2020 IEEE International Students' Conference on Electrical, Electronics and Computer Science

Smart Helmet Wiper

Sarika Kanetkar [1], Ankit Rathore [2], Krati Maheshwari [3], Prasanna Dubey [4], Ankit Saxena [5]
Department of Electronics Engineering
Medi-Caps University
Indore, India
sarika98.kanetkar@gmail.com [1], ank.rathore5654@gmail.com [2], kabara.krati@gmail.com [3], prasannadubey@gmail.com[4], ankitsaxena.mitm@gmail.com[5]

2020 IEEE International Students' Conference on Electrical,Electronics and Computer Science (SCEECS) 978-1-7281-4862-5/20/$31.00 ©2020 IEEE 10.1109/SCEECS48394.2020.40

***Abstract*—An improvised helmet design which is integrated with a circuitry for automatic rain sensing mini wiper located on the eye shield. The presence of a smart helmet wiper will make two wheeler riding easier and safer in rainy season since the driver won't be bothered by the continuous rain drops disturbing his/her vision. The wiper will automatically start as soon as it detects the presence of rain drops on the rain sensor mounted on the top of the helmet. In addition to this the wiper will be able to adjust its speed of wiping according to the intensity of rainfall automatically. In some situations manual turn off of the wiper is also possible by a switch which may be located inside the ear shield. Commands to the wiper will be given with the help of Arduino Nano and power will supplied by rechargeable Li Batteries.**

Keywords—Smart Mini wiper, Rain sensor, Arduino NANO, Li- Batteries

I. INTRODUCTION

Safety is always the biggest concern when it comes to long distance two wheeler riding. A systematic review in the year 2008 concluded that helmets reduce the risk of head injury by around 69% and death by around 42%. Also, studies have shown that since 1980's many public authorities around the world have encouraged the use of helmet as shown in Figure 1, while riding a two wheeler. Helmets play a very important role in providing protection from various head injuries that might be caused due to road accidents. Wearing helmet during rainy season causes difficulty to the rider since rain water drops accumulate on the eye shield of helmet as shown in Figure 2. Figure 3 shows the hazy view of road seen by the rider wearing a helmet in rain which causes difficulty in riding.

Figure 1: A Helmet [2]

Figure 2: Eye shield of helmet from outside in rain [6]

Figure 3: Hazy view of road from inner side of helmet [7]

II. OBJECTIVE

The objectives of the project are:

1. Enabling clarity of vision for helmet users in rain.
2. Minimizing road accidents caused due to poor vision.

III. LITERATURE SURVEY

Wearing helmets has been made compulsory by many public authorities around the world since 1980s. many medical bodies have also supported to encourage cyclists to wear helmets for protection from head injury, and some have compelled it. [1]. According to the Bicycle Helmet Attitudes Scale, only 12% of students were self-reported helmet users. It also reported men being more influenced by media than women [3]. Tolerable head impact limits related to serious injuries or death must be essentially provided and should be included in the process of designing and type of head protective devices [4]. The Helmets are made up of three types of compositions; an outer shell from molded thermoplastic, energy absorbing foam which is made from expanded polystyrene and a comfort liner made of urethane foam covered with synthetic textile fabric [5]. When drivers were found to be highly distracted due to rainfall on the windshield ,automatic rain-sensing wipers become an even more appealing feature, since they greatly minimize the time the driver must take his/her hands off the wheel [8]. An aerodynamic lift force, which is exerted perpendicular to the windshield is experienced by the windshield wiper. When its preload force is not powerful enough to counteract the aerodynamic lift force, the wiper floats. Due to this the rainwater does not get brushed away, completely [9]. Studying the friction between the wiper blades and windshield is always a matter of concern and challenge, from both theoretical as well as the practical point of view [10]. The mechanism of the windshield wiper is vehicle-specific. Linkages play the role of transferring the wiping motion from the wiper motor to the pivot-shaft assemblies [11].

IV. DESIGN AND FLOW

Following are the important components and the working block diagram of Smart Helmet Wiper:

A. Components

a) Arduino Nano: The Arduino Nano as shown in Figure 4, is a small board based on the ATmega328P (Arduino Nano 3.x). It operates with the help of a Mini-B USB cable. The rain sensor's output is connected to the analog pin A6 of the Arduino Nano and digital output is obtained on pin D13. Its program is written in a software named Arduino IDE.

