

Seebeck Detector

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Abstract: Freezer, the most important and crucial machine for food industry, chemical & drug laboratory. A small fault in freezer leads to lots of food & chemical wastage, as well as money wastage. The major problem in a freezer is condensation. Because of this condensation, water settles on food or chemicals and leads to the spoilage of it by growth of fungus. This has to be handled effectively and efficiently. So, to overcome such a problem a thermocouple can be used which reduce the loss to food and drug industries.

Keywords: Condensation, Spoilage, Thermocouple, Chemical wastage, MSP430, GSM.

I. INTRODUCTION

In first case, the hot item makes the cold air inside the freezer, start condensing. In second case, the air from outside which is much hotter than the air which is inside the freezer causes the condensation. In the third case, the hardware failure of freezer causes the condensation. A refrigerator is a common 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]. There are many causes for condensation in a freezer. Condensation is generally occurring close to the evaporator surface [2]. But condensation in a freezer is not a small issue, and it can't be neglected. This problem has to be handled carefully, if not, then it is not possible to see the product which is placed in the freezer and adjust temperature accordingly. It's not that the products are visible but also even such condensation leads to growth of fungus in case some raw materials, food and drugs are placed in it. So the above problems tell how important it is to handle the condensation problem and avoid it.

Some of the reasons which cause condensation are:

1. Placing hot items in the freezer.
2. Keeping the freezer door open unknowingly for a long time.
3. Faulty Gasket operation of freezer.

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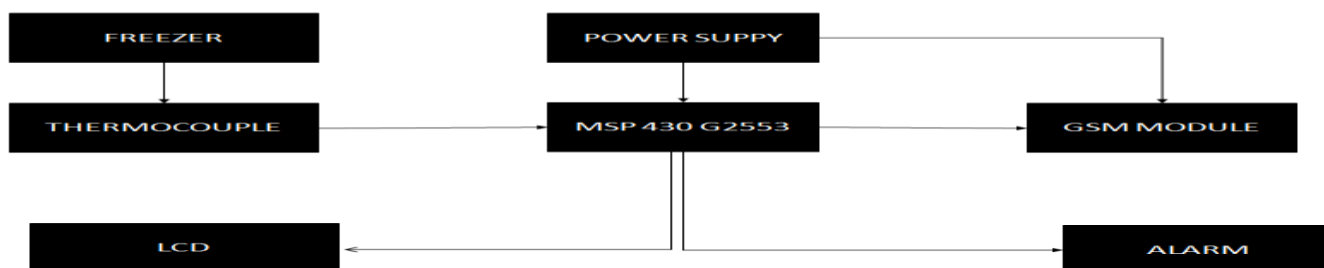
II. LITERATURE SURVEY

Refrigerators work to remove moisture that is naturally present in the air inside of the unit. If there is too much moisture (condensation) present for the refrigerator to remove, the moisture will build up on the interior of the refrigerator. Moisture (in the form of frost or ice) can also build up in the freezer compartment [3].

1. Initial start-up: When the freezer is switched on after being shut down for a period time, moisture builds up in the freezer.
2. Frequent door openings: Opening doors frequently causes the warm air outside the freezer interact with the cold air inside the freezer and cause condensation.
3. Doors not closing completely: When the doors are not closed properly, it leads to condensation inside the freezer since there will be a temperature difference between the interior of freezer and outside environment.

III. PROPOSED SYSTEM

IV. Figure 3.1: Block Diagram



To detect the condensation in the freezer there is a need for a temperature sensor to be placed into the refrigerator/freezer. The sensor used in this system is Thermocouple Sensor. This Thermocouple sensor is very sensitive to even small changes in temperature since it has the property of linearity between temperature and electric voltage produced. The thermo coupler tip is placed inside the freezer which is interfaced with the Microcontroller. An optimum value is set by observing the temperature at which the condensation takes place. Now, once the optimum value is reached, the microcontroller raises the alarm or it can also be used to send messages using a GSM to the person concerned. The optimum value is also set where the food spoilage occurs and a message is sent to the person concerned.

The advantages of this system are low cost system and low power consumption.

This system has its applications in various fields like Chemical Industries - Medicines, Drugs spoilage detection, and Household Purpose – Food spoilage detection, Microbiological Laboratories – Enzyme spoilage detection.

III. HARDWARE

Hardware required for this system is less and it makes the product very low cost and low power consumption system. The main hardware involved in this system are:

1. Thermocouple.
2. MSP430G553 Microcontroller.
3. GSM Module.

The thermocouple is interfaced with microcontroller and temperature is sensed with other end of thermocouple, if the temperature reaches the optimum levels of food spoilage or condensation, then a message is sent by using GSM module interfaced with the microcontroller.

Thermocouple: A thermocouple is a sensor which is used to measure temperature as high as 1250 centigrade & as low as -250 centigrade based on a “Seebeck effect”. In 1821 Thomas Johann Seebeck proposed that when two wires of different materials are joined at their ends then a voltage is developed at the opposite end which is proportional to the change in temperature [4].

There are different types of thermocouples namely:

1. Type B
2. Type E
3. Type J
4. Type K
5. Type N
6. Type R
7. Type S
8. Type T

Each type of thermocouple has its own properties and among all of thermocouples the Type K thermocouple shows the linearity property.

Microcontroller: As the system doesn't have much of interfacing, it's better to use a low power and efficient microcontrollers like MSP430G2x53 [5] which hails from the family of Texas Instruments. It has inbuilt Analog to Digital (A to D) and Digital to Analog (D to A) converters avoiding the extra use of hardware for conversion. It provides the option for serial communication. The MSP430 series provides pulse width modulation pins which are very useful for speed control applications.

GSM Module: GSM stands for Global System for Mobile Communication. It uses a mobile operator and acts as a mobile phone. It's a wireless system [6] and mainly used for sending messages. GSM Module consists of a SIM card slot and thus a communication is established..

IV. SOFTWARE

As the Microcontroller is used from the family of Texas Instruments, it requires a coding platform to control the peripherals. Such coding platform is provided by the Texas Instruments by the name “Energia”. The required coding is done on this platform and that is dumped into controller using the same coding platform. Energia platform provides inbuilt serial monitor where serial communication outputs can be checked even before proceeding to actual hardware. The platform provides codes for many simple interfaces which can be used for many basic applications and can be modified according to the requirement.

V. FUTURE SCOPE

The present system concentrates on detecting the condensation and indicating it to the person concerned through a message. But instead of that, this system can be extended as an automatic system which will itself looks into condensation and then controls it.

VI. CONCLUSION

We are developing an industrial and household based application. We aim to provide a low cost, efficient & automatic system which avoids the spoilage of food and chemicals, thus saving a lot of money for the industry and laboratories.

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