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Fabrication Of Air Conditioning System Through Peltier Principle By Using IOT Concept

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ABSTRACT :

The interior of parked cars can get dangerously hot during the sweltering summer months, which can be uncomfortable and pose health concerns to drivers when they reenter the vehicle. By employing an experimental thermoelectric cooling system that makes use of the Peltier effect, this project offers a creative way to deal with this problem. As a solid-state active heat pump, the Peltier cooler effectively moves heat from one side of the vehicle to the other, giving the driver a way to regulate the temperature within the vehicle. When the interior temperature rises beyond a certain threshold during parking hours, the suggested system is intended to automatically operate. By integrating a microcontroller, this temperature regulation is accomplished, guaranteeing ideal cooling without sacrificing power efficiency. Additionally, real-time temperature monitoring of the vehicle's interior is made possible by the use of Internet of Things (IOT) technology. Through a specialized website or mobile application, users can easily access this information. With the help of the Internet of Things, the thermoelectric cooling system can be remotely controlled, offering a practical way to turn on or off the cooling process in response to temperature readings.

Keywords: IOT, Microcontroller, TEC, KEIL Software, PELTIER

1. Introduction :

Due to the growing demand for refrigeration in the fields of refrigeration air conditioning, food preservation, vaccine storage, medical services, and electronic device cooling, more electricity was produced globally, which increased CO2 emissions and contributed to climate change. Because it can turn waste electricity into useful cooling, thermoelectric refrigeration is a novel solution that is anticipated to be crucial in addressing today's energy concerns.

Thermoelectric refrigeration is therefore desperately needed, especially in underdeveloped nations where long lifespan and minimal maintenance are required. When a solar panel charger is added for battery charging in situations where the electrical power source is unstable. Thus, a thermoelectric module uses two permanent junctions, one of which gets hot and the other cold when electrical energy is applied.

As a type of solid-state refrigeration, thermoelectric cooling has the benefits of durability and compactness. With the exception of a few fans, it has no moving components, no fluids, and doesn't need the large pipes and mechanical compressors found in vapour-cycle cooling systems. In some circumstances, its durability makes thermoelectric cooling preferable to traditional refrigeration. Conventional refrigeration is not an option because of the design's portability and requirements for small size and weight.

Peltier plates are being used in the design and optimization of the AC system. In place of the evaporator unit from the current AC system, we are installing the Peltier plates, heat sink, and cooling tank. Plaiter plates with two faces or surfaces one of which cools and the other of which rejects heat are used in the Peltier effect. In order to reject heat energy into the environment, we are removing cooling energy from the paltrier. We included a water tank, heat sink, and Peltier plates in the design of the Peltier unit. Peltier cooling is absorbed by the heat sink, and air is permitted to flow from these fins/heat sinks. We will experience a cooling impact when the air cools. Likewise, we must continue to maintain the Peltier's heating side. We are permitting the water to flow through these heated heat sink side fins. Pumping is used to circulate this water, and heat exchange, or a low-temperature radiator (LTR), rejects the heat.

2. Peltier methodology :

The Peltier effect is used in thermoelectric cooling to create a heat flux at the interface of two different types of materials. Depending on the current direction, a Peltier cooler, heater, or thermoelectric device can be a solid-state active device that uses electrical energy to move heat from one side of the device to the other. This type of equipment is also known as a thermoelectric cooler (TEC), solid state refrigerator, Peltier apparatus, or Peltier device. Both heating and cooling are common uses for them [1], however cooling is really the most common usage. It can also be used as a temperature controller to regulate the temperature.

Compared to vapor-compression refrigeration, this method is used for refrigeration far less frequently. The main benefits of a Peltier cooler over a vapor compression refrigerator are its extended lifespan, invulnerability to leaks, compact size, flexible shape, and absence of moving parts or flowing liquid. Poor power efficiency and high cost for a given cooling capacity are its primary drawbacks. Numerous companies and researchers are working to create affordable and effective Peltier coolers. (See materials that are thermoelectric.) Another application for a Peltier cooler is as a thermoelectric generator. A voltage is delivered across the device when it is used as a cooler, which causes a temperature differential to develop between the two sides. When the device is used as a generator, one side of it is heated to a higher temperature than the other, which causes a voltage differential to develop between the two sides (the Seebeck effect). However, due to various design and packaging requirements, a well-designed Peltier cooler is becoming a mediocre thermoelectric generator, and vice versa.

