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Intelligent Cold Climate Glove

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Abstract: *The environment is affected by the varying climatic conditions from time to time. Extreme temperatures can be quite harmful to your health. Serious health problems are caused by prolonged exposure to heat and by keeping the body at an extreme temperature. Heat stroke is the most dangerous issue in an excessively hot climate. The risk of hypothermia or hazardous overcooling of the body is the most important issue at very low temperatures. These strange weather patterns can occasionally result in tragic deaths of individuals. In order to provide better protection to those who live in harsh weather conditions, the "Intelligent Cold Climate Glove" design was created. The ideal temperature is maintained inside this glove. Particularly for our soldiers serving in harsh weather, the Smart-Glove is incredibly helpful. By using the heating pad with this technology, the user may regulate and keep an eye on their internal body temperature. This glove also has a Bluetooth module as an added feature for monitoring body temperature as well as the humidity and temperature of the surrounding area. The user can also keep an eye on the data using an Android app connected via Bluetooth and an OLED display. When the temperature reaches the threshold value, the heating pad is automatically turned on to give the appropriate temperature, and when the temperature surpasses the threshold value, the threshold value is automatically turned off.*

Keywords: Arduino Nano, IOT, DS18B20, DHT11, Heating pad

I. INTRODUCTION

People find today's weather to be quite bothersome and odd. Temperature-related disorders including heat stroke, heat rash, frostbite, dehydration, hypothermia, etc. have plagued people throughout history, and there is no way to avoid them. The climate-adaptable glove is a highly useful product. Some technical solutions created to keep people thermally comfortable in their homes, cars, and other places can aid individuals, but not in situations requiring personal mobility. Naturally, this glove can maintain the precise temperature inside.

The most valuable resource in our nation is its army. They are extremely important in defending the nation and its people. All of the armed forces Army, Air Force, Navy, and Marines are considered soldiers. They are constantly prepared to accept and perform their duties in adverse weather, whether it be a chilly or hot environment throughout the year. In these harsh weather conditions, they may have difficulties in ensuring the safety of the country.

The climatic conditions vary from region to region. People find today's weather to be quite bothersome and odd. Temperature-related disorders including heat stroke, heat rash, frostbite, dehydration, hypothermia, etc. have plagued people throughout history, and there is no way to avoid them. Unfortunate deaths of persons have been caused by some of these illnesses. Some technical solutions designed to keep people thermally comfortable, like air conditioning equipment, are most effective when used by people in their homes, cars, and other stationary environments but not while they are moving around on their own. Climate-adaptive gloves are a very useful product if one wants to move in these types of climatic circumstances. This glove can naturally maintain this specific temperature inside the glove, and because of its design, it provides superior protection for troops and navy personnel working in harsh weather conditions by lowering the temperature.

II. LITERATURE SURVEY

Swetha K *et.,al*[1] "Weather Sensible Smart Adaptable Jacket" they described a novel method for determining body temperature and ambient variables, which displays on LCD modules and mobile screens using Wi-Fi modules. In turn, the heater and cooler will assist the user in creating warming or cooling effects inside the jacket. This jacket serves as a

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guard and makes it possible for employees to operate comfortably in all weather and against temperature changes. This project's limitation is that carrying a jacket might be difficult.

Bhuvaneshwari *et.,al*[2] "Smart Army Jacket" in this article, information input technologies and methods connected to information entry into electronic systems that would be appropriate for smart clothing were taken into consideration. An overview of current advancements in the field of flexible switches is given, outlining the methods utilised to create these connections as well as the obstacles and difficulties that come with them. The purpose of the smart army jacket is to keep soldiers safe by tracking their whereabouts and their immediate surroundings.

Sonali Kavitake *et.,al*[3] "E-Jacket" in this study, the peltier effect is used to allow the wearer of the jacket to regulate and track the interior temperature. To track the soldier's whereabouts, this jacket also has GPS and GSM units. Arduino Lilypad serves as the central controller for all of these gadgets. This project's limitations include slow cooling and insufficient power sources.

S. AnnapurnaDevi *et.,al*[4] "Adaptable Jacket Based on Climate Conditions Using ARM Microcontroller" here, the jacket can maintain the internal temperature naturally, but in order to lower the temperature, it activates the fan that is installed inside the jacket. The design of this garment provides military and navy personnel working in adverse weather conditions with improved protection. With the aid of the thermoelectric effect, this jacket enables the user to regulate and keep an eye on the interior temperature of the garment from hot to low temperatures, and it shows the results in both GPS and GSM Modules.

