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Helious Helmet

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Abstract : In our daily life safety may be general term, but the study of these in the transportation has been very limited. Worldwide, there are estimated to be approximately one million road accident and fatalities and ten million people injured annually. In India around 20 million two wheelers come up road. Most of the people die in bike accidents due to head injury. This is happens because they don't wear helmet. Riders feel uncomfortable to wear helmet while riding a bike. In this work we will propose a solar based cooling helmet which will definitely attract the bike riders. Here we use solar power to drive all the components. Temperature sensor with cooling system is used to provide cooling effect to the motorcycle rider's head when temperature goes beyond the threshold value. Switch with the air purifier is used to provide purified air. Along with this a USB mobile charging module will help a bike rider to charge his mobile when he is in rest condition.

I. INTRODUCTION

The concern over the safety of motorcyclists has pushed for new invention, not only for the safety, but also comfort of the user. The primary safety feature used by the latters is uncomfortable and dangerous environment to the head, especially for long distance travel in hot conditions and also we have very high number of road accidents and fatalities relating to it, every Indian on the road considers himself special and an expert level driver and believes that he/she does not need a helmet. Another misconception is that, helmet is not required in low speeds. This is not just the case with helmets. When it comes to safety, we never think anything wrong can happen to us. The reason for all this is overconfidence that nothing can happen to them. Another stupid argument is that the traffic speeds in India are low and we do not need all the safety features and accessories. Well, if that was the case we would not be toppers in terms of fatalities in road accidents. We live in a country where the roads are unsafe. Even otherwise, an accident can happen for many reasons, whether it's your fault or not. Wearing a helmet is the sensible thing to do, it decreases the risk and severity of injuries by about 72%, decreases the likelihood of death by up to 39%, with the probability depending on the speed of the motorcycle involved and it also decreases the costs of health care associated with crashes.

This work aims to design and build the helmet with inbuilt cooling fan, cell phone charging, air filtration system, using solar power. We find our self regularly stuck in frustrating traffic jams with summer heat getting to our head, difficult for breathing due to which the user opens the visor there by exposing himself to the air pollution which is at its peak at traffic signal as vehicles tend to release more pollutants during the start of vehicle when the signal is free to move, this helmet is useful at that time. The inbuilt cooling fan can reduce the internal temperature and we can get the cool air to face, so with this rider get comfort riding[6]. This helmet protects against inhalation of hazardous air pollutants on the road, with the help of an air filtration mechanism used in the helmet. It creates pollution free and breathable environment inside the helmet by cleaning the polluted air. Cell phone charging with the solar power, in this feature we can charge the cell phone battery, by using solar power as energy source. Solar device is considered more advantageous than the other alternative because although the motorcyclist stops riding, charging can still proceed by directing the helmet towards the sunlight. Through our environment-friendly solar powered helmet, we aim to make life more comfortable for the bike riders[7]. While designing the product, the focus is to optimize the use of solar energy without compromising on our goal to provide clean breathing air to the bike rider and reducing the temperature inside the helmet.

II. RESEARCH REVIEW

Thermoelectric cooling to provide cool air for the users through solar energy trapped by solar cells placed on the top of the helmet. A fan sucks the hot and polluted air from the outside, and pumps clean and cool air on to the face of the rider. The air first passes through the filters and then through the thermoelectric Peltier cooling unit [5].

Smart Helmet: A Next Generation Solar Gadget by incorporating many features like Thermo electric cooler, Bluetooth enabled headphones, and emergency switch in case of emergency situations and ignition control system; that makes the rider feel comfort, safe and receive calls any time while riding. And even it provides the theft and accident alert messages by implementing GPS and GSM into the vehicle module. Here the important feature ignition controls mechanism that controls the On/Off status of the vehicle engine. Until and unless riders wear the helmet bike engine will not turn ON, that ensures helmet is mandatory. Its design incorporates components like, solar strips, Bluetooth headphones, Thermoelectric cooler, Ignition control switch and RF Transmitter. Solar strips are installed on helmet to power up all the peripherals interfaced into the helmet. When the rider wears the helmet then only the ignition control activates. An emergency switch is used in case of emergency situations to alert the family members/any authorized persons about the disastrous situations [2].