3. Hardware accessories detail :

3.1 hardware requirement

1. Atmega 328p
2. Temperature Sensor DS1812b
3. Esp 8266 IOT
4. Power Supply
5. TEC 12706
6. 3.3v Regulator

3.2 Software requirement

1. Arduino IDE 8.2
2. Atmel Studio -8
3. Multisim for circuit design
4. Flasher for microcontroller programming

3.3 Block diagram

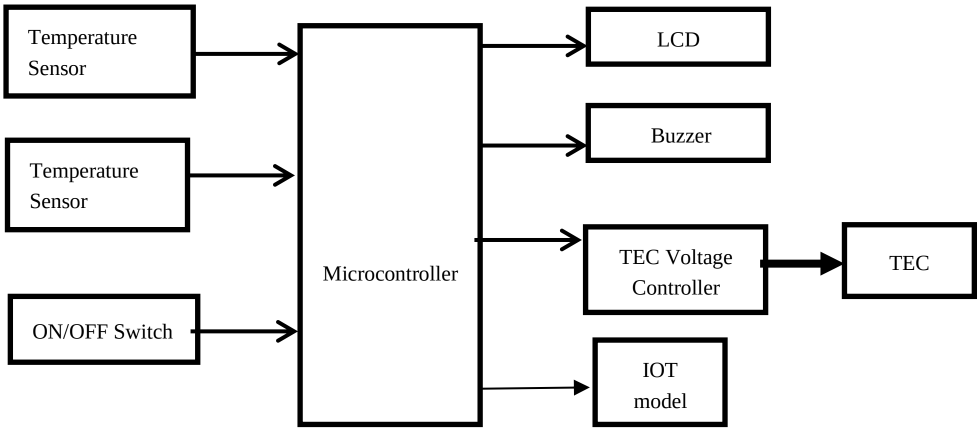

Figure: 1 Block Diagram

4. Basic of IOT :

Simply said, the Internet of Things is "A network of Internet connected objects able to collect and exchange data." It is frequently shortened to IOT. The two primary components of the term "Internet of Things" are "things," which refer to objects or devices, and "internet," which is the foundation of connectivity. All web-enabled devices that use embedded sensors, processors, and communication hardware to gather, transmit, and act upon data they obtain from their surroundings make up the Internet of Things (IOT), also known as the Internet of Everything (IOE).

The ever-expanding network of physical items with IP addresses for internet access and the communication that takes place between these objects and other Internet-enabled systems and devices is known as the Internet of Things (IOT). Applications that monitor, manage, and control linked devices can be deployed thanks to the Internet of Things platform, which is made up of a number of components. Gathering data remotely from linked devices. Devices can connect independently and securely. Management of sensors and devices. The term "Internet of Everything" (IoE) refers to a more sophisticated system that includes people and processes, building on the Internet of Things' (IOT) focus on machine-to-machine (M2M) connections. Physical devices, automobiles (also known as "connected devices" or "smart devices"), buildings, and other objects that are embedded with electronics, software, sensors, actuators, and network connectivity that allow them to gather data are all part of the Internet of Things, or IOT. The cloud, or the processing of data on web-connected servers in massive data centers, has also played a significant role in enabling commonplace devices to join the Internet of Things.

4.1 Local communication method

These gadgets could use a local communication technique to connect to the Internet by delivering data to your phone or other specific hardware in your house that serves as a hub, like:

1. Bluetooth
2. Bluetooth LE (low energy)
3. 6LowPan
4. IEEE 802.15.4
5. NFC (near-field communication)
6. ZigBee
7. Z-wave

The IOT ecosystem offers business applications in a variety of industries, including retail, medical/preventive healthcare, factory/assembly line automation, home automation, and more, as the visionaries have recognized.

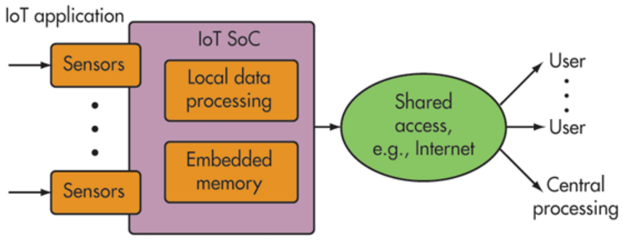

Figure: 2 IOT with Sensor module

Data is output in a digital format by the digital sensor. Some data processing tasks, such as calibration, may already be handled by it. Additionally, it might use sensor fusion techniques, which involve integrating multiple sensors to extract useful data, such as motion detection. Raw data in analog format is output by the analog sensor. The output of a wide variety of analog sensors, including temperature sensors, is provided in the analog domain. For processing, the application SOC must gather the output in its unprocessed state and transform it into a digital representation.

