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"Multipurpose Peltier Module Base Cooling Box Using Solar"

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Abstract:

Now a days when whole world facing challenges due to COVID-19 viruse to prevent from it scientists made some vaccines and that vaccines required cold conditions to store. So that we made a mini portable cooling box which helps to carry that vaccines to the remote places where conventional cooling system may not be reach. Solar cooling box using thermoelectric module is going to be one of the most cost effective, clean and environment friendly system. This paper does not need any kind of refrigerant and mechanical device like compressor, prime mover, etc for its operation. The main purpose of this project is to provide refrigeration to the remote areas where power supply is not possible.

Keywords: Peltier plate, Temperature sensor, battery,solar panel

I. INTRODUCTION:

For recent scenario It seen that CORONA virus created a pendamic situationb which taking lifes of many peoples. To overcome this situation scitists from various countries developed a vaccine which saves lifes. Government of various countries taken a charge to circulate this vaccine to all the peoples of the their country.

Government of india developed two vaccines called COVISHEILD & COVAXIN. It is necessary to store it in cold condition. So that we put them in cooling box which are gets cool with the help of Peltier plate and that temperature is gets maintained by temperature sensor which is programmed with the Arduino Nano such that if the required temperature is getting change then circuit activate and cool the system so that we can safely store our vaccines in there.

II. OBJECTIVE:

The overall short term aim was to develop a small, inexpensive and compact coolerbox using a thermoelectric cooling heat exchanger.

1. To maintain the temperature of cooling box.

2. To maintain the temperature of vaccines stored in it.

3. To make use of environmentally friendly refrigeration system.

4. To study the results coming out from this project.

5. To compare results with theoretical result.

LESS SPACE REQUIRED: Now days, most of the people install solar panel on their roof top and they get more Space. So, instead of this we are installing solar panel on windows and getting less space.

GENERATION OF ELECTRICITY: With the help of waste heat which falls on window we are generating electricity by using solar panel.

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GREEN TECHNOLOGY: Solar power is pollution free and causes no greenhouse gasses to be emitted after installation. It will not create noise and wear and tear will be minimized.It does not required fuel to generate electricity so it does not produce waste and therefore, there will be no pollution issue.

III. METHODOLOGY& SYSTEM DEVELOPMENT

The design of the inside volume of the prototype is of dimension 12.6*7.1*11.8 which was based on a manufacturer's datasheet that mainly manufactures vaccine storage that uses cold packs to maintain the inside temperature using arduinouno controller. The cooling effect is done by the peltier plate. When we provide 12V dc supply to the peltier plate then one side goes to cold temperature and other goes heat up that use cooling fan with heatsink.
The aim is to maintain the temperature of the box and turn ON off the peltier plate to save power

HARDWARE USE

- Peltierplate
- Arduino nano
- LCD
- Charge circuit
- Solar panel
- Relay
- DHT11
- Battery
- Heatsink and fan

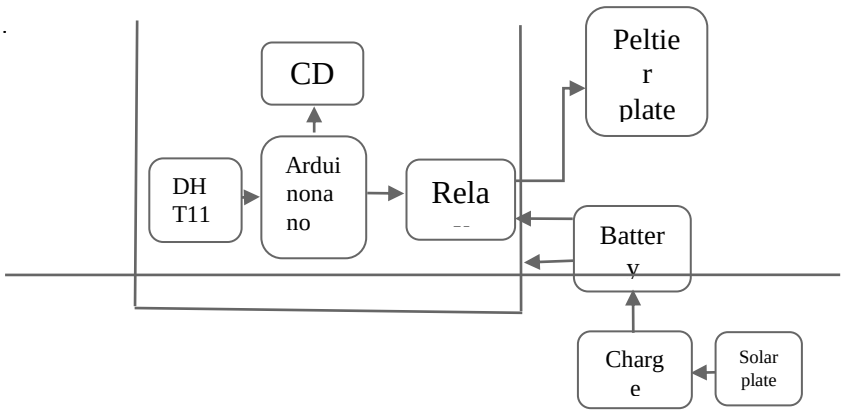

Fig. Block Diagram

IV. Working:

A 5w Solar panel having rating of 12v , 450mA output from sunlight is used to store energy in the Battery.
The power supply to the Arduino and peltier plate is given through 12v Battery .A12v ,1.2AH Battery which is rechargeable is used to fed the power supply to all the equipment which are connected to each other.
Arduino nano is a microcontroller board .microcontroller used in arduino nano is AT mega 328 it has 12 digital pins starting from D2 to D13 and it also has 8 analog pins starting from A0 to A7. This digital and analog pins are assigned with multiple function but the main function is to act as a either input or output .Arduino nano can performs 3 types of communication protocols which are 1)

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serial protocol ,2)SPI protocol, 3)I2c protocol.

Arduino is the central controller and (Digital Humidity Temprature) DHT11 sensor send signal to read the temperature and gives command from arduino nano .we set in program if the temperature is above 5 degree then relay will trigger and peltier plate turns ON.

Single pole double throw (SPDT) 5v dc operated relay is used for switch ON and OFF power to the peltier plate. It has two poles and connected two loads.

The voltage is applied across a joint conductors of peltier plate to create an electric current. When the current flows through the junction of two conductors heat is removed at one junction and cooling occurs at another junction (i.e cooling occurs inside the box).

A 12v dc operated fan is used to extract the heat from heat sink and make air to pass from it to cool the heat sink.

A 16 character , 2 line liquid crystal display (LCD) is used for measuring the temperature .

V. RESULTS:

We achieved this temperature which are required to store the vaccines of different different temperatures ranges.

Sr. No	**Vaccine (s)**	**Vaccine storage temperature**
1.	Covidshild	2°C - 8 °C (35°F - 46°F)
2.	Polio	2°C - 8 °C
3.	Diphtheria,tetanus,pertussis-containing vaccines (DTap,DT,Tdap,Td)	(35°F - 46°F) (2°C - 8°C)
4.	Hepatitis A	2°C - 8 °C (35°F-46°F)
5.	Hepatitis B	2°C - 8°C (35°F-46°F)
6.	Influenza (LAIV)	2°C - 8 °C (35°F-46°F)
7.	Influenza(TIV)	2°C - 8°C (35°F-46°F)
8.	Meningococcal (MCV4-Menactra)	2°C - 8°C (35°F-46°F)
9.	Meningococcal (MCV4-Menveo)	2°C - 8°C (35°F-46°F)
10.	Polio vaccine	2°C - 8°C (35°F-46°F)
11.	Insuline	2°C - 8°C (35°F-46°F)

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12.	TT(tetanus toxoid)	2°C - 8°C (35°F-46°F)

Conclusions:

Multiple prototypes were designed and fabricated and each was able to reach and continuously provide a storage and ideal storage temperature ranging from 22°C to 27°C. When subjected to a conditioned area, it obtained a lowest temperature of 20o C.
We have been successful in designing a system that fulfils the proposed goals. However we do realize the limitations of this system. The present design can be used only for maintaining a particular temperature. The system is unable to handle fluctuations in load. Extensive modifications need to be incorporated before it can be released for efficient field use. Thermoelectric refrigeration is one of the key areas where researchers have a keen interest. Some of the recent advancements in the area surpass some of the inherent demerits like adverse COP. Cascaded module architecture has defined new limits for its application. Moreover recent breakthrough in organic molecules as a thermoelectric material promises a bright future for TER. With more and more countries showing interest in Montreal and Kyoto protocol, TER is gaining more attention as an affordable, reliable and a green refrigeration alternative.

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