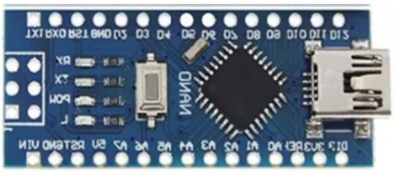

Figure 4: Arduino NANO [12]

b) Servo Moto: A servo motor as shown in Figure 5, is an actuating device which can push or rotate an object precisely. It runs through servo mechanism. In this project we have used a 9g servo motor for which the angle is set as 0 degree to 180 degree.

Figure 5.Servo Motor [13]

c) Wiper: The mini wiper which is connected to the servo motor rotates on the eye-shield to wipe out the water droplets.

d) Battery: Two Lithium rechargeable cells (each 3.7V, 2200 mAh) will be used in this project. The rechargeable batteries consist of lithium cells arranged in series combination. They have a long running time of around 3 hrs.

e) LM2596 (DC-DC Buck Converter): It is a step down converter which steps down voltage from its input to its output. Here the buck converter steps down the voltage from 7.2V to 5V.

f) TP4056 Charging Module: Li-Ion cells require special circuitry for recharging. Hence this module is the intermediate circuitry between Li-Ion cells and the charger.

B. Block Diagram

Figure 6 shows the circuit diagram of Smart Helmet Wiper:

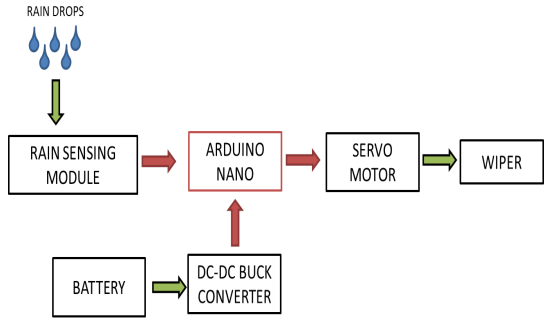

Figure 6. Block Diagram of Smart Helmet Wiper

V. IMPLEMENTATION

The steps of implementation are as follows:

A. Content:

The concept of this helmet wiper system is similar to other conventional wiper, yet this system will be upgraded to an automatic control system by using an Arduino Nano and a rain sensor. Whenever the water hits the dedicated sensor that is located on windscreen, it will send a signal to move on the wiper motor. The wiper will automatically stop moving on the windscreen once water is not detected by sensor. This will help the driver to give more concentration and reduce the road accident probability.

In addition to this a manual OFF button will also be provided to stop the wiper whenever required. The speed of the wiper can be adjusted according to the intensity of rainfall with the help of Arduino programming.

B. Circuit Diagram:

Figure 7 shows the circuit diagram of Smart Helmet Wiper.

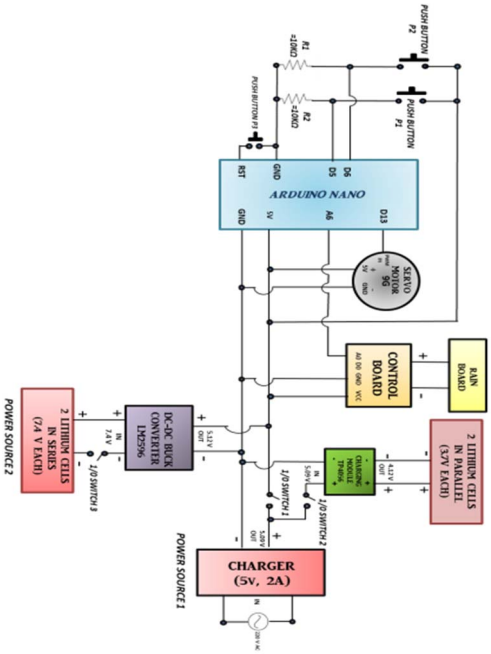

Figure 7. Circuit Diagram of Smart Helmet Wiper

Following components are used in the circuit:

a) Arduino Nano
b) Servo Motor
c) Rain sensing module
d) 2 Lithium Cells
e) 2 Resistors (10KΩ each)
f) DC-DC Buck Converter (LM2596)
g) Charger (5V, 2A)
h) 3 Push buttons
i) 3 Switches

One of the main components of this circuit is servo motor. The servo motor has three input terminals which are as follows:

1. Positive input power supply terminal (4V-6V)
2. Negative Ground terminal
3. PWM Input terminal

In our circuit, we are providing 5V power supply to servo motor and for PWM inputs we will need a controller which will generate PWM signals. For that we are using Arduino Nano.