The IOT SOC must have a digital interface that is compatible with the one used by the sensor chip to transmit sensor signals to the SOC's CPU when it connects to a digital sensor device. The IOT SOC must use an analog-to-digital converter (ADC) to transform the sensor signal into the digital domain when connecting to an analog sensor. Now that everyone is aware of the Internet of Things, it would be beneficial to delve deeper to familiarize oneself with its fundamental components:

1.) Sensors and sensor technology: These will sniff a wide range of data, including location, weather and environmental conditions, grid characteristics, movement on manufacturing lines, jet engine maintenance data, and a patient's vital health information.

2.) IOT Gateways: As the name implies, IOT gateways serve as the entry points to the internet for any objects or gadgets with which we wish to communicate. Gateways facilitate communication between the external Internets or World Wide Web and the inside network of sensor nodes. They accomplish this by gathering information from sensor nodes and sending it to the internet's backbone.

3.) Cloud/server infrastructure & Big Data: The cloud infrastructure uses a Big Data analytics engine to securely store and process the data that is sent through the gateway. All of our gadgets are now "Smart Devices" thanks to the clever actions taken with the help of this processed data!

4.) End-user mobile apps: These user-friendly apps will enable end users to remotely manage and monitor various systems, from assembly lines and aircraft engines to room thermostats. These apps assist in sending commands to your smart gadgets and transmit critical information to your handheld devices!

5.) IPv6: The foundation of the whole Internet of Things ecosystem is IP addresses. IP addresses are all that the internet cares about, not whether you're a human or a toaster. We were running low on IPv4 addresses, but thanks to IPv6 (which was introduced in 2012), we now have 3.4*10^38!

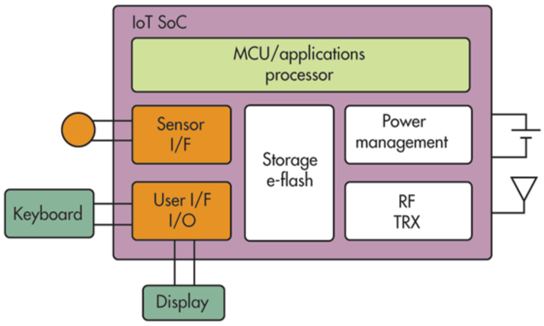

Figure: 3 IOT SOC

1.2 Connected of wifi port with microcontroller general layout

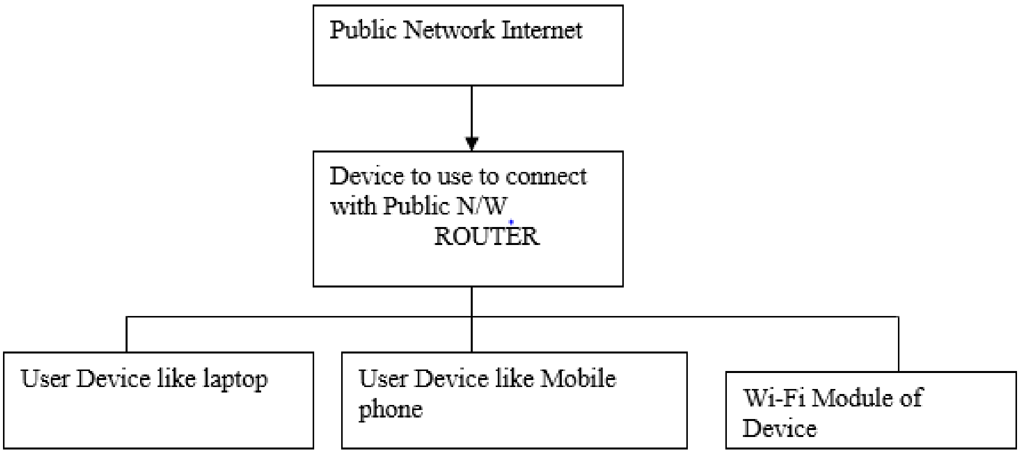

Figure: 4 Connection Direction of WiFi

Circuit diagram and working principle :

