International Journal of Research in Engineering, Science and Management
Volume-3, Issue-8, August-2020
journals.resaim.com/ijresm | ISSN (Online): 2581-5792 | RESAIM Publishers

Design of Temperature Controlled Riding Gear

Amith Prakash[1*], Ayush R. Kajava[2], Jeevan K. Jose[3], Maashok Shalimar[4], A. R. Girish[5]
[1,2,3,4]*Student, Department of Automobile Engineering, Srinivas Institute of Technology, Valachil, India*
[5]*Professor, Department of Automobile Engineering, Srinivas Institute of Technology, Valachil, India*
*Corresponding author: amith.prakashan@gmail.com

***Abstract*: The helmet and jacket are the safety equipment for a two-wheeler rider. "The primary purpose of helmet is to protect the head against injuries and to safeguard the eye from sunlight and dust particles" [1]. Jacket is as important as a helmet because it protects the other vital parts of your body such as the shoulder, elbow, back and chest. It is crucial that the motorcyclist is comfortable while wearing the helmet and jacket for long rides. The inconvenient equipment may affect concentration and create hazards that could lead to accidents. The motorcyclist can be affected by temperature which results in loss of concentration. Our intention is to comfort the rider with cool air through the entire gear. This work focuses on absorbing the heat produced inside the helmet and jacket, the absorbed heat is then converted into cool air. The mechanism facilitates the release of hot air and circulates cool air without any manual effort during required circumstances.**

***Keywords*: Helmet, Jacket, Riding gear, Temperature controlled.**

1. Introduction

In a normal riding gear, there will be inconvenience to the rider which can cause less concentration due to heat produced inside the helmet and jacket. To avoid this, we have come up with an idea of temperature-controlled riding gear, which circulates atmospheric air from the compressor and cools it by passing through the cooling agent.

We are using commonly available riding gear and introducing a compressor on to the jacket which will be used to cool the air and circulate through tubes which are placed around the jacket. The helmet is connected with a help of a tube which can connect with easy fit mechanism.

The helmet will consist of duct's which allows the flow of air inside the chamber of the helmet, the air inside the chamber is exhaled with the use of duct which is operated using a mechanism, in particular interval of time. There will be a compact dc powered compressor placed behind the spinel protection of the jacket to provide power. A sensor will be provided on the helmet as to cut-off supply, when the air is cooled excessively below 27°C, when the temperature increases at around 30°C.

Riding gear which is going to make a revolution between riders. The planning of this gear is made in such a way that the rider gets the at most comfort and relax throughout the ride. The weight and the dimension are taken into consideration so that comfort is not compromised. The fog formed inside the helmet will be removed with the help of a thin film that will be stuck on the visor. There will be a duct on the helmet to ensure there is a passage for fresh air every 30 minutes that will help in circulating fresh air. The project is going to be spilt in four ways which will deal with data collection, fabrication, testing and designing. Which is going to make the project easy to work on. The idea of making this project came from coming across riders riding in the traffic, under the hot sun and pollution which provoked the idea about this unique solution that can solve a major problem commonly associated with riders. This design of the riding gear will ensure protection as well. This will make the rider feel comfortable and relaxed so that the person can concentrate on the road without hassles.

2. Literature Review

A. Chelliah et.al - In this paper a thermally comfort helmet has been designed using PCM by providing hole set both front and rear side of the helmet for forced convective heat transfer through air. The result shows that the designed helmet gives the comfort up to 1.24 hour while driving.

K. M. Nizar Ahammed- In this paper a jacket for safeguarding a person from hot atmosphere is the objective of this project. The thermoelectric refrigeration is the method adopted here. "A prototype of the proposed cooling jacket is designed and fabricated. The following are main components to fabricate the proposed cooling jacket. The thermoelectric modules which work on the principle of Peltier effect are selected for the cooling jacket for refrigerating effect. To order to operate the thermoelectric module efficiently, the heat accumulates at the hot end must be dissipated. A heat sink with a water reservoir is designed and fabricated for this purpose" [2]. The thermoelectric module must not be overloaded. The temperature at the cold end can be varied by adjusting the flow of current through the circuit. A control switch is designed and assembled to do this. The components must be suitably concealed in a jacket. A suitable fabric jacket is designed and prepared for this. The works done are properly ordered and documented in the thesis.

Gh. Karimi et.al- The results show that with the use of the PCM-based cooling system, it will take a longer time for the temperature inside the helmet to exceed the thermal comfort level as compared to a normal helmet. Although the present study focuses on the thermal comfort of motorcycle helmet, this simulation of melting of PCMs under various boundary

conditions could also be useful for the "development of PCM-based cooling systems in textiles and cloths, heating storage systems. This paper concludes that a PCM- based helmet cooling system could be very effective under various ambient conditions in Iran. The limitation of the PCM-cooled helmet is that the stored heat" [3].