A rain sensing module is used in our circuit which detects the water drops from its rain board and will provide the corresponding output in the form of voltages to Arduino Nano which decides the speed of rotation of motor accordingly.

Three Push-Buttons are used along with two Pull Down resistors that will pull down the voltage of D6 and D5 pins of Arduino to Ground when the push buttons will be left open. First push button triggers the sensor. Second push

button runs the servo motor manually with a specific speed. Third push button terminates the functions of previous two.

TP4056 Module is used as a recharging circuit for two rechargeable Lithium-ion batteries.

LM2596 DC-DC Buck Convertor is used to convert 7.4V Output of two Li batteries connected in series into 5V. This is used as a power supply for Arduino Nano, servo motor and rain sensing module.

Two power supplies are used. One is from Li-ion batteries and another one is optional (a charger).

C. Implementation:

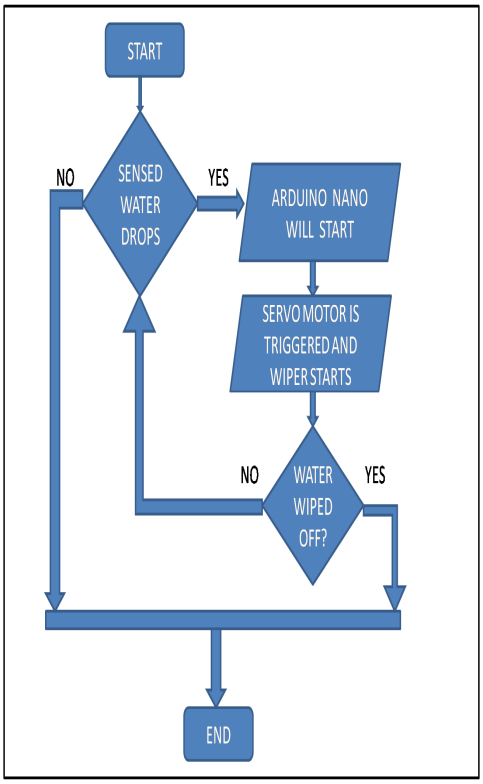

Figure 8. Flow Chart of Smart Helmet Wiper

The Flowchart of the "Smart Helmet Wiper" as shown in Figure 8, can be defined as follows:

The system starts by sensing the presence of water droplets on the sensor. If no water is sensed task is not performed. If water is sensed it triggers the Arduino which starts the servo motor. The servo motor rotates the wiper. If water is not wiped off the logic again goes to sensing water droplets. If water is wiped off, the task is ended.

VI. RESULT

This project focuses upon creating a system of the automatically operated helmet wiper which will work according to the intensity of rainfall and will significantly reduce the discomfort caused while two wheeler riding in rainy season.

VII CONCLUSION

Two wheeler riding in rainy season becomes convenient with the use of a Smart Helmet Wiper. It works automatically by sensing the intensity of rain and can be manually terminated with a switch. Figure 9 shows a helmet with Smart Helmet Wiper system installed and Figure 10 shows the circuitry of Smart Helmet Wiper system.

Figure 9. A helmet with Smart Helmet Wiper system installed

Figure 10: Circuitry of Smart Helmet Wiper

VIII. FUTURE SCOPE

The further scopes of improvement in this project are as follows:

a) The use of Nano Technology for designing this circuit can reduce the size of the circuit which will make it easier to be installed on a helmet

b) Low cost yet more powerful batteries can be used to reduce the overall cost of this system.

ACKNOWLEDGMENT

We would like to express our deepest gratitude to Honourable Chancellor, Shri R C Mittal, who has provided us with every facility to successfully carry out this project, and my profound indebtedness to Prof. (Dr.) Sunil K Somani, Vice Chancellor, Medi-Caps University, whose unfailing support and enthusiasm has always boosted up my morale. We also thank Prof. (Dr.) D K Panda, Dean, Faculty of Engineering, Medi-Caps University, for giving us a chance to work on this project. We would also like to extend our gratitude towards our Head of the Department Mr. Ajay Kulkarni, for his continuous encouragement for betterment of the project.

We are also very grateful to Mr. Vivek Kumar, Training Faculty at Tech-Achievers, Indore, who extended his kind support and help towards the completion of this project.