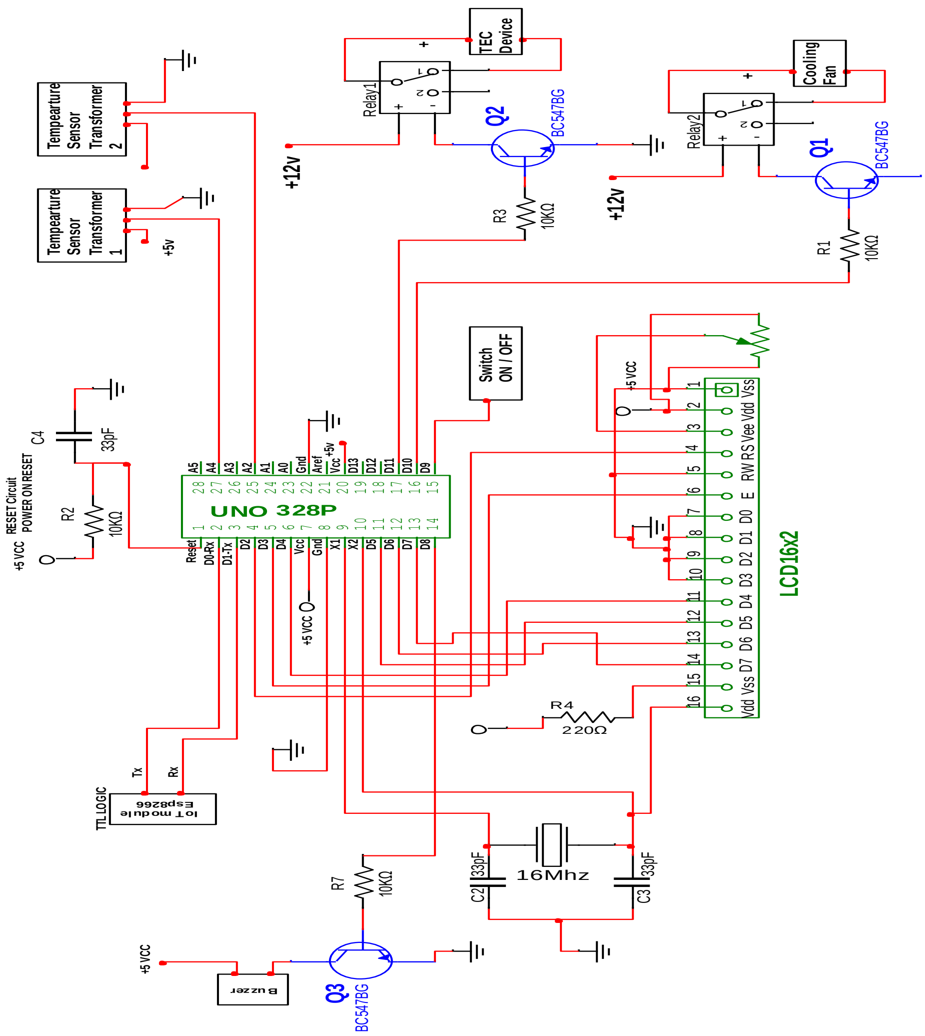

Figure: 5 Circuit Diagram

5.1 Working principle

The suggested thermoelectric cooling system uses cutting-edge technology to effectively control an automobile's interior temperature while adjusting to the outside climate. The technology continuously analyzes the surroundings thanks to temperature sensors installed both inside and outside the car. The thermoelectric cooling (TEC) system is triggered when the car's internal temperature increases and the outside temperature rises, indicating a hot day. By actively absorbing heat from the inside using the Peltier effect, this TEC system keeps temperatures from becoming dangerously high or uncomfortable.

Additionally, the system tackles issues unique to the wet season. The TEC system is purposefully used when internal temperatures rise above ambient temperatures and cause vapor to develop on interior glass surfaces. The device effectively reduces and eliminates condensation by detecting and reacting to the presence of vapor by starting a heating process around impacted areas. In inclement weather, the TEC system's dual functioning guarantees both temperature control and unobstructed vision.

A microcontroller, which serves as the decision-making center of an intelligent system, coordinates the entire procedure according to preset standards. Furthermore, the use of Internet of Things (IOT) technology enables users to remotely monitor and operate the system via an intuitive mobile application or web page. This intelligent system provides a complete solution to improve driving safety and comfort while dynamically adjusting to changing weather patterns and seasonal obstacles.

6. Software tools :

The software used in this project is given below

1. IDE
2. PROTEUS
3. IC PROG
4. KEIL Development Tool

7. Conclusion :

Because it uses the Peltier module, which is not accountable for Ozone Layer Depletion, this system is environmentally beneficial. Technically speaking, we can therefore conclude that a larger COP can be achieved at low power input, which lowers the rate of energy consumption. In comparison to the air conditioner, it provides the following benefits: The main benefits of a Peltier cooler over a vapor-compression refrigerator are its small size, flexible shape, extended lifespan, invulnerability to leaks, and absence of moving parts or flowing liquid. Eco-friendly and reasonably priced. Safety since no gas is utilized. The system managed to maintain the ambient temperature with satisfactory results. Air was brought into the cooling chamber using the air recirculation method, passed over the cooling fins, where its temperature decreased, and then recirculated into the cabin using blower fans. Conversely, the cooling fans maintain the Peltier module's operational temperature by forcing air onto the heat sink. To attain optimal cooling, the system used a thermoelectric cooling unit. The system's efficiency, including all accessories, is between 80 and 85 percent. This system is powered by batteries. Therefore, none of the car's electric components are under anystress.

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