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ORIGINAL ARTICLE

Designing of an equilibrium temperature controlled domestic Refrigerator

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ABSTRACT

From the very first day of refrigerators stepping into the common people's lives, they have been performing the noble task of preserving the food of fellow humans by storing them in a cold atmosphere. But, the conventional domestic refrigerators we use is only limited to storing food materials in a cold atmosphere irrespective of the temperature of the edible product. People tend to directly put in their food products into the cold atmosphere despite of keeping the temperature of the food itself in mind, which ultimately leads to a lot of chemical changes in the food product because of the abrupt temperature swift. Hence in our experiment, we have implemented a separate chamber attached to the domestic refrigerator with the help of Arduino UNO, Temperature Sensor, Servo Motor and a Ventilation Cooling Fan which saves one's time and takes care of individual health meal by bringing the food stored, down to the room temperature in a natural way and then automatically shifts the food directly into the refrigerator.

Keywords: Domestic, Household, Refrigerator, Arduino UNO, Temperature Sensor, Servo Motor

1. INTRODUCTION

Ever since the evolution of mankind, we humans have evolved to be a smart being who simply got smarter with every passing day, that has led us to a tendency of incorporating smarter objects in our day to day lives of which one of the most essential smart objects being the domestic refrigerator. A household refrigerator is a common household appliance that consists of a thermally insulated compartment and which when works, transfers heat from the inside of the compartment to its external environment so that the inside of the thermally insulated compartment is cooled to a temperature below the ambient temperature of the room [1]. Generally, people tend to put their food products directly into the cold atmosphere despite of keeping the temperature of the food itself in mind which at times results in the development of pathogens in the food material because of the abrupt change in temperature. The growth of pathogens can make the food unsafe for eating which might lead

to foodborne illnesses [2]. In past, and all this while several researches have been done on energy consumption, efficient cooling and environment friendly factors of the household refrigerator which has led to quite a few remarkable innovations such as temperature control using a potentiometer [3] as per external weather conditions, refrigerator with the freezer compartment at the bottom [4] to name a few. All of these innovations only concern the device and not the product of which the refrigerator is given a responsibility.

In our paper, we have made an effort to put an eye on one the most less talked about aspect of the domestic refrigerator, i.e. the temperature of the food stored. A large pot or container of food that is hot, should never be placed in the refrigerator or freezer [2]. Which is why, we have implemented a separate servo motor controlled rack to the household refrigerator which senses the temperature of the food container, brings it down to room temperature in a natural manner and automatically shifts it into the refrigerator once the desired temperature is achieved; thus saving the extra time spent by the operator in cooling the food item and preventing the slightest chance of pathogen growth in the food.

2. EXPERIMENTAL DETAILS

Work topology/ process/methodology:

The Designing of an Equilibrium Temperature Controlled Domestic Refrigerator involved the incorporation of the following devices:

Components	Model Number
Arduino board	UNO R3
Temperature Sensor Module	DTH11
Servo Motor	--
Cooling Fan	--

In this project, we have kept space to determine the architecture of the separate chamber attached to the refrigerator. This work is a result of experimentation and is under evolution on its path towards practical implementation.

In order to ensure the proper and safe storage of food, it must be cooled from 140 to 70 degrees Fahrenheit within two hours and to 41-degree Fahrenheit or lower within four hours [2]. To achieve this, we have programmed the Arduino UNO R3 board using ARDUINO software such that the Temperature Sensor Module (DTH11) connected, senses the temperature of the food container. If the food is above desired temperature level, it is cooled down using the cooling fan that acts as a ventilltor for hot air, and when the desired temperature (room temperature) is achieved, the food is transferred into the refrigerator for the second phase of cooling with the help of servo motors.

3. RESULTS AND DISCUSSION

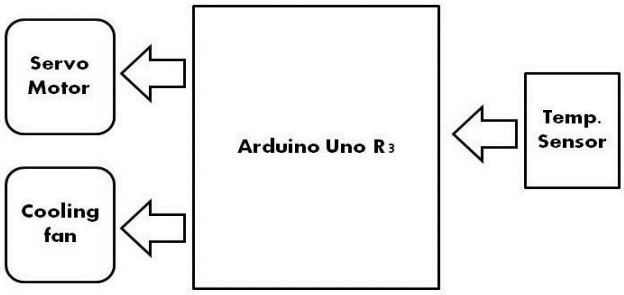

Figure 1. Basic block diagram of the system.

A separate chamber represented by the block diagram in figure 1 is attached to the domestic refrigerator. Cooling the food outdoors exposes it to the outer atmosphere and makes it prone to bacteria and pathogen exposure. Hence, we have designed a chamber with multiple racks that has space for storage of multiple containers so that when a container is cooled down to room temperature is immediately transferred into the refrigerator without disturbing the other containers, hence letting those cool down naturally. The operator does not have to put much thought, he or she can simply put the containers carrying food into the racks and the rest of the job will be an automatic process, thus saving time and delivering safe and healthy food for a better wellbeing of current busy lifestyle schedule of humans.

4. CONCLUSIONS

Till date a lot of innovations and researches have been done regarding the internal cooling factors and its effect on environment in the field of commercial domestic household refrigerators. This particular problem of abrupt temperature change in food items can be easily solved by cooling the containers until the room temperature is achieved but, this process is time consuming and requires a lot of extra attention. With every passing day, our lives are becoming more and more busy and 24 hours in a day seems pretty small a span. In our project, a simple effort has been made to save the unnecessary time and energy spent by our fellow humans so that they can utilize their precious time without having worries about that minute

factor which could have caused a major health problem. This is just a small step taken towards achieving the goal of providing humans a better, heathy and efficient lifestyle

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REFERENCES

1. Sreejith K, Sreesastha Ram TR, Rizwan, Sachin M.P. et al.:' Experimental Investigation of a Household Refrigerator Using Evaporative-Cooled Condenser', Research Inventy: *International Journal of Engineering And Science,* 2017; 7 (4): Pp -01-06.
2. https://www.canr.msu.edu/news/cooling_hot_food_do_it_right_to_prevent_bacterial_growth
3. Jose Ruiz, RTAC Americas.: 'Implementation', in Freescale Semiconductor Application Note.: 'Basic Refrigerator Control Using the MC9RS08KA2', Document Number: AN3409, Rev. 0, 01/2007.
4. https://www.bijlibachao.com/refrigerators/latest-refrigerator-technologies-india-review.html
5. Andrej Kitanovski, Uros Plaznik, et al.:' Present and future caloric refrigeration and heat pump technologies', *International Journal of Refrigeration*,2015; 57 :Pp. 288-298.
6. Demetris Parpas, Carlos Amaris, Savvas A. Tassou .:'Investigation into air distribution systems and thermal environment control in chilled food processing facilities', *International Journal of Refrigeration*, 2018; 87:Pp. 47-64.
7. Mayank Awasthi, and KV Mali. Design and development of thermoelectric refrigerator', *Int. J. Mech. Eng. & Rob. Res*. 2012, 1(3) October 2012.
8. Akintunde MA. Validation of a vapour compression refrigeration system design model', American Journal Of Scientific and Industrial Research © 2011, Science Huβ, http://www.scihub.org/AJSIR.
9. United States Department of Agriculture Food Safety and Inspection Service, Food safety Information.
10. Akshadnya D. Ukey, Mohd. Irfan Khan, et al.: 'A Reassess on Phase Change Material Application in Refrigeration and Air Conditioning', *International Journal of Mechanical Engineering Research*. 2017; 7 (2):pp. 119-128.