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Development of a Blind Spot Detection System for Motorcyclists

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ABSTRACT – *Side mirrors are an important component of road safety, providing drivers with a clear view of the surroundings of the vehicle, especially at the rear and sides. However, the existence of blind spots, areas that cannot be seen through side mirrors, often increases the risk of accidents. This study aims to develop a blind spot detection system using ultrasonic sensors that can detect objects in the blind spot area and provide warnings to the driver. This system integrates ultrasonic sensors with visual warning signals, such as LED lights, to provide timely warnings about potential risks. Initial tests show that this system works well in detecting objects at appropriate distances and providing timely feedback. With a design that can be easily integrated into motorcycles and other vehicles, this system has the potential to reduce accidents caused by blind spots, especially in congested and high-risk traffic situations. This system offers an innovative solution to enhance road user safety by overcoming driver visibility limitations, thereby reducing the risk of accidents.*

KEYWORDS: Side mirror, blind spot, sensor, accident, motorcycle

1. INTRODUCTION

Rapid technological advances have led to innovations that not only facilitate daily life but also enhance the quality of life and safety. In the field of road safety, one of the main challenges still faced is the issue of blind spots on motor vehicles (Ibrahim et al., 2019). Blind spots are areas around the vehicle, especially on the left and right sides, that the driver or motorcyclist cannot see. Although side mirrors have been designed to help drivers see vehicles behind and beside them, the existence of blind spots that cannot be directly monitored remains a significant safety risk to road users (Hassan et al., 2020).

The issue of blind spots affects not only four-wheeled vehicles; motorcyclists are also exposed to greater risks due to their limited field of vision (Zaman et al., 2020). Vehicles in the blind spot area, especially when they are too close or overtaking, are difficult for motorcyclists to detect. Although various safety systems have been introduced to address this issue, such as wider side mirrors and safety cameras, the blind spot problem remains a major cause of road accidents (Kassim et al., 2019).

To address this issue, Blind Spot Detection System (BST) technology has been introduced in two main categories: detection systems and non-detection systems (Kassim et al., 2019). The detection system uses sensors to detect the presence of objects in the blind spot, while the non-detection system, which is more focused on visual sight, uses cameras to extend the view of the side mirrors, allowing motorcyclists to see more broadly and detect the presence of vehicles that are outside their normal field of vision (Hassan et al., 2020).

Recognizing the importance of addressing this problem, this study aims to develop a Blind-Spot Detection System for Motorcyclists using advanced blind-spot detection technology. This project integrates a detection system using ultrasonic sensors with LED warning lights, helping motorcyclists to detect the presence of vehicles more efficiently and safely. It is hoped that this innovation will reduce the risk of accidents caused by blind spots, thereby enhancing motorcyclists' safety. With the implementation of this technology, road safety can be enhanced, especially in congested and high-risk areas.

1.1 Background of the Study

Motorcycle accidents often receive serious attention because statistics show that motorcyclists are among the groups most exposed to the risk of accidents (Khalid et al., 2021). One of the main factors contributing to these accidents is the presence of blind spots, areas around the motorcycle that the rider cannot see. These blind spots are primarily on the left and right sides of the motorcycle, where the rider's visibility is limited, especially when other vehicles are too close or overtaking.

The blind spot issue arises from the motorcycle's design, which prevents the rider from seeing other vehicles clearly, even with side mirrors installed. These side mirrors provide the rider with a view of vehicles behind and to the sides of the motorcycle. However, motorcycle side mirrors are not sufficient to detect vehicles in the blind spot. This situation exacerbates the risk because riders often overlook the presence of vehicles moving quickly and within a dangerous distance.

In line with this, this study aims to develop a blind-spot detection and motorcycle signaling system that can detect the presence of vehicles in blind-spot areas. Figure 1 shows the blind spot experienced by motorcycles on the road. This system will use motion sensors and blind spot mirrors. The design of this system aims to replace or improve traditional side mirrors, providing motorcyclists with a clearer view and giving early warnings of the presence of vehicles in blind-spot areas. It is hoped that this system will improve motorcyclists' awareness of vehicle presence, thereby enhancing their safety and reducing accident rates caused by blind spots.

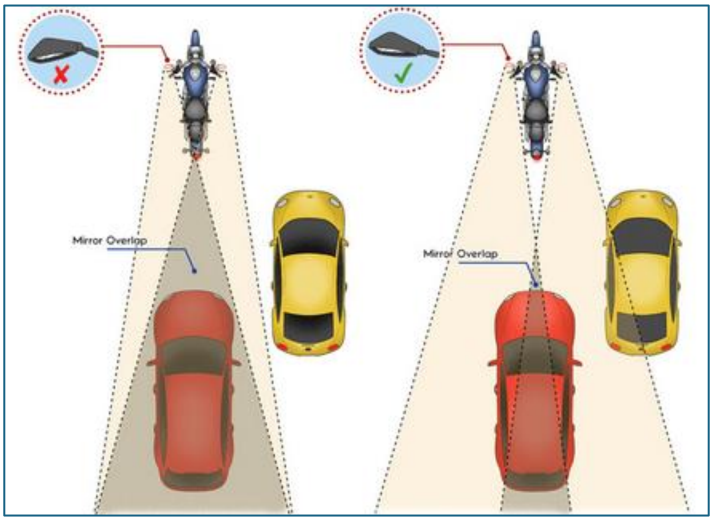

FIGURE 1: Motorcycle blind spots (Rider Magazine)

2. LITERATURE REVIEW

Detection of changes in moving objects across a sequence of images taken at different time intervals is an important field in computer imaging (Elhabian et al., 2008). This method identifies the movement of objects in images and analyzes changes from one frame to the next. The use of this technique is widespread across various disciplines, including surveillance video for security, diagnosis and treatment in medical imaging, remote sensing for environmental monitoring, underwater sensing for maritime research, and applications in civil infrastructure, such as building and road structure inspections (Han et al., 2007).

Furthermore, the Anti-Blind Spot System (ANBLIS) uses motion sensors to detect obstacles around the motorcycle, such as vehicles approaching from the rear or sides. The data collected