AUTOMATIC HEADLIGHT INTENSITY CONTROLLER FOR MOTORCYCLE

Abstract*–Developing a technology that can enhance nighttime driving by minimizing the use of high beams is the main objective of this research development. A system that complied with the requirements was constructed using the Inputs Processes Output paradigm. The technology is quite helpful in comfort driving—a common problem for drivers behind you who get a sudden glare in their eyes. We came up with the concept to build an automated headlamp intensity controller. An automatic headlight intensity high beam light controller that is affordable and easy to install. All the necessary hardware and components for the suggested design were used. Experiments indicate that when facing other drivers, the controller automatically switches on and off the high and low beam lights to give the driver the proper command. The system's ability to detect light from the opposite direction—quantified in intensity and distance—was found upon testing. Consequently, the user rate and assessed the system, and the system and the automated headlight functioned as intended. The user gave the system a Strongly Agree rating in intetion to uses 4.86.

Keywords--Automatic, Buck Converter, Controller, Relay Module

I. INTRODUCTION

All car headlights are made to shine brightly and safely as you drive. Two reflectors on them are intended to provide high and low beams[1]. Depending on the road conditions, the driver manually switches between the two types of lighting[2]. The other driver may have a blind area due to the excessive headlight beams. To avoid this effect, drivers should switch to low beams instead of high beams. Road visibility is decreased by these lights, which emit a softer light.This level of distraction is a contributing factor in many traffic accidents[3].

The automated headlight intensity that has been built lessens the issue by instantly switching from high to low beam when our car senses an approaching vehicle from the opposite direction[4]. The dimmer's complete mechanism is a straightforward electronic circuitry configuration that sensors and turns the headlight based on the necessary circumstance[5].The car lighting system is built using new technologies, which change from a high to a low beam, requiring little physical effort. This technology utilizes a phototransistor, which automatically switches the spotlight to a low beam when it detects the light from the other car[6]. This technology has a drawback on the power consumption with the headlamp due to voltage drop across the phototransistor, thus compromising the efficiency of the headlamp.

This research project has developed an ideato explore the light-dependent resistor LDR, which improves the current and voltage using a buck converter and relay module to enhance the headlamp. Also, it targets affordability, is lightweight, and readily available on the market. It also has fewer parts than other similar devices. People drive at night to save time and avoid traffic during the day. When driving at night, approaching cars turn on their high beams, which gives the driver of the car a quick flash of light and increases the risk of an accident. He is legally supposed to lower his beam as a car approaching from the opposite direction, but no one follows the rules.

Review Related Literature

Adaptive headlamp systems are the result of recent developments in automotive illumination[7]. These systems, mostly for cars, automatically change the intensity of the headlight beams to improve road safety[8]. Research has indicated that these systems have a critical role in lowering accidents caused by glare, especially at night[9]. Light-dependent resistors (LDRs) are one type of sensor that can detect cars coming and modify light intensity accordingly[10]. The system lessens the risks related to using high beams. The creation and operation of these systems have been the focus of many academic publications 10. Several techniques include LDRs, Arduino microcontrollers, and fuzzy logic control[11]. These studies investigate several real-time headlight intensity optimization approachesconsidering variables such as the proximity and intensity of approaching cars[12].

The focus is on developing affordable, effective, and easy-to-use technologiesto be extensively implemented in many cars[13]. These systems' main goal is to lessen glare, which is a major factor in temporary blindness that results in auto accidents[14]. These systems ensure that the driver and any approaching traffic have the best visibility by automatically alternating between high and low beams[15]. This highlights the necessity for wider implementation of such technology and is especially significant in nations where headlight glare contributes to high traffic accident rates[16]. Numerous studies have demonstrated the systems' economic viability and deployment simplicity, enabling a wider range of cars, including those in poorer nations, to access them[17].

The goal is to use inexpensive parts without sacrificing the system's functionality so that adaptive headlamp technology can benefit more cars than just luxury ones[18]. A fascinating study area could involve adapting similar bicycle technologies in the future[19]. Adaptive headlights on bicycles have the potential to greatly increase biker safety, particularly in urban areas with changing lighting conditions[20]. Subsequent investigations may examine incorporating small, energy-conserving devices appropriate for bicycles, thereby enhancing the safety of cycling experiences[21].

Adaptive headlamp technology has a lot of exciting things in store, especially for bicycles[22]. One way to make improvements would be to use AI algorithms and smart sensors so that lighting may be dynamically adjusted according to current traffic and ambient conditions[23]. Another important area of study for these systems might be the investigation of renewable, energy-efficient power sources like solar energy or kinetic energy collection[24]. Better integration with other smart gadgets and transportation systems may also result in safer and more integrated urban mobility solutions[25]. Research and development in this field must continue as the advancement of this technology has the potential to greatly increase the safety of nighttime cycling[26].