M. Sivalingamaiah *et.,al*[5] "solar based E-uniform for soldiers-Used for temperature control and tracking" here, in this research report, the soldiers operating in inclement weather are better protected. Solar panels deplete the circuitry of the E-internal uniform. A 12 V DC lead acid rechargeable battery is used to store the energy. Additionally, they employ a standard battery changing machine to supply the circuits. This outfit is primarily used for military purposes and may be worn in any climate.

Gregory Paul *et.,al*[6] "Battery powered heating and cooling jacket" the proposed system in this research study includes a battery-operated heating/cooling suit that is controlled by thermoelectric devices. The circuit is made with an ATmega16 microcontroller, a 12 volt alkaline battery, and an LM34 temperature sensor, but it is not suitable for wearing devices or for carrying things around conveniently.

K M Nizar Ahammed *et.,al*[7] "Thermoelectric cooling prototype" this research paper details the construction of a jacket and an original evaporative heat sink. a switch to regulate the circuit's current flow, which in turn regulates the heat capacity of the module. The performance of the prototype jacket was evaluated using analytical and computational methods. Ansys 9.0 was used to do the numerical analysis.

Faming Wang et.,al[8] "a review of technology of personal heating garments" new fibre and electronic technology allows for the production of smart clothes that can help users manage under specific settings by improving the functionality of conventional clothing. The personal heating garment (PHG) broadens the operating temperature range of the garment and improves its level of cold protection. It describes four different types of personal heating garments and enumerates the advantages and disadvantages of each. Finally, some concerns and suggestions for improving personal heating clothing are discussed.

Bao-guoYao *et.,al*[9] "Protective thermo-physiological clothing integrated with intelligent control and wireless measurement" Artificial intelligence heat control and body physiological monitoring were applied in the research effort. They used a computer-controlled climate room, an infrared camera to capture thermal images, and wireless temperature and humidity readings as their three primary experimental protocols. The system loss has increased, and the unwashable product has presented significant challenges.

A thorough analysis of numerous research papers and publications helped to clarify that some systems have slow cooling, little available power, and are difficult to transport. Some models also use GPS & GSM modules to track the soldier's whereabouts. The survey aids in understanding the issues with current weather gear.

III. PROPOSED SYSTEM

Create an adaptive heating system to maintain a normal temperature of 30 degrees Celsius inside the glove. This system will be able to monitor the wearer's temperature and provide a solution to issues like hypothermia, shivering strokes, etc. It will also develop a heating system that will continuously monitor the temperature of the room and the outside air. The

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heating and monitoring systems that make up this project. Heat is produced via a heating system, and a monitoring system measure and shows the temperature. These two systems are combined on a single board.

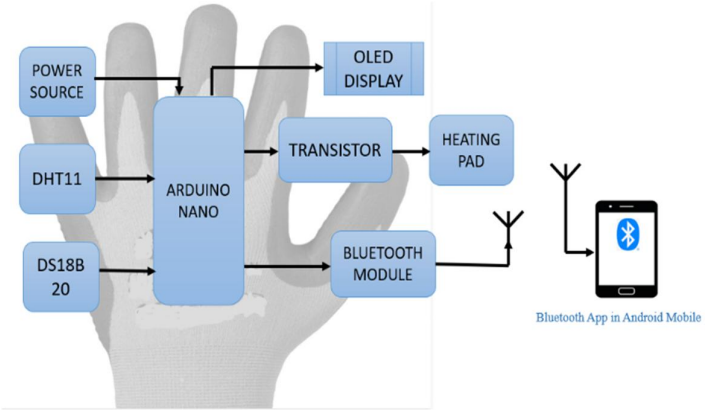

Fig. 1. Block diagram of a proposed model

Figure 1 depicts the block diagram for the intelligent cold climate glove. In order to monitor temperature information, the Arduino nano may be a microcontroller board that is connected to a temperature sensor and Bluetooth module. The ground and voltage pins are connected to a number of locations on the Arduino board because the temperature sensor analogue pin is connected to the analogue pin of the Arduino board. Only four of the six pins on the Bluetooth module were connected to the Arduino board in order to relay the temperature information to a mobile device.