Amogh Mhatre1 et.al- this jacket is for the ones who work in conditions, exposed to high temperatures. It can also be used by 2-wheeler riders, saving them direct heat of the sun. The jacket can also be powered by connecting it to battery of the bike. Hence, it can have a very good efficiency and a longer battery life. Here, a battery powered cooling Jacket is introduced. A battery is a limited source of power. It must be recharged regularly. Solar cell can be used to recharge the battery. Paper type solar cell is available in the market which is suitable for this application. The crystal type solar cells are heavy but amorphous cells are. There is scope for more innovation and modifications. "Following observations have lighter been derived by the study of the project. Reduces skin temperature by up to 25^{o}C while maintaining a stable core temperature" [4]. Delays the onset of dehydration by conserving fluid that would normally be lost through sweating. Lowers cardiac output towards the skin and allows more blood to be sent back to the muscles resulting in a prolonged high level of performance.

Steve Feher- Steve Feher wants to cool motorcyclists' heads, using the same technology he invented to cool drivers' butts. "The Feher helmet is the world's first fully integrated air-conditioned motorcycle helmet, and it claims to keep your head 10-15 degrees cooler than the outside world. Feher invented the miniature air conditioning units used to cool the seats in Rolls-Royce, Bentley, Ferrari, Lexus, and GM cars, and now he's stuck one in the back of a helmet to cool your head" [5]. "There are no vents on a Feher lid. Much like car air- con systems, they work better when the outside air is kept out. A small thermoelectric pump at the back of the lid cools and dehumidifies air before pushing it out across the top of your dome" [6]. It's designed such that it's not a distracting or forceful feeling – "no ice cream headache," as Feher puts it – rather just a cooler environment for your bonce to be in that helps your whole body feel fresher.

Sandeep Dahiya-The pipes and wiring inside the helmet are attached to an external device that draws 12 volts of current from the bike battery, once attached. This 'air- conditioner' works on solid state cooling, that is, unlike in conventional coolers, it doesn't have a compressor and does not require any water. It only has thermoelectric components. While the cooler comes in a small knapsack that can be worn on the back, once the device is switched on, and the cooling mode is switched on, it sends cool air into the helmet.

3. Objectives

The main reason behind the project is to make the journey of the rider comfortable.

The gear should be easy to wear and comfortable.

The gear must give an individual the cool feeling we intend to provide.

To build a temperature-controlled riding gear is to help and achieve the ideal temperature that is suitable for the human body.

Successful implementation of this technology will result in the irritation and hassle-free mind of the rider.

Construct a reliable, affordable riding gear system to travel the short and long distance without any inconvenience.

To introduce a modern way of travel with innovative technology which provides a very pleasing riding experiment. Introducing newer technologies as an icebreaker in riding gear. With steeply rising temperature in the environment, many people get heat rashes and even heat strokes. Creating an efficient and effective way of new possibility in riding gear.

Improving riding experience with utmost comfort.

4. Design and Fabrication

This is the inner view of the helmet this shows the space between the head and outer shell of the helmet. This figure also shows why a person might feel discomfort inside a helmet. We are going to use the space provided to place the pipes which will make the air flow.

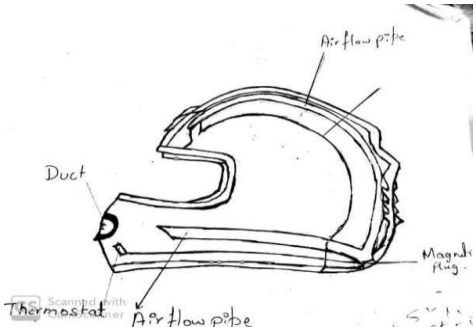

Fig. 1. Drawing shows the placement of the pipe

This drawing shows how we are going to be placing the pipes which will be connect to the jacket which carries the cold air from the AC. The thermostat sensor is placed near the chin which will read the temperature and cut off the supply of air when it crosses 27^{o}C. There is also a duct which will open every half hour to let fresh air in. There will be a plug which will used u connect and disconnect with ease.

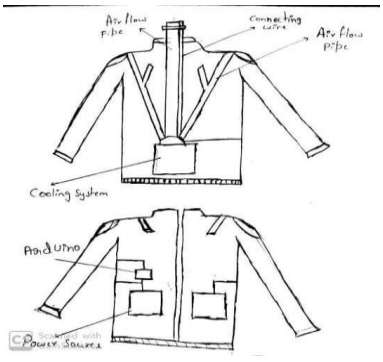

Fig. 2. Drawing showing placemat of components and airflow pipes

This above drawing shows the placement of the cooling system which will be placed in back of the jacket. The cooling system will be running with R 134a gas which is a refrigerant which will be helped for cooling. There will be a microcontroller which will be controlling the cut off of the compressor as well as the inlet of the helmet because there is a difference in the temperature between helmet and the jacket. The power source well be a portable 12v battery which will be connected to the cooling system as well as the Arduino unit. The secondary battery source will be the bike battery itself this is only if the portable batteries are completely discharged. The jacket also comes with a thermal lining which will keep the cool air from escaping.