According to the Peltier Effect, at the junction of two dissimilar metals the energy level of conducting electrons is forced to increase or decrease. A decrease in the energy level emits thermal energy, while an increase will absorb thermal energy from its surroundings. The major components of the air conditioned thermoelectric helmet include: circular cavity as outside/inside air channel, Electric fan as a heat extracting device, the peltier module, cooling chamber, heat sink and water as coolant. On the very front side of the helmet two circular ducts are facilitated to introduce the atmospheric air in to the helmet. This air is collected in to the cooling chamber above which the assembly of peltier module and heat sink is placed while in between the riders head and the cooling chamber a pouch filled with water is fixed. The pouch of water not only works as coolant but also does service as spreading media for the cooled air on to the head. The heat sink is used to enhance the rate of heat transfer from the hot surface of the thermoelectric module so that the heat will be discarded outside the helmet. In order to maintain the efficiency of the thermal module, a cooling fan is used to reject the heat from the hot side of the module to ambient surroundings [3].

The development of cooling system for motorcycle helmet using thermoelectric technology system consists mainly of a heat sink and thermoelectric module. When electrical voltage is applied to the thermoelectric module, it will create a temperature difference across the thermoelectric module. This phenomenon is also known as peltier effect, is being used to utilize electricity to pump heat. The prototype had been fabricated and mounted onto a motorcycle helmet. The designed thermoelectric cooled helmet was simulated using the finite element software ANSYS as well as experimentally tested for the cooling purpose. Experiments are conducted on the prototype to analyze the performance of the cooling system. The numerical and experimental results showed a good agreement and indicated that the temperature inside the helmet was reduced from 25.5°C to 19.3°C in approximately 6 min [1].

III. METHODOLOGY

The system will perform the following steps for performing the task .The system is designed such that energy generated by the solar panel is used to charge two lead acid batteries which are connected in parallel. The microcontroller is powered using the lead acid battery by connecting it to the microcontroller's 5v pin and GND. By using the same supply we can drive the charging outlet which acts as a power bank so that we can charge our cell phone. The lead acid battery status is displayed on the LCD in terms of percentage. Temperature sensor senses the temperature inside the helmet. This temperature value is also displayed on the LCD in degree Celsius. After sensing the temperature the work of the sensor is to decide whether to turn on the cooling system or to be kept off. For this a pre-defined temperature value have to be formulated i.e., below a certain threshold value the cooling system have to be turned off and above a threshold value the cooling system have to be turned on. Design of carbon activated and hepa filter helps in purification of air[8].

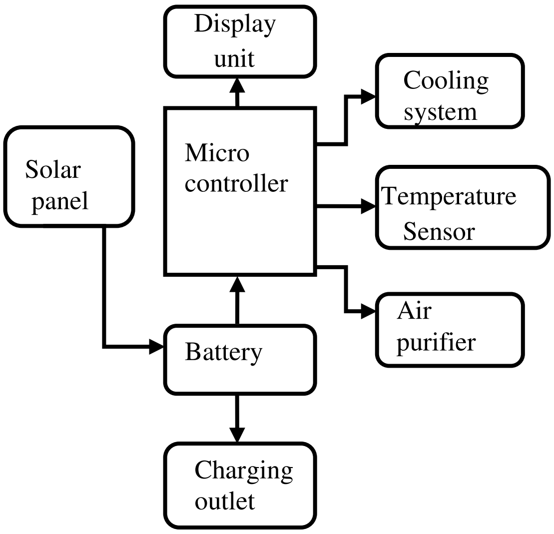

Fig 1: Block diagram of Proposed System

Voltage Regulator circuit

The battery is charged using solar panel of maximum voltage 12v. Since we use two 4v rechargeable batteries in parallel, the output from solar panel has to be controlled to 4v, otherwise the battery may get damaged and also we can't get constant solar power for whole day, there will be fluctuations due to changes in climatic conditions. So we need a circuit which can fix this type of fluctuations. This can be achieved by using LM317T voltage regulator circuit. The regulator takes the energy from the solar panels and converts the voltage to desired value so it's suitable for charging. The input to this regulator circuit is output of the solar panel and output of this regulator is input to the battery.