Conceptual Framework

The researcher employs an IPO (Input–Process–Output) model to categorize the process steps and explain the system life cycle provided by this framework[27]. IPO offers a systematic approach to defining a system's goals and objectives as outputs and how to evaluate process method choices by analyzing those outcomes[28]. Additionally, the IPO's structured approach makes gap analysis—which determines which inputs are required to achieve which outputs—considerably easier.

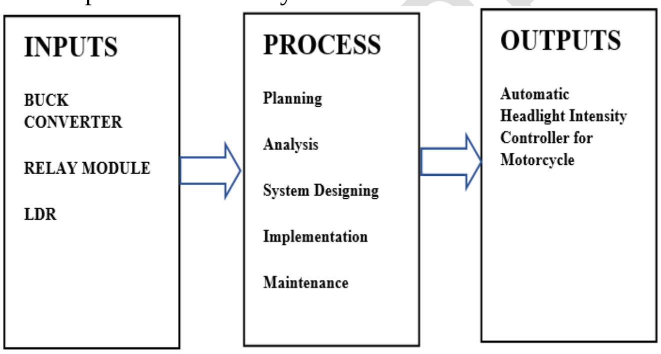

Figure 1.***Input-Process-Output Diagram of the Project***

The block diagram displays the overall definition of the system. The framework describes how the system flows[29]. The input block is the supplies required to construct a power supply project, an automatic headlamp for testing, and the controller provides the driver with the required automated command by turning on and off the high and low beam lights while facing other drivers[30].

To reduce visual impairments caused by approaching cars, an automatic headlight dimmer that employs a Light Dependent Resistor (LDR) sensor to dim headlights has been developed[31]. By detecting the light intensity of approaching cars, the high beam would automatically switch to the low beam, decreasing glare and requiring the driver to adjust manually, which was not always done. A load with a lower output voltage (Vo) than the input voltage (Vin) can be powered using a buck converter. The output voltage may be controlled and regulated by the duty cycle of the converter, D=Ton/TsD=Ton/Ts, where Ton is the length of the charging period, and Ts is the total switching cycle time; the inverse is the switching frequency, fs=1/Tsfs=1/Ts. There is an increase in battery life[32].

The phases of planning, review, system design, implementation, and maintenance are contained in the process block, which comes after the input block[33]. All project procedures and activities must be scheduled, and a thorough set of plans must be made to ensure success. They are compared, assessed, and provided the necessary context to make several gathered and processed items meaningful during an examination. System design is to get a respectable performance out of your project. Parts of the project's implementation include launching it and achieving its objectives. Advocates for the Project work on the deliverables here. The next phase is repair, which involves modifying the system's documentation, software, and hardware to guarantee that it continues functioning effectively[34]. It entails improving security, resolving bugs, maximizing system performance, and meeting user requirements.

The Project's output, an automatic motorcycle headlight intensity controller, is the result of the input and procedure.

Objectives

The general objective is to build and implement an Automatic Headlight Intensity Controller for Motorcycles that will make night driving safer while minimizing accidents caused by headlight glare and creating a gadget that is comfortable to use while driving.

The study specifically aimed to:

1. To design and build a motorcycle's automatic Headlight Intensity controller.
2. To test and evaluate theusing Technology Acceptance Model (TAM).

II METHODS

Research Design

The main aim of the research was to assess the proposed approach and the implemented autmaticheadlight intensity controller for motorcycle according to Technology Acceptance Model which focus on the measurement of different lumens and ability to reduce the light intensity. Able to anser the research questions:

1. What are the angles in terms ofdetection and blind spot?
2. How many lumens where generated based on applied accelerator?
3. How much lumens were produced using Halogen and Lead head lamp?
4. Assessment of the developme system as to usefulness, ease of use, user satisfaction, atttitudes, and intention to use.

To acquire the appropriate information, a seven-part questionnaire, with 28 questions, was used. The first part contained demographic questions. The following five parts contained 5-point Likert scale questions. The participants were asked to specify the extent of their agreement or disagreement using this scale. The scale ranged from “strongly agree” to “strongly disagree”. Participants were asked about perceived usefulness, perceived ease of use, user satisfaction, user attitudes and intention to use. The final part of the questionnaire was consisted by optional open-ended questions about their overall experience asking them what they liked or disliked to the technology and their suggestions for improvements.