5. Design and Simulation

A. Design

The temperature-controlled riding gear is designed in two different ways, with their respective advantages and disadvantages. The current unfortunate situations have forced us to do simulation of the project rather than fabricating and testing it manually. The purpose of two designs is therefore to ensure a better approach to the final stage. The main difference of the two designs is the position of placement of the components. Below specified are the two designs.

1) Design 1

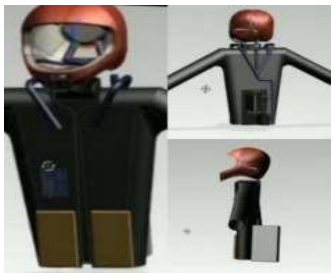

Fig. 3. Design 1

- In this design, the components are placed below the spine protection pad of the jacket.
- The units are assembled at the back, which helps in the even distribution of weight.
- This design enables handling of the riding gear more user friendly. Since condenser ad evaporator are kept close, extra connecting units are not required. Hence require minimal amount of refrigerant gas and less of tubing as well.
- The disadvantage with this design is that the air flow will not be sufficient for the evaporator so the efficiency of the cooling system will be less, thereby heating the evaporator which can affect the rider.
- Another disadvantage is that riding gear will be bulky in the back and limits the movement of the rider.

2) Design 2

Fig. 4. Design 2

- Unlike the former design, these components are occupied places like the side as well as the front of the jacket.
- The evaporator is placed at the side of the chest and the air let is placed at the front.
- The major feature in this design is the reduced bulkiness which adds up to the overall aesthetic appearances.
- The drawbacks of this design include the rigidity of the jacket while wearing and removing it.
- There is a possibility that the jacket feels heavier on one side.

B. Simulation

Simulation results of the design using ANSYS software is as follows:

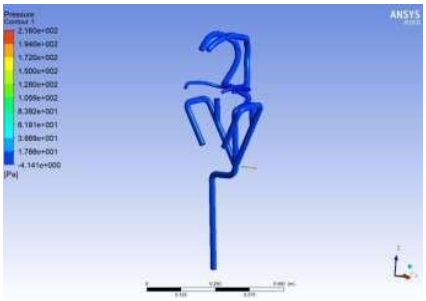

Fig. 4. Pressure contour

This is the pressure contour simulation obtained using ANSYS software. This shows the pressure is constant throughout the system and it is very minimal, so that the pressure does not change. Pressure change occurs only near the compressor region as shown in the simulation.

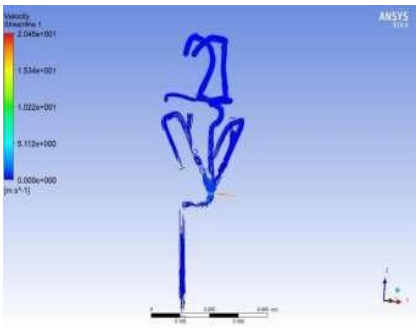

Fig. 5. Velocity streamline

This is the velocity streamline simulation obtained using ANSYS software. The velocity is constant throughout the system and is very minimal, so that the velocity does not change.

6. Conclusion

On concluding, there have been numerous breakthroughs in the history of the automobile era, all of them improving the quality of life. Comfort and efficiency are two most important factors to be considered in this field. This project evolving the design of temperature- controlled riding gear can make a huge impact and difference in the traditional styles of riding gear. The present situation of the unfortunate outbreak has led us to simulation of the design, failing to test the design manually. From analysis of the simulation of both the designs, it was found that the designs enable utmost efficiency and comfort.

References

[1] Arumugam, Chelliah & Karthick, B & Vimalkodeeswaran, A & Hariram, V. (2015). Helmet cooling system using phase change material for long drive. Journal of Engineering and Applied Sciences. 10.
[2] Ahammed, Nizar. (2013). Thermoelectric Cooling Prototype Jacket. MES Journal of Technology and Management. 05. 85-94.
[3] Helmet Paper Soft Copy, https://www.scribd.com/document/95190280/7-Helmet-Paper-Soft-Copy.
[4] “Personal cooling products are the best way to tackle heat stress”. Available: https://coolhats.com.au/.
[5] “Feher ACH-1: Air-conditioned helmet cools biker bonces”. https://newatlas.com/feher-air-conditioned-motorcycle-helmet/56046/.
[6] “Feher ACH-1: The first Air-conditioned helmet!”. http://en.protothema.gr/feher-ach-1-the-first-air-conditioned-helmet-video-photos/.