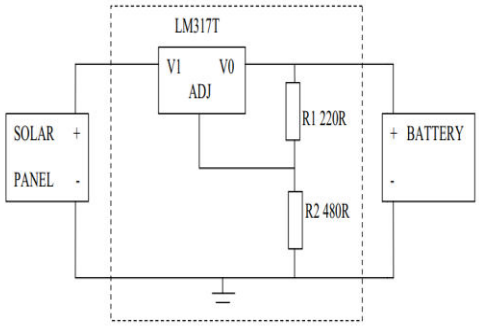

Fig 2**:** Input and output connections of voltage regulator circuit

LCD interfacing with ATMEGA32A AVR microcontroller

16X2 LCD can interface with AVR microcontroller by using two modes, 4-bit mode or 8-bit mode. In this we have used 8-bit mode for interfacing. In 8-bit mode we send command to LCD by using eight data lines (D0-D7) while in 4-bit mode we use four data lines (D5-D7) for sending command and data. These data lines can be connected to any port of Atmega32. The circuit diagram is shown below. The 8 data pins of the LCD are connected to PORTB of the microcontroller as shown in Fig.3

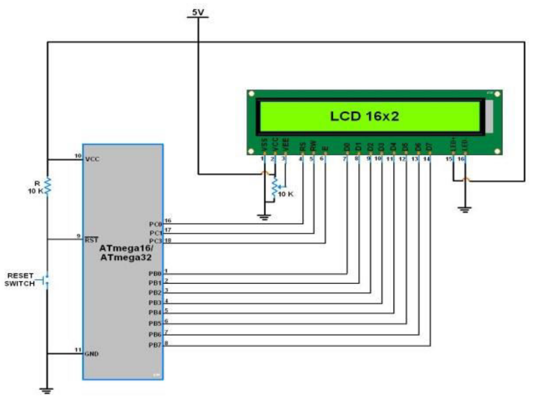

Fig 3: Interfacing LCD with ATmega32A

Temperature Sensor (LM35) interfacing with ATmega32

Temperature sensor has 3 input pins. Middle one is output and other two pins are ground and VCC. To use the sensor simply connect the Vcc to 5V, GND to Ground and the Out to one of the ADC pin of the microcontroller. Here we use Pull-down along with the LM35 sensor to stop them from floating about randomly when there is no input condition i.e. if there is no voltage coming through the temperature sensor, then the resistor pulls the pin to ground and we get a reading of zero volts. Here we used a 10K pull-down resistor. This gives us a range of 2.5V-5V readings at the output of LM35 sensor. As we scale up the value of the pull-down resistor, we will get less voltage drop across that resistor, which means that we get a wider voltage range at the input pin for the same temperature variance, which results in more precise readings. The connection is shown in Fig.4

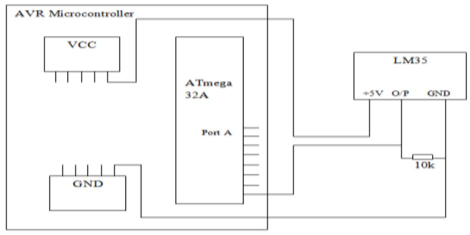

Fig 4: Lm35 interfacing with ATmega32A

Cooling system interfacing with ATmega32

We need to connect the relay circuit consisting of resistor and transistor, to the PORTA of the microcontroller. Connect the input of relay i.e. base of the transistor to P0.0 pin of the microcontroller. Then connect the output of relay i.e. collector to the DC cooling fan and emitter terminal is grounded[4].

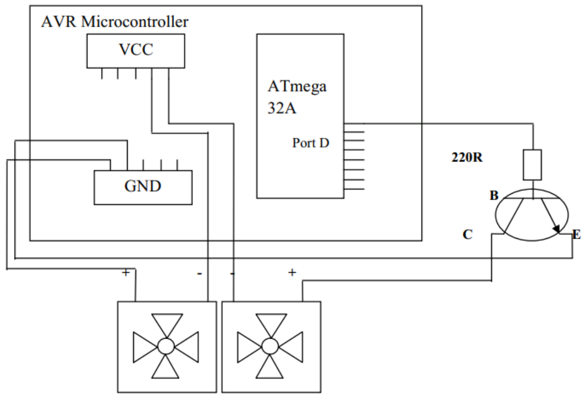

Fig 5: Cooling system interfacing with ATmega32A

The program was written in Atmel Studio and the program is dumped into a microcontroller using AVRdudes software.