This Arduino board is incredibly small, portable, and simple to programme for Bluetooth module and temperature sensor operations. There are three pins on the DS18B20 temperature sensor: ground, analogue, and voltage. When power is applied, the Arduino nano board's pins sense the temperature and show it in the user-developed application. It is primarily controlled by the Arduino programming language and helps the user by providing precise temperature information. The output voltage of the DS18B20 is inversely proportional to the Celsius temperature.

In this project, the Bluetooth module HC-05 aids in data transfer from the hardware component to the user-developed mobile application. The user just connects the mobile application to the Bluetooth device to facilitate data transfer. Only four of the six pins were connected to the Arduino mini module. The Arduino's transmitter and receiver are attached, respectively, to the pins for the receiver and transmitter. Next, the Arduino ground pin and 5v pin are connected to the power supply pins and the ground pin, respectively. By communicating with the user-developed application, this Bluetooth module plays a significant part in this project.

The DHT11 Sensor, which provides data on the outside temperature and humidity, allows us to modify the heating temperature of the coils inside the glove. way we can protect ourselves against the conditions of the environment. The microprocessor Arduino Nano automatically turns off the heating pad to prevent harm to the body when the temperature reaches the saturation value. To prevent excessive heating, temperature sensors were also inserted within the gloves to monitor wearers body temperatures.

We have interfaced the OLED display to allow the user to examine the information and see the sensor values and project functioning and all connections. MIT App Inventor is used in the simultaneous development of an android app that communicates these values. The device is able to read sensor data from a distance, enabling Bluetooth communication to monitor a number of wearer factors. Here, several sensors and modules were built into a glove. Consequently, it will be beneficial for preventing the issues that army personnel might encounter.

IV. SOFTWARE IMPLEMENTATION

The following is how the microcontroller programming is done. The microcontroller and organic light emitting diode display are initialised at the beginning of the code. The DS18B20 sensor's input pin is checked by the codes main loop for binary temperature information. The binary temperature data is transformed into decimal form. The stored temperature is first sent to the OLED module for display before the DS18B20 sensor determines the gloves interior temperature. If the body temperature is less than 33 degrees, the heating pad begins to heat constantly up to 33 degrees, and if the body temperature is greater than 33 degrees, the heating pad does not switch on, where the DHT11 temperature sensor measures

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the outside temperature. On OLED, both the heating pad state and the body inner and outside temperatures will be shown at once. This cycle repeats until the 33 °C threshold temperature is reached is as shown in the figure 2. Using the Bluetooth module HC-05, the OLED and mobile device both display the information simultaneously