Project Design

Its goal is to create one or more designs that will help the Project meet its objectives. The Project's block diagram can be seen in the image below.

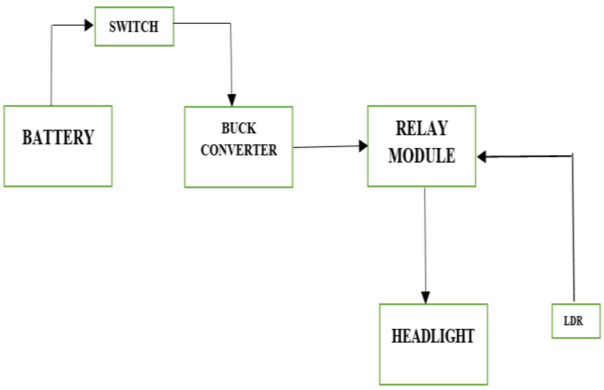

Figure 2. ***Block diagram of the Project***

The block diagram for the project is shown above. The researchers built a device using these hardware components.Researchers also utilized the Buck Converter to monitor the battery life offered on the mini digital panel of the Buck Converter when they were going somewhere.LDR is used by the Relay Module to analyze the command. The LDR can only give the command based on the given criteria.

Project Development

The development of this Project is divided into many sections. The researcher's primary responsibility is illustrated in the diagram above. Each block evolves From the analysis stage to the assessment level.

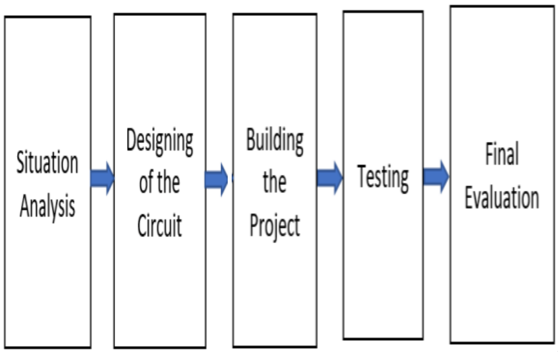

Figure 3. ***Development***

Figure 3.To do a Situation Analysis, the researchers must be familiar with any vehicle used daily, particularly at night.The design of the circuit diagram is used to map the circuit and its functionalities regardless of the size, shape, or location of the component devices or components. The design process includes circuit layoutsand device definition.Building the Project is not easy, as you often encounter many errors. Building the Project is creating instructions that tell a logical guide on how to perform a task and how the Project works.The device must be tested to assess its consistency and functionality. In the final evaluation, the researcher decided where they would build their system, and the motorcycle was chosen.

Project Evaluations

It aims to identify the Project's relevance and level of success, as well as the development's efficacy, efficiency, impact, and long-term viability. The project evaluation of the research is depicted in the block diagram below.

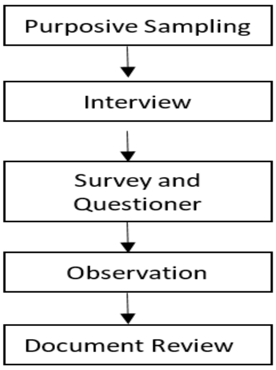

Figure 4. ***Qualitative Data Collection Process of the Block Diagram***

The researcher employed and observed purposeful sampling. The researcher was questioned about how the headlight was enhanced and how this project would be performed utilizing qualitative analysis to gather data from the proponent. To help supporters of the project learn more about it, surveys and inquiries regarding the methods researchers use to gather data could be useful. The supporters pay attention to the elements that fit the design. The proponents' data results will be recorded and examined.

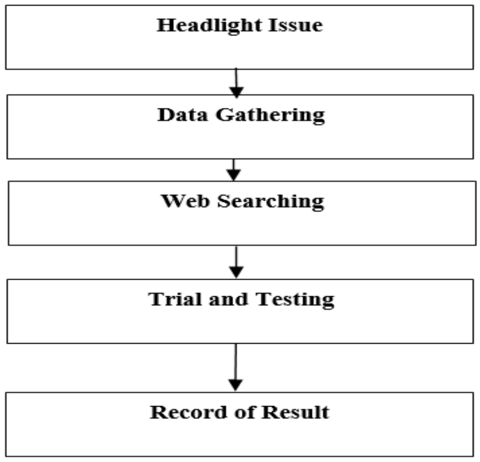

Figure 5. ***Quantitative Data Collection Process of the Block Diagram***

The researcher observed and applied to the headlight issue. To acquire statistics and information from the proponent on how the system works formotorcyclesand how this Project is going to be implemented by using Quantitative analysis. Web searching on how researchers can collect data via the Internet helps the proponents enhance their knowledge about their Project. The proponents did a series of trials and tests to ensure their components were suited to the design. The proponents record the results of the data gathered through surveys and interviews.