Flow Chart of Cooling System

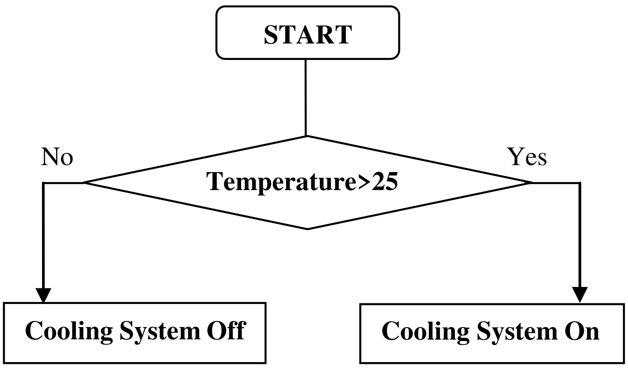

Fig. 6: Flow chart of cooling system

The cooling system is to be designed in such a way that the DC fan is automatically turn on or off according to the temperature. The above flow chart is for the cooling system which automatically turns on a DC fan when it detects the temperature inside the helmet greater than its threshold

value. In this, LM35 temperature sensor will give continuous analog output corresponding to the temperature sensed by it. This analog signal is given to the ADC pin of the microcontroller, which converts the analog values to digital values.
The ATmega32 microcontroller has 8 ADC channels. The analog value is applied to one of the input ADC pins. Thus conversion occurs internally using successive approximation method. For ADC conversion, internal registers should be declared. The ADC pin outputs a digital value. The digital output of the ADC is equivalent to sensed analog voltage. In order to get the temperature from the sensed analog voltage, we need to perform some calculations in the programming for the microcontroller. Formula to convert analog value to digital value is a=value*0.48876. Once the calculations are done by the microcontroller according to the logic, the temperature is displayed on the LCD. This is compared with the threshold value by the controller. Like this, the microcontroller will continuously monitor the temperature. If the temperature exceeds more than 25 deg Celsius (as per the code)the microcontroller will turn on the relay circuit, to turn on the fan.

Flow chart of air purifier

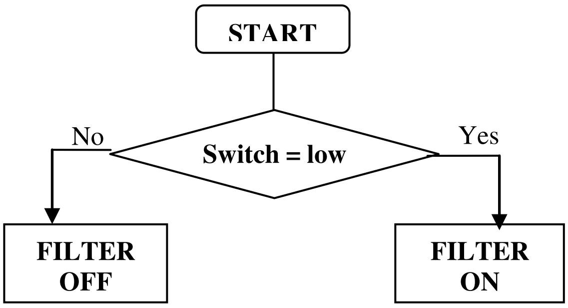

Fig 7: Flow chart of air purifier

IV. RESULTS

A working prototype with all the mentioned components and tested for its comfort and usefulness for the user has been successfully developed. The prototyping was done on a readily available covered helmet. The total setup of the helmet with multi features is as shown in Fig.8 its design incorporates components like solar panel, battery, microcontroller, filter, charging unit and cooling fans.

Fig.8: Prototype image

The above figure shows the fabricated helmet with an external solar panel, and the circuit embedded at the back side of helmet. The battery pack is placed at the bottom back position in order to minimize the weight borne by the user while wearing the helmet. Solar panel power up all the peripherals interfaced into the helmet. The cooling system worked successfully, which reduce the internal temperature and we get the cool air to face, so with this rider get comfort riding. The charging unit works properly; with this we can charge the cell phone battery by using solar power as energy source.

The hardware design consisting of solar panel, battery, and microcontroller and cooling system is shown in Fig. 9

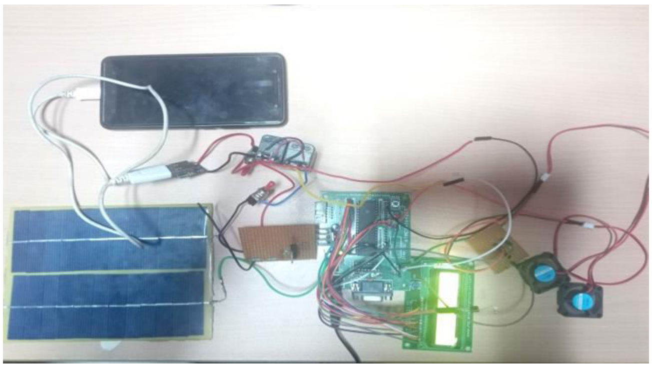

Fig.9: Hardware design of the proposed system

The value of temperature inside the helmet in degree Celsius and the lead acid battery's percentage is displayed on the LCD. This is shown in Fig.10