REFERENCES

[1] Curnow W. J. (2008). Helmets: A scientific evaluation. Transportation accident analysis and prevention edited by: anton de smet, pp. 141-177

[2] https://images-na.ssl-images-amazon.com/images/I/31pMz1tFeLL.jpg

[3] P. AbhilashReddy, G. SaiPrudhvi, P J Surya Sankar Reddy, Dr. S. S. Subashka Ramesh. Self operating rain sensing car wiper, International Journal of Advance Research, Ideas and Innovations in Technology, www.IJARIIT.com

[4]Costabile G., Amodeo G., Martorelli M., Schwanitz S., Lanzotti A., Odenwald (2013). Testing new protection devices to improve passive safety of sports equipment . International conference on graphic engineering june 19-21, Madrid, spain, pp. 1-6

[5] Ross P., Ross L., Rahman A., Cataldo S. (2010). The bicycle helmet attitudes index states that: Using the health belief model to predict helmet use among undergraduates. Journal, of American college health.vol. 59, no.

[6] https://images.app.goo.gl/mk41L1qN6zs8Jdi89

[7]https://www.dreamstime.com/rainy-day-rain-drops-helmet-mirror-image99960460

[8] Otteet al., (2013), J. of Advancement in Engineering and Technology Volume3 / Issue4 ISSN: 2348-2931 pp. 3

[9] Journal of Applied Fluid Mechanics, Vol. 9, No. 5, pp. 2133-2140, (2016). Available online at www.jafmonline.net , ISSN 1735-3572, EISSN 1735-3645. DOI:10.18869/acadpub.jafm.68.236.2509.

[10] Bulletin of the Transilvania University of Braşov • Series I • Vol. 7 (56) No. 1 – (2014). Study of windshield wiper mechanisms and friction between wiper blades and windshield.

[11] Design and Kinematic Analysis of Windshield Wiper Mechanism Using CATIA V5.

[12]https://www.circuitarte.com/wp-content/uploads/2019/05/arduino-Nano-3.png

[13] https://aws.robu.in/wp-content/uploads/2017/09/IMG_0521.jpg

Sarika Kanetkar is a student of Medicaps University, Rau, Indore who is pursuing B.Tech. in Electronics and Communication. Currently in her 8th semester of engineering she's pursuing internship at Scientech Technologies Pvt. Ltd. which is a leading electronics production company. She has keen interest in studying and exploring latest technological innovations. Email: sarika98.kanetkar@gmail.com

Ankit Rathore is a student of Medicaps University, Indore who is pursuing B.Tech program in Electronics and Communication Engineering. Currently in his 8th semester of engineering, he is working on a major project related to designing of a portable gadget for safety of women. He is interested in research field and is preparing for the same currently. After B.tech, he is looking forward to pursue Masters in Electronics and Communication Engineering. Email: ank.rathore5654@gmail.com

Krati Maheshwari is a student of Medicaps University, Rau, Indore who is pursuing B.Tech. in Electronics and Communication. Currently in her 8th semester of engineering she's pursuing internship at Paragon Business Solution Ltd. (DigiValet) Indore, which is a leading automation company. She has keen interest in learning new technologies and enhancing her knowledge and capabilities in automation. She has also won “Branch Topper in University” award during her engineering. She’s looking forward towards new technical opportunities. Email: kabara.krati@gmail.com

Mr. Prasanna Dubey has bachelor degree in Electronics and Communication Engineering (2008), a masters degree in Digital Techniques and Instrumentation from SGSITS Indore. Currently he is pursuing PhD from IET, DAVV Indore. His areas of interest are next Generation Wireless and Optical Networks. Email ID: prasannadubey@gmail.com

Dr. Ankit Saxena has a Diploma degree in Electronic Communication. He obtained a Bachelor of Engineering degree in Electronics and Instrumentation, a Master’s degree in Business Administration (System) and a Master’s degree in Electronics Engineering (Electronics and Telecommunication Engineering). He started his career in the telecom industry with a major telecom operator in different technologies-: Airtel in 2000, Tata (2003-04), Reliance (2004-2008); and telecom product manufacture and manage services in Alcatel-Lucent (2008-2009), and Ericsson (2009-2015). He was awarded by the Ph.D. degree in Electronics and Telecommunication (in the Laboratory of the Institute of Engineering and Technology), Devi Ahilya University, Indore. His current research is in the area of performance analysis and key performance improvement in EUTRAN network (LTE and LTE-Advance), and reviewer of various International Journals and Conferences. Email: ankitsaxena4u@gmail.com