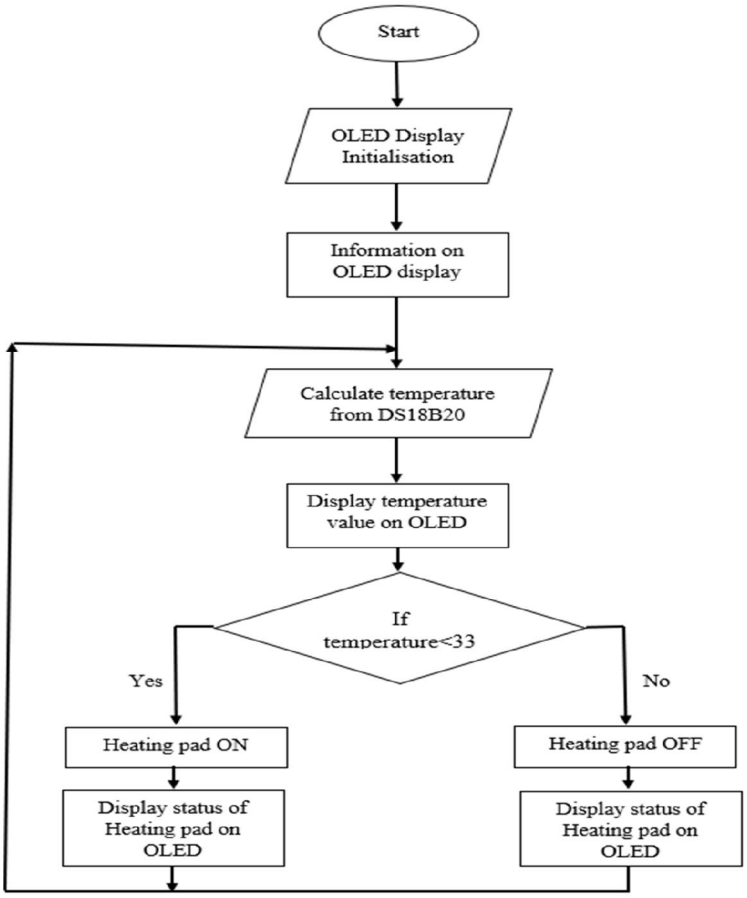

Fig. 2. Flowchart of the proposed model

V. ADVANTAGES/APPLICATIONS

Benefits of this system include its ability to automatically regulate body temperature in cold climates, promotion of physical health, improvement of blood circulation, and potential reduction of exercise-induced muscular discomfort through the use of alternating heat. The project's drawback is its high energy consumption.

This project helps to maintain the health and wellbeing of soldiers who are working in extremely cold weather conditions by allowing them to manage appliances with a smart glove.

VI. RESULTS AND DISCUSSION

The results of the intelligent cold climate glove implementation are depicted in figure 3. The wiring of the module and the Arduino Nano module were connected by means of the connections. The software was created using the Arduino IDE once the electrical connections and wires were put together. Each module's source code was created individually, and it was attempted to calibrate them. The relevant variables in each code segment were given their ideal values. Three lines of text can fit on the OLED panel using a unique set of characters. The temperature and humidity sensor, along with the Arduino development board and battery, will be inserted within the glove in order to measure the parameters as closely as possible to the body.

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Fig. 3. Output of the proposed model

Fig. 4. Temperature readings following Bluetooth connection

Duration in seconds	DHT11		DS18B20	Maximum temperature in °C
	Temperature in °C	Humidity in %	Glove temperature in °C	
0	28.20	69	31.50	33
30	28.60	69	31.94	
60	29.10	68	32.31	
90	29.50	68	32.63	
120	29.70	67	32.80	
150	29.90	66	33	

Fig. 5. Results of the implementation of the system

In this project, the heating pad serves as the primary source of the heat that creates the thermal gloves. This heating pad is positioned between the clothing and is heated by a circuit. As soon as the user click the app, he/she is supposed to enter the username as admin and password as 12345 and click on submit and a screen will appear displaying outside temperature and humidity from DHT11 sensor and inside glove temperature from DS18B20 sensor. Since the heating pad has a unique heating analysis value, the circuit can be used to monitor and recorded the values in the figure 5. The main component of this project is the mobile application. This application needs to be connected to the mobile Bluetooth option before it can start, and the temperatures shown in the application.

As a result of the hardware connection to the temperature sensor, the outside and glove temperature will be automatically determined and presented in the applications temperature choice as determined in figure 4. Once the maximum temperatures have been chosen as 33°C, the circuit is turned on, and the heating pad is heated using a transistor connection. The transistor in the circuit will be used to trigger the voltage, and it will also be heated to a range of maximum temperatures. When heat is required, the user can switch it frequently. In addition, the user can disable Bluetooth by choosing to disconnect from the device, which will prevent the application from running the circuit

VII. CONCLUSION

The "intelligent cold environment glove" project will have the ability to monitor the temperature in a mobile device with the aid of circuit design while simultaneously monitoring the temperature in cold settings utilising a heating pad and temperature sensor. This system is small in size and simple to operate. It is also lightweight and simple to operate. The electrical components are removable, and the glove can be utilised to provide warmth for soldiers or other people in frigid climates. People who are exposed to extremely low temperatures run the risk of developing frostbite, hypothermia, insect bites, shivering, and other health problems. These issues make the soldiers unable to do their duties in any crucial

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circumstances, thus this can be managed by the glove. This appliance serves as a lifesaving tool and automatically regulates body temperature while activating warmth for comfort.

VIII. FUTURE SCOPE

Future versions of this glove might be easily included into a jacket, making it echo-friendly and powered by a compact, foldable solar panel. The use of solar panels enables continuous power production with minimal maintenance, allowing us to wear this glove throughout the year to protect ourselves from overheating and overcooling in addition to integrating humidity sensors, rain drop sensors, and other components for optimal glove performance.

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