Table 1. ***List of Participants***

Participants	f (n=20)	% 0f involvement
Tricycle driver	5	45.00
Motorcycle driver	10	55.00

The researchers used a purposive sample and a selective strategy to find participants who could provide detailed information about the venture while meeting the standard output requirements for the phenomenon under investigation. It represents the entire population within the scope of the study for the selected respondents.

The table above shows the number of participants and their involvement in the study. The survey had 15 participants, with a Tricycle driver having 5 participants and a 45 percent participation rate and a Motorcycle driver having 10 participants and a 55 percent participation rate.

III. RESULT AND DISCUSSION

This section shows the output of the developed autmatic headlight intensity controller for motorcycle. as to design of the system, testing and evaluation.

3.1 Hardware

Figure 6. ***Buck Converter***

A buck converter reduces the input voltage to produce a lower output voltage. From a 5 V USB supply, a buck converter might be used to charge a lithium-ion battery to 4.2 V. A boost converter raises the voltage to a level higher than the input voltage.

Figure 7. ***2way Switch***

A two-way light switch is used in conjunction with another two-way light switch to turn on and off a light (or lights) from multiple locations. This serves as the activation of the developed autmatic headlight intensity controller for motorcycle.

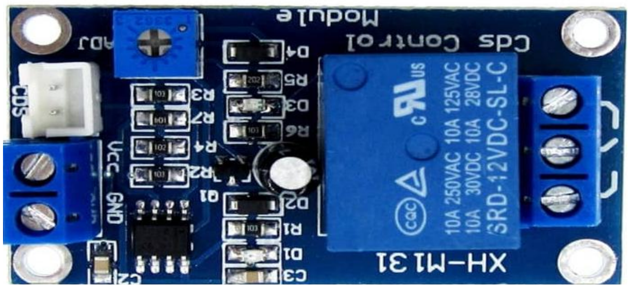

Figure 8. ***Relay Module***

A power relay module is an electromagnet-controlled electrical switch. A separate low-power signal from a microcontroller activates the electromagnet. The electromagnet pulls to open or close an electrical circuit when energized.

Figure 9. ***LDR***

The principle of operation of an LDR is photoconductivity, an optical phenomenon. When the substance absorbs light, the material's conductivity improves. When light shines on the LDR, the electrons in the material's valence band rush to the conduction band.

Figure 10. ***Halogen and LED Headlight***

A headlight is a light mounted on a vehicle's front and illuminates the road ahead. Headlamps are sometimes referred to as headlights. However,in the most accurate sense, a headlamp refers to the device itself. In contrast,a headlight refers to the light beam produced and distributed by the device.

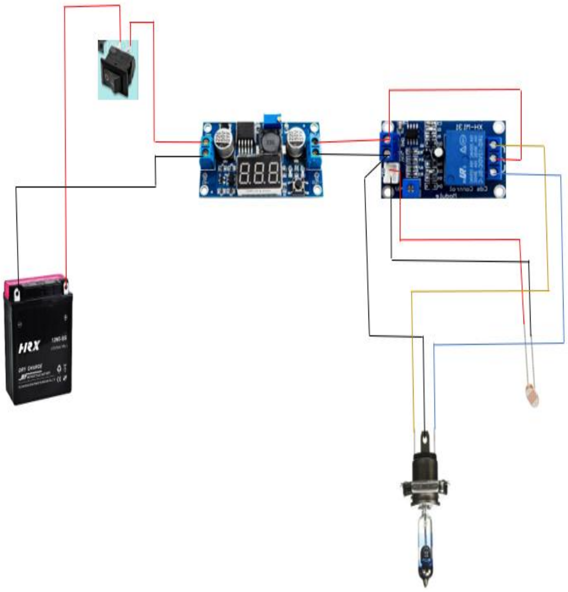

Figure 11. Schematic Diagram

Connect the battery supply to the 2way Switch, then connect the input of the buck converter. The battery voltmeter will be displayed on the buck converter's mini digital panel, and the buck converter's output will be connected to the input relay module. Thepositive and negative are present in the input relay module, while the common, normally open, and normally close are present in theoutput of the relay module. The positive input of the relay module will be tapped to the common. The negative input of the relay module will be tapped to the ground of the headlight, then the normal close of the relay module will be tapped to the headlight's High Beam. The normalopen of the Relay Module will be tapped to the Low Beam of the Headlight, and so on. LDR will be tapped to the Relay Module.