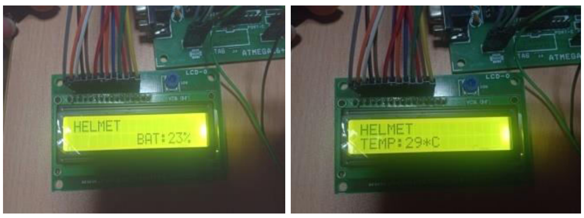

Fig.10: LCD readings

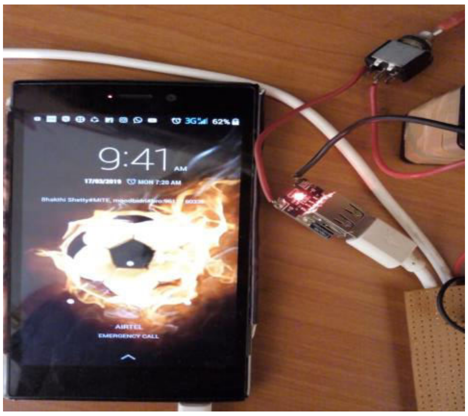

Fig.11: cell phone charging system

This helmet can further be developed as more comfortable and aesthetically, better appealing. The prototype could have been built lighter in weight and can have on-board solar panel for its efficient working. All the components could have been designed in flexible PCB's, in order to make it more compact and balance the weight.

V. CONCLUSION

we have discussed about developing a "Helious Helmet" by incorporating many features like cooling system, cell phone charging unit, air filtration system that are lacked in the conventional helmets. Especially the Helious helmet is designed to reduce the temperature and to filter the air inhaled by the motorcycle user from fine dust particles and comfort journey to the rider. The prototyping of a cooling system and air filtering system for motorcyclist helmet has been done successfully and targeted temperature lowering and air filtering performance is achieved. The charging unit is also designed successfully with which a cell phone battery can be charged. Finally we can conclude that the design of this Helious helmet has shown the satisfactory results and works well by harvesting solar energy.

REFERENCES

[1] *M.Hrairi, A.F Abdullah, M.Ahmed "Cooling of Motorcyclist Helmetwith Thermoelectric Module" Middle-East Journal of Scientific Research 13 (Mathematical Applications in Engineering):103-108,2013,ISSN1990-9233*

[2] *Kodanda Ramaiah GN1, Prabhakar V Hunagund and Santosh B Panjagal, "Smart Helmet: The Next Generation Solar Gadget" Ramaiah et al, Int J Adv Innovat Thoughts Ideas 2015, 3:2 DOI: 10.4172/2277-1891.1000159*

[3] *Deshpande Atish Kishor "COOLING OF BIKER'S HELMET USING PELTIER MODULE" International Journal of Advanced Technology in Engineering and Science Volume No 03, Special Issue No. 01, March 2015.*

[4] *E.Sharifpour,M.Farrokhnia, F.Golzar, Gh.Karimi "Improving thermal comfort of motorcycle helmet by using phase change materials"20th Annual International Conference on Mechanical Engineering-ISME2012 16-18 May, 2012, School of Mechanical Eng., Shiraz University, Shiraz, Iran*

[5] *Swati Arora,Yathartha "Prototyping Solar Powered Helmet, DU Journal of Undergraduate Research and Innovation" Volume 4, Issue 1, pp 117-124, 2016-17*

[6] *Linlin Cao, Jitian Han, Lian Duan, and Chong Huo,"Design and Experiment Study of a New Thermoelectric Cooling Helmet" 10th International Symposium on Heating, Ventilation and Air Conditioning, ISHVAC2017, 1922 October 2017, Jinan, China*

[7] *Mr.P.Dileep Kumar1, Dr.G.N.Kodanda Ramaiah, Mr.A.Subramanyam3, Mrs.M.Dharani4," A Solar Powered Smart Helmet With Multifeatures", International Journal of Engineering Inventions e-ISSN: 2278-7461, p-ISSN: 2319- 6491 Volume 4, Issue 10 [June 2015] PP: 06-11*

[8] *GORLE, Sunil Kumar "Motorcycle Helmet with Inbuilt Air Filtration System", International application published under the patent cooperation treaty (pct), International Publication Date 26 May 2016.*