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DESIGN OF SMART REFRIGERATOR USING RASPBERRY PI

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ABSTRACT

In any conventional or standard refrigerator there is no system of automatically monitoring the food items. A smart refrigerator is one which possesses self-monitoring capability of food items and automatically detecting and alerting the consumer of the need to restock the food items with minimal human intervention. Thus the devices ought to be smart enough to recognize our needs. Hence smart refrigerator is designed to convert any existing refrigerator into intelligent cost effective appliances using sensors. In our system the smart refrigerator automatically detect the weight of the products, any gas leakage and any changes in the level of the liquid in a container using load cell sensor, gas sensor and ultrasonic sensor then the system will automatically inform the owner about the status of the smart refrigerator through short message service (SMS) using GSM mobile network.

I. INTRODUCTION

"TO EAT IS A NECESSITY, BUT TO EAT INTELLIGENTLY IS AN ART."

The necessity for any living form is food, water, air. Food provides the fuel for you to function, to move, to think, to grow and repair our body, basically if we don't eat we die. But to eat intelligently is an art, getting the right balance between quantity, quality and the combination of protein, carbohydrates, fats, minerals and vitamins, good crabs, bad crabs, good fats and bad fats, it's not only an art it is a science. As in today's situation, most of the people are working and have hectic schedule all the day. These entire factors have been considered for the design of smart refrigerator. Smart refrigerator is used to measure its contents automatically and if there are any changes in the Content, it sends an SMS via GSM. It uses sensors like load cell, ultrasonic and gas sensor to detect and monitor its contents and sends user a notification via GSM mobile network. It uses Load cell sensor for measuring the weight of the products, Ultrasonic level sensor for measuring the level of the liquid in a container and gas sensor for monitoring the leakage of gas and changes inside the refrigerator will be sent to the user mobile phone via GSM mobile network. Since this design uses sensors for the automatic monitoring, it saves more time of the people using it. It uses GSM technique for the notification of inadequate products to the user mobile, this would be very helpful for the user because they may need not go to shop for each and every product that run off. Instead they can shop when it sends an alarm message, thus it requires no manual monitoring.

II. RELATED WORK:

R.V. Lithika, P.Shruthi, R.Nagashree published that the primary function of this smart fridge module is able to remotely notify the user about the low contents inside the refrigerator. It also facilitates purchase of the scarce food items from an online vendor. The link to the online vendor is incorporated inside the notification that is sent to the user via SMS (Short Message Service) and email. 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 [1].

Deepti Singh and Preet Jain introduced smart refrigerator application with intelligent multimedia capability. It is designed for managing items stored in it. More importantly, it can perform other functions such as dietary control, eating routine analysis [2].

III. EXISTING SYSTEM

There are certain features limiting the process of the present system. The drawbacks of the present system are listed below.

- ONLY MANUAL MONITORING IS POSSIBLE.
- NO SENSORS ARE USED TO NOTIFY ABOUT THE PRODUCTS.
- QUANTITY OF THE PRODUCT CAN'T BE MEASURED BY THE USER.

IV. PROPOSED SYSTEM

The proposed system, Design of Smart Refrigerator overcomes the drawbacks
of the present system.

- THE PROPOSED DESIGN AIMS TO IMPLEMENT A SMART REFRIGERATOR SYSTEM, WHICH IS EASY TO USE AND ECONOMICAL FOR THE USER.
- IT IS CAPABLE OF NOTIFYING IT OWNER ABOUT THE ACTIVITIES GOING ON INSIDE THE REFRIGERATOR.
- IF THE ITEMS WEIGHT IS BELOW THE THRESHOLD VALUE, NOTIFICATION WILL BE SEND TO THE USER MOBILE.

V ARCHITECTURE

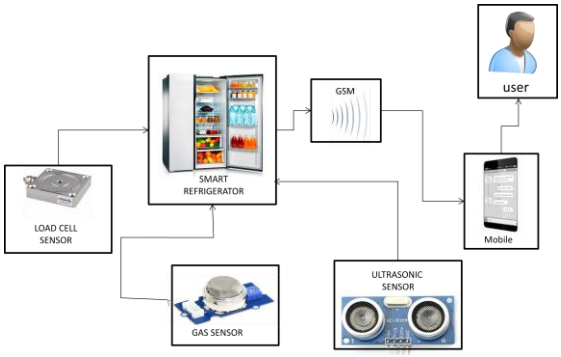


Fig 1.1 System Architecture for a design of smart refrigerator.

LOAD CELL SENSOR:

A load cell is a transducer that is used to create an electrical signal whose magnitude is directly proportional to the force being measured. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used. The electrical signal output is typically in the order of a few milli-volts.

ULTRASONIC SENSOR:

Ultrasonic distance sensors are designed to measure distance between the source and target using ultrasonic waves. We use ultrasonic waves because they are relatively accurate across short distances and don't cause disturbances as they are inaudible to human ear. . HC-SR04 is a commonly used module for non contact distance measurement for distances from 2cm to 400cm. It uses sonar (like bats and dolphins) to measure distance with high accuracy and stable readings. It consists of an ultrasonic transmitter, receiver and control circuit. The transmitter transmits short bursts which gets reflected by target and are picked up by the receiver. The time difference between transmission and reception of ultrasonic signals is calculated. Using the speed of sound and '**Speed = Distance/Time**'equation, the distance between the source and target can be easily calculated.