Figure 12. ***Pictorial Diagram***

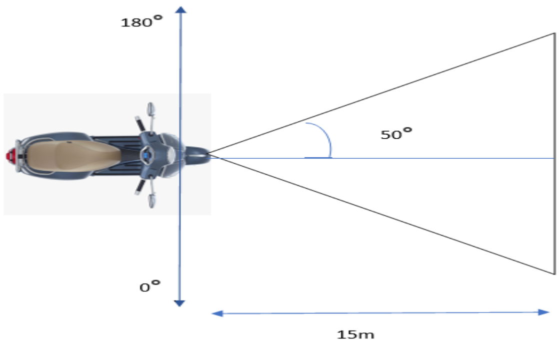

Figure13. ***Range of the LDR andblind spot of the LDR sensor's detection***

The diagram above shows that when it encounters an opposing vehicle, each of the two vehicles detects the light of the opposing vehicle. As a result, if either vehicle uses a high beam, it will automatically switch to a low beam approximately 15 meters away. When the vehicles collide, the intensity of light falling on the sensor after 50 degrees from the center of the LDR switches back to the previous model.

3.2 Test and Evaluation of the System

Table 2. ***Detection and blind-spot angle analysis***

Angle (degrees)	LDR (Detect)	LDR (Blind Spot)
10^0	NO	YES
30^0	NO	YES
50^0	YES	NO
70^0	YES	NO
90^0	YES	NO
110^0	YES	NO
130^0	YES	NO
150^0	NO	YES
180^0	NO	YES

Table 2. shows the angle detection and blind spotwhen encountering an opposite vehicle.

Table 3. ***LED light dimmer analysis***

Percent of Accelerator (%)	Voltmeter (V)	Luminance (Lux)
0	12.7	5791
25	13.15	5791
50	13.6	5791
75	14.05	5791
100	14.5	5791

Table 3 above illustrates how the relay regulates voltage and produces a fixed output and keeps the lumen's output constant even when the accelerator and voltage rise.

Table 4. ***Halogen light dimmer analysis***

Percent of Accelerator (%)	Voltmeter (V)	Luminance (Lux)
0	12.7	9222
25	13.15	9222
50	13.6	9222
75	14.05	9222
100	14.5	9222

Tables4. This table displays the same data as Table 3 regarding voltmeter and accelerator percentage, but the lumen output remains the same. LED lighting is less intense than halogen lighting.

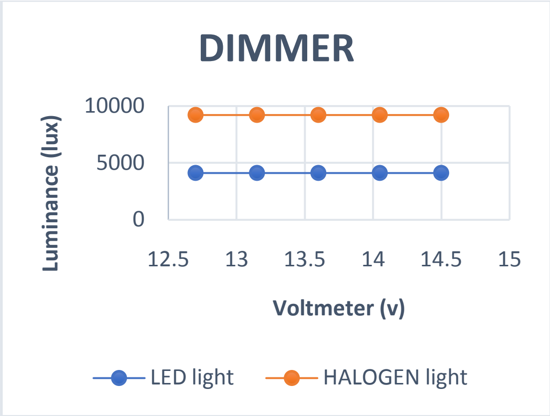

Figure 14.*Halogen and LED light dimmer analysis*

The graph depicts the difference in light intensity between LED and Halogen. The halogen bulb emits lighter than the LED bulb. Even at higher voltages, the Lumens remain constant.

Table 5. *LED light dipper analysis*

Percent of Accelerator (%)	Voltmeter (V)	Luminance (Lux)
0	12.7	4113
25	13.15	4113
50	13.6	4113
75	14.05	4113
100	14.5	4113

As shown in table5. above, as the accelerator and voltage increase, the output of the lumen remains constant due to the relay, which controls the voltage and provides a fixed output

Table 5. *Halogenlight dipper analysis*

Percent of Accelerator (%)	Voltmeter (V)	Luminance (Lux)
0	12.7	7148
25	13.15	7148
50	13.6	7148
75	14.05	7148
100	14.5	7148

Tables6. In terms of voltmeter and accelerator percentage, this table displays the same data as Tables 1 and 2, but the lumen output remains the same. LED lighting is less intense than halogen lighting.

