of goods and services, along with providing technical or customer support through the internet. Some of them include Flipkart, Snapdeal, etc. These were the firms that were previously unknown to many but now with the help of mobile apps every second person has a certain idea of these firms. And he can order basic stuff like earphones, etc. from such apps. We have selected android to be our medium because it has a wide range of users and popular. People using android operating systems in their Smartphone are more in number as compared to that of others mobile operating systems. Proposed smart refrigerator uses sensing technology integrated with SMS mechanism for online purchase with

home delivery with minimum user interaction. This novel methodology will ensure towards a more relaxed and comforting future. The following proposed work will also include the area of B2B (Business-to-business), android application development, etc. The main objective of the paper is for convenience of user who will be able to get the information about the contents in the fridge & also order food hassle free. Rest of the paper is organized as follow: section 2 describes the architecture of proposed system, section 3 discusses in detail about literature survey, section 4 deals with the proposed system architecture in section 4 we conclude with future research direction.

### II. LITERATURE SURVEY

Literature Survey was done by our team to compare the weight sensors which will meet our minimum requirement because they will be placed in the fridge where it can withstand the cold temperature and the also work under harsh conditions like extreme humidity. The wavelength of the wireless signal should be optimized and should be strong enough as the sensor will be placed inside the refrigerator.

The types of load cells are -Shear beam - the shear beam load cell is fixed rigidly at one end with the force being applied to the other end. These can be used singly or in groups e.g. a platform scale using one cell in each corner. [1]Double ended - shear beam type cells are of different construction and are fixed rigidly at each end with the force being applied to the center of the beam. [1]Single point - load cells are of similar design but are intended for use in single cell applications only. [1]

The sensor may even face difficulties due to interference from the refrigerators moving part e.g. compressor, etc. and should be robust to handle this conditions effectively. Names of the Tech Magazines are: Popular Science, Mini-Windows, Science News, etc.

While searching for our project we found out an article about milkman stating that: firstly the milkman used to go to peoples places to deliver milk, it was very time consuming and lots of man power was required and then guessing when the milk will be over was quite difficult. So he purchased a sensor which told him that his milk tank was about to get finished and he could go back to the dairy and get more milk. This method made quite convenient as whenever the tank was getting depleted the person knew exactly when he would run out of milk and when to get more. Using the technology at our door steps is the one thing that gave us the idea to develop something that is useful in our day today life. Then it came to our minds that why not make a shopping app that sends your item details to the local shopkeeper & then he can give you home delivery of the product

### III. ARCHITECTURE OF SMART REFRIGERATOR

The architecture of our system is explained in the following part.

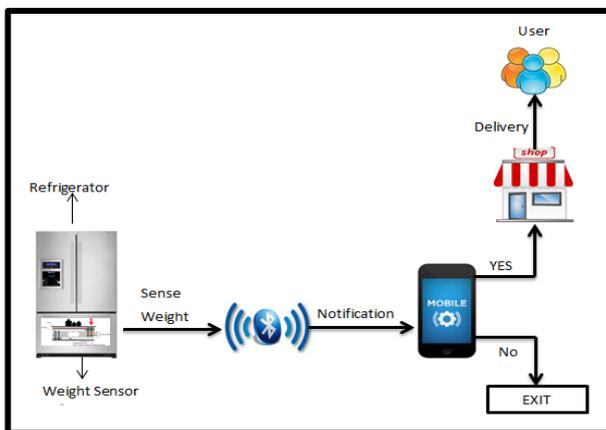


Figure 1: Block Diagram of Proposed System

A load cell is a sensor or a transducer that converts a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used. There are many different kinds of load cells. We offer resistive load cells and capacitive load cells.

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz[2]) from fixed

and mobile devices and building personal area networks (PANs). It was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

Android is a mobile operating system (OS) currently developed by Google, based on the Linux kernel and designed primarily for touchscreen mobile devices such as smartphones and tablets. Android's user interface is mainly based on direct manipulation, using touch gestures that loosely correspond to real-world actions, such as swiping, tapping and pinching, to manipulate on-screen objects, along with a virtual keyboard for text input. In addition to touchscreen devices, Google has further developed Android TV for televisions, Android Auto for cars and Android Wear for wrist watches, each with a specialized user interface. Variants of Android are also used on notebooks, game consoles, digital cameras, and other electronics. As of 2015, Android has the largest installed base of all operating systems.[2]

Stepwise working of proposed system

**Input:** Initialize threshold weight in database.  
getInput (weight)

**Output:**

Step 1: Start

Step 2: Continuously send weight to the Arduino.

Step 3: Comparison between Continuous incoming weight and threshold weight.

IF (weight < thresholdWeight) THEN  
Trigger Arduino to send push notification.

Goto Step 4

ELSE

Repeat Step 3.

ENDIF

Step 4: Confirm from the user whether to place order or not.

IF (User input == YES) THEN

Goto Step 5.

ELSE

Goto Step 6.

ENDIF

Step 5: User details and required product quantity.

getInput (Information from user)

Step 6: Exit.

#### IV. MODULES

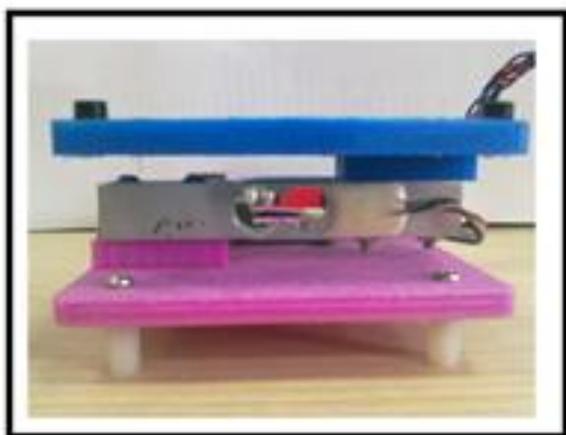
##### 4.1 Load Cell

The first component that is also the main component in our project is- The HX711 Weight Sensor. HX711 is a precision 24-bit analog-to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor. The reason I selected this weight sensor is because there is no programming needed for the internal registers. All controls to the HX711 are through the pins. Compared with other chips, HX711 not only has a few basic functions, also contains high integration, fast response, immunity, and other features. The chip lowers the cost of the electronic scale, at the same time, improving the performance and reliability. The table 1 gives us the more detail about the load cell we will be using and also about the temperature the cell can withstand without much change in the output.

The figure 2 is the picture of load cell which will be used by the proposed system

**Table 1: Specification of Load Cell**

Specification	Range
Input impedance	420 ohm
Output impedance	350 ohm
Operating temp. range	-20C to +55C
Compensated temp. range	-10C to +40C



**Figure 2: Load Cell[4]**

##### 4.2 Bluetooth Module HC-05

The second important component without which the project is not possible is- The Bluetooth HC-05 Module. This module was introduced because there were some complications with the Wi-Fi module. HC-05 embedded Bluetooth serial communication module (can be short for module) has two work modes: order-response work mode and automatic connection work mode. And there are three work roles (Master, Slave and Loopback) at the automatic connection work mode. When the module is at the automatic

connection work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order-response work mode, user can send the AT command to the module to set the control parameters and sent control order. HC-05 is a more capable module that can be set to be either Master or Slave [6]. HC-06 is a Slave only device. (It looks physically just like the HC-05). (Note: Now HC-06 not cheaper). These modules are based on the Cambridge Silicon Radio BC417 2.4 GHz Bluetooth Radio chip. This is a complex chip which uses an external 8 Mbit flash memory. The module has two modes of operation, Command Mode where we can send AT commands to it and Data Mode where it transmits and receives data to another Bluetooth module.

There is interface between the weight sensor and GSM modem. The weight sensor will constantly read the weight of the tray and will forward it to GSM modem. The moment the change in weight is detected, the GSM modem will be triggered and will forward a push notification from the modem to android app via Wi-Fi signal. The GSM modem and Android phone with the app installed are connected in the same Wi-Fi network. In the app, the user will be prompted whether to continue with the purchase of commodities or not. If user agrees, further details will be asked by the app on the quantity of commodity to be ordered, time of delivery (if required), etc. if user denies the prompt the order will be cancelled.

##### 4.3 Android Application

Android applications are developed in the Java language using the Android Software Development Kit. The android application is the major module for our proposed system as application will allow user to order the commodity with very few inputs. The development of the android application will done using the open source tools such as Java JDK5 or JDK6 Android SDK, Eclipse IDE for Java Developers (optional), Android Development Tools (ADT) Eclipse Plugin (optional)[7]. The Bluetooth module will forward the notification to android app. The application will be using Broadcast Receiver to get the notification. Broadcast Receivers simply respond to broadcast messages from other applications or from the system itself. These messages are sometime called events or intents.[7] On ordering of food the an email app will be fired along with the data of required commodity as attachment using Content Providerclass.AContentProvider component supplies data from one application to others on request.[7]Content providers are one of the primary building blocks of Android applications, providing content to applications. They encapsulate data and provide it to applications through the single Content Resolver interface. [8]A content provider is only required if you need to share data between multiple applications.[8]

---

## V. CONCLUSION AND FUTURE RESEARCH DIRECTION

Smart Refrigerator is developed by various electronic hardware component & java as programming language. Tested on various refrigerator models. Initial results were very much encouraging and appreciated by large no of users indicating high efficiency, effectiveness as well as minimizing the user's intervention. In proposed to extend this work by replacing Bluetooth module with Wi-Fi module to the system for increasing stability of the system.

## REFERENCES

- [1] <http://www.aicpl.com/brochures/loadapp.pdf>
- [2] <http://www.nytimes.com/2015/05/28/technology/personaltech/a-murky-road-ahead-for-android-despite-market-dominance.html>
- [3] <http://www.instructables.com/files/orig/F3O/K70G/H1LWQ0P/O/F3OK70GH1LWQ0PO.pdf>
- [4] <https://www.bluetooth.com/what-is-bluetooth-technology/bluetooth-fact-or-fiction>
- [5] <https://arduino-info.wikispaces.com/BlueTooth-HC05-HC06-Modules-How-To>
- [6] [http://www.dfrobot.com/wiki/index.php/Weight\\_Sensor\\_Module\\_V1](http://www.dfrobot.com/wiki/index.php/Weight_Sensor_Module_V1)
- [7] [http://www.tutorialspoint.com/android/android\\_tutorial.pdf](http://www.tutorialspoint.com/android/android_tutorial.pdf)
- [8] <http://developer.android.com/reference/android/content/ContentProvider.html>