V.
VI.
VII.

GAS SENSOR:

The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current.

Global System for Mobile communication:

GSM is a digital mobile telephony system that is widely used in Europe and other parts of the world. **GSM** uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, **GSM**, and CDMA). GSM modem is introduced to rectify the main limitation of the dial up modem based on its acceptance of a sim card. It is almost equivalent to a mobile communication system as operates over a subscription to a mobile operator. From the mobile operator perspective, a GSM modem looks just like a mobile phone. Using the transmission and reception pins, a modem can receive and send the messages and it could be interfaced with the PC or to a microcontroller. This property makes the modem to exist in a relevant position on embedded applications.

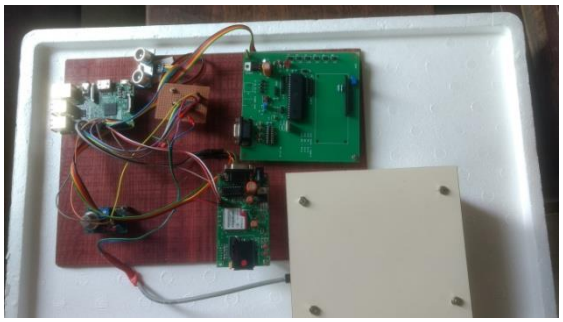
MCP3008:

The MCP 3008 connects to the raspberry pi using SPI serial connections. It is an SPI based analogue to digital converter (ADC). It has 8 analog input channels, pi uses 4 pins and others are used for sensors. The MCP3008 is a 10-bit ADC that can convert up to 200 kilo samples per second (200ksps) (@ 5V!!).

VI IMPLEMENTATION

HARDWARE IMPLEMENTATION:

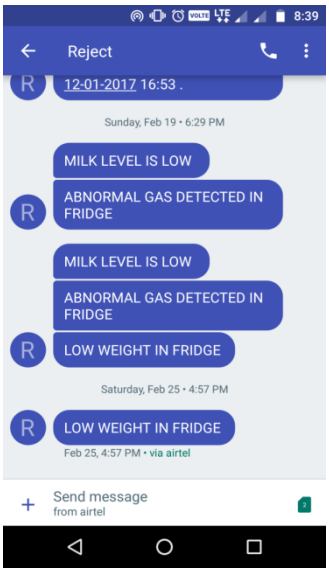
All the components are to be connected with raspberry pi3.Typically the VDD pin is connected to 3.3V power. The AGND and DGND pins can be connected directly to the ground reference point. The VREF pin is the reference voltage which is the largest possible voltage that the ADC can interpret. In our scenario we will connect the VREF pin to 3.3V (same as VDD). So if 3.3V was sampled on any of the ADC's channels it would be interpreted as the maximum digital value that can be represented by this 10-bit ADC i.e. 2^10 - 1 = 1023. Similarly the smallest analog voltage that the ADC can detect (also known as the 'LSB size') is VREF/1024. Which in our case is 3.3V/1024= 3.22mV. The equation that converts between the analog voltage and its digital interpretation is given by "Digital output code = 1024*VIN/VREF"; where VIN is the analog input voltage and VREF is the reference voltage



Implementation of a design of smart refrigerator

VII RESULTS

Normally in any conventional refrigerator, only manual monitoring is done whereas in smart refrigerator everything is done automatically. Initially, the load of the product is measured after the usage of the product load is again measured and checked against the threshold value. If the value went below the threshold value, it sends a SMS via GSM. Level of the liquid is measured and after the usage if it went below the threshold value, it sends a SMS via GSM .Finally if there is any leakage of gas or gas from the rotten vegetables and fruits, it monitors and sends an SMS to the user.



VIII CONCLUSION

This project has given me an opportunity to design, code, and test and designs an application. This project has helped us to work with RaspberryPi3, Rasbian and python. Further, this has helped us knowing more about sensors and its working.

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X FUTURE ENHANCEMENT

As this was developed for certain functions happening inside the refrigerator there are lots more to be done as future enhancement. It should provide the nutritional value of the food. The future smart refrigerator can use image processing for maintaining the quality of the food. If any malfunctioning happens inside the refrigerator, it can directly send the status to the customer care using SMS.

XI REFERENCES

[1] Emily Moin, ―Smart Refrigerator for grocery management‖ Technical disclosure commons May 6, 2015

[2] Lei Xie, Bo Sheng, Yafeng Yin, Sanglu Lu, Xiang Lu, I Refrigerator:―An Intelligent Refrigerator for Food Management based on RFID Technology‖ UbiComp'13, September 8–12, 2013, Zurich, Switzerland

[3] M. Salman and J. Vrindavanam, "Efficient Interactive Control System Based on GSM", *Int. J. Latest Trends Eng. Technol.*, vol. 3, no. 2, pp. 50–56, 2013.

[4] K. Mohanta and V. Khanaa, "Friendly home Automation system using Cell phone with instant voice messages", *Int. J. Adv. Res.*, vol. 1, no.9, pp. 411–414, 2013.

[5] M. Salman and J. Vrindavanam, "Efficient Interactive Control System Based on GSM", *Int. J. Latest Trends Eng. Technol.*, vol. 3, no. 2, pp. 50–56,2013.