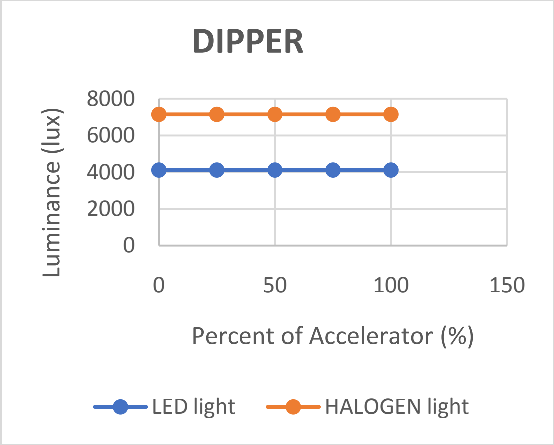

Figure 15.*Halogen and LED light dimmer analysis*

The graph depicts the difference in light intensity between LED and Halogen. The halogen bulb emits lighter than the LED bulb. Regardless of acceleration, the Lumens remain constant. A relay serves this function.

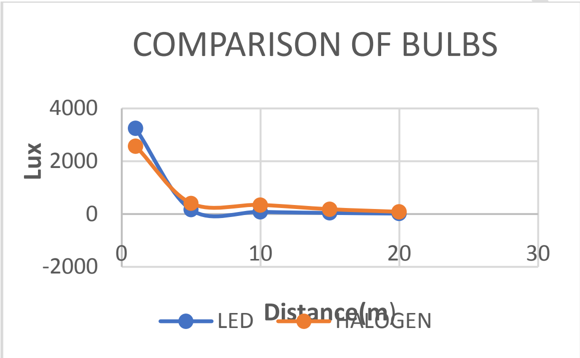

Figure 16.*Comparison of the dimmer's bulbs*

The graph shows the Lux difference in a single bulb. The lumens decrease asthey move away from the light.

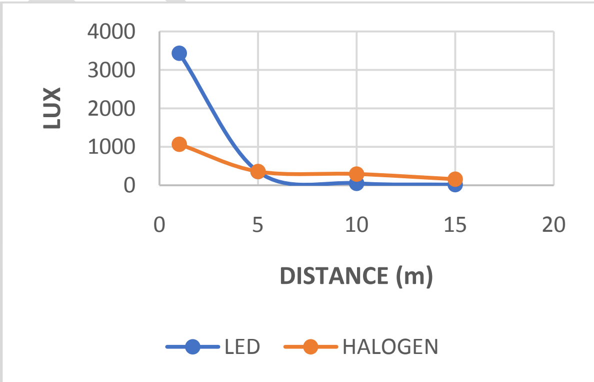

Figure 17.*Comparison of the dipper's bulbs*

The graph depicts the difference in Lux produced by a single light bulb. The luminescence of researchers decreases as they move away from the light. The LDR detects at about 15 meters.

Table 6. Evaluation per criterion

Criteria	Sensitivity	Accuracy	Total
Usefulness	4.44(94.4%)	4.76(93.3%)	4.68(95.8%)
Ease of Use	3.92(66.7%)	4.11(77.8%)	4.06(75%)
User Satisfaction	4.5(100%)	4.67(97.2%)	4.63(97.9%)
Attitudes	4.67(83.3%)	4.83(100%)	4.79(95.8%)
Intention to use	4.89(100%)	4.85(100%)	4.86(100%)

The Table 7 results shows the target participants such as motorcyle driver and tricyle driver has very much interested to use the developed system for their safety and ease while driving.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusion

The headlight on a motorcycle is controlled manually. Immediately dimming the bright lights will help the driver avoid gazing at the other person, which is not the intention. Thus, the notion of creating and constructing a motorcycle headlight intensity controller on autopilot was born. When necessary, the driver can utilize a high beam thanks to a mechanism known as automatic headlamp intensity. But when it detects an oncoming car from the other side, it instantly turns the lamp to a low beam. So, when this gadget is installed in every car going forward, driving will be safe and comfortable, and accidents will be prevented.

Because of this, the researchers examined and assessed the system's functionality, and the outcome was flawless, proving that both the system and the automatic headlight intensity function effectively.

Recommendation

Based on the study's findings and the conclusion obtained, the following recommendations are given:

1. Using a 24V Buck Converter to regulate a higher current and utilize the low current is recommended.
2. Using a 3-way switch to control the headlight manually and automatically is recommended.
3. It is recommended to cover the LDR with a reflector light cover so that it can detect light easily.

VI. REFERENCES

[1] F. M.-T. of the O. Society and undefined 1922, “On autocar headlights,” *iopscience.iop.org*, Accessed: Dec. 18, 2023. [Online]. Available: https://iopscience.iop.org/article/10.1088/1475-4878/23/4/307/meta.

[2] S. Fotios, R. G.-L. R. & Technology, and undefined 2018, “Road lighting research for drivers and pedestrians: The basis of luminance and illuminance recommendations,” *journals.sagepub.com*, vol. 50, no. 1, pp. 154–186, Jan. 2018, doi: 10.1177/1477153517739055.

[3] A. Dubey, A. Gulati, … A. C.-2021 I., and undefined 2021, “Adaptive Headlight System for Reducing the Dazzling Effect to Prevent Road Accident,” *ieeexplore.ieee.org*, Accessed: Dec. 18, 2023. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9776464/.

[4] R. A. Musthafa, … T. B. K.-… in I. J. T. R. D., and undefined 2017, “Automatic headlight beam controller,” *academia.edu*, Accessed: Dec. 18, 2023. [Online]. Available: https://www.academia.edu/download/99241532/IJTRD7846.pdf.

[5] Ylaya, V. J. V., & Arcaya, R. C. A Review on Non-Evasive Groundwater Determination Technique using Electromagnetic Wave Principle.

[6] E. Land, J. Hunt, and V. Roper, *The polarized headlight system*. 1948.

[7] Ylaya, V. J. V., & Arcaya, R. C. Design of Ultra-Wideband Vivaldi Antenna for Software Defined Radio Radar Based with Application to Geophysical Sensor.

[8] D. Gupta, G. Gohil, and M. S. Raval, “Driver Friendly Headlight Controller for Driving in Developing Countries,” Sep. 2015, Accessed: Dec. 18, 2023. [Online]. Available: http://arxiv.org/abs/1509.04636.

[9] G. Mandal, D. Bhattacharya, and P. De, “Real-time automotive night-vision system for drivers to inhibit headlight glare of the oncoming vehicles and enhance road visibility,” *J. Real-Time Image Process.*, vol. 18, no. 6, pp. 2193–2209, Dec. 2021, doi: 10.1007/S11554-021-01104-Z.

[10] Ylaya, V. J. (2020). School Level Information System (IS) Discontinuance Intention: A Case Study on Information System (IS) Discontinuance of Surigao State College of Technology SSCT. Intelligent Information Management, 12(04), 121.

[11] R. A. Musthafa, … T. B. K.-… in I. J. T. R. D., and undefined 2017, “Automatic headlight beam controller,” *academia.edu*, Accessed: Dec. 18, 2023. [Online]. Available: https://www.academia.edu/download/99241532/IJTRD7846.pdf.

[12] K. Xie *et al.*, “Study on the Influence of Opposing Glare from Vehicle High-Beam Headlights Based on Drivers’ Visual Requirements,” *mdpi.com*, 2022, doi: 10.3390/ijerph19052766.

[13] P. F. Alcantarilla *et al.*, “Automatic LightBeam Controller for driver assistance,” *Mach. Vis. Appl.*, vol. 22, no. 5, pp. 819–835, Sep. 2011, doi: 10.1007/S00138-011-0327-Y.

[14] Ylaya, Vrian. (2020). Experimental Analysis using Free Space Measurement for Rapid and Nondestructive Moisture Sensing in Tropical Almond Fruit (Terminalia Catappa L.). International Journal of Emerging Trends in Engineering Research. 8. 3546-3552. 10.30534/ijeter/2020/108872020.

[15] P. Alcantarilla, L. Bergasa, P. Jimenez, … I. P.-M. V. and, and undefined 2011, “Automatic LightBeam Controller for driver assistance,” *Springer*, Accessed: Dec. 18, 2023. [Online]. Available: https://link.springer.com/article/10.1007/s00138-011-0327-y.

[16] A. Dubey, A. Gulati, … A. C.-2021 I., and undefined 2021, “Adaptive Headlight System for Reducing the Dazzling Effect to Prevent Road Accident,” *ieeexplore.ieee.org*, Accessed: Dec. 18, 2023. [Online]. Available: https://ieeexplore.ieee.org/abstract/document/9776464/.

[17] D. Mace, P. Garvey, R. Porter, … R. S.-… F. for T., and undefined 2001, “Countermeasures for reducing the effects of headlight glare,” *denethor.wlu.ca*, Accessed: Dec. 18, 2023. [Online]. Available: http://denethor.wlu.ca/pc300/projects/library/HeadlightGlare.pdf.

[18] S. Ramana Kumar Joga *et al.*, “Limitations of Probable Vehicle Headlight Technologies–A Critical Review,” *iopscience.iop.org*, doi: 10.1088/1757-899X/390/1/012073.

[19] G. Mandal, D. Bhattacharya, P. D.-J. of R.-T. I. Processing, and undefined 2021, “Real-time automotive night-vision system for drivers to inhibit headlight glare of the oncoming vehicles and enhance road visibility,” *Springer*, Accessed: Dec. 18, 2023. [Online]. Available: https://link.springer.com/article/10.1007/s11554-021-01104-z.

[20] V. J. V. Ylaya, “School level is discontinuance intention: A case study on information system is discontinuance of Surigao State College Of Technology,” *Int. J. Phys. Soc. Sci.*, vol. 10, no. 7, pp. 9–18, 2020, Accessed: May 11, 2023. [Online]. Available: https://www.indianjournals.com/ijor.aspx?target=ijor:ijpss&volume=10&issue=7&article=002.

[21] V. J. Ylaya, “Technology Management Practices for Sustainable Sand and Gravel Mining Industry along Surigao del Norte River,” *J. Homepage Int. J. Eng. Sci. Res.*, vol. 8, pp. 2347–6532, 2020.

[22] Ylaya, Vrian Jay. (2020). Power Spectral Density Analysis of Subsurface Electromagnetic Wave (EM) Radar Implemented in USRP 2932. International Journal of Advanced Trends in Computer Science and Engineering. 9. 4515-4520. 10.30534/ijatcse/2020/47942020.

[23] V. J. V. Ylaya, O. J. L. Gerasta, J. M. S. MacAsero, D. P. Pongcol, N. M. Pandian, and R. R. P. Vicerra, “Linear Frequency Modulated Continuous Wave LFM-CW Short-Range Radar for Detecting Subsurface Water Content with Deep Learning,” *2020 IEEE 12th Int. Conf. Humanoid, Nanotechnology, Inf. Technol. Commun. Control. Environ. Manag. HNICEM 2020*, Dec. 2020, doi: 10.1109/HNICEM51456.2020.9400001.

[24] V. Z. Delante, V. J. V. Ylaya, R. R. P. Vicerra, and R. R. Bacarro, “Analysis of Wind Power Potential using the Developed Windmill with Data Logger,” *2021 IEEE 13th Int. Conf. Humanoid, Nanotechnology, Inf. Technol. Commun. Control. Environ. Manag. HNICEM 2021*, 2021, doi: 10.1109/HNICEM54116.2021.9731980.

[25] J, Ylaya. (2020). Improved Design of Binary Full Adder. International Journal of Advanced Trends in Computer Science and Engineering. 9. 4113-4116. 10.30534/ijatcse/2020/239932020.

[26] E. Land, J. Hunt, and V. Roper, *The polarized headlight system*. 1948.

[27] V. Jay, V. Ylaya, and R. R. Bacarro, “Novel Rectenna Design for RF Harvesting,” *Int. Res. J. Adv. Eng. Sci.*, vol. 7, no. 2, pp. 90–93, 2022.

[28] V. Jay, V. Ylaya, and R. T. Buba, “Improved Vortex Channel for Whirlpool Generator for Harnessing Water Flow Energy from Irrigation,” *Int. Res. J. Adv. Eng. Sci.*, vol. 7, no. 2, pp. 68–72, 2022.

[29] P. Alcantarilla, L. Bergasa, P. Jimenez, … I. P.-M. V. and, and undefined 2011, “Automatic LightBeam Controller for driver assistance,” *Springer*, Accessed: Dec. 18, 2023. [Online]. Available: https://link.springer.com/article/10.1007/s00138-011-0327-y.

[30] R. A. Musthafa, … T. B. K.-… in I. J. T. R. D., and undefined 2017, “Automatic headlight beam controller,” *academia.edu*, Accessed: Dec. 18, 2023. [Online]. Available: https://www.academia.edu/download/99241532/IJTRD7846.pdf.

[31] P. F. Alcantarilla *et al.*, “Automatic LightBeam Controller for driver assistance,” *Mach. Vis. Appl.*, vol. 22, no. 5, pp. 819–835, Sep. 2011, doi: 10.1007/S00138-011-0327-Y.

[32] Ylaya, V. J. V., & Malicay, L. G. (2022). Assessment of energy savings potentials at University in Lanao del Norte, Philippines.

[33] S. Roy, B. Annasamy, R. Agrawal, and B. A. Assistant Professor, “Automatic Vehicle Beam Controller,” *ieeexplore.ieee.org*, 2019, doi: 10.1109/i-PACT44901.2019.8960141.
[34] Y. Chen, S. C.- Optik, and undefined 2018, “New method of automatic control for vehicle headlights,” *Elsevier*, Accessed: Dec. 18, 2023. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0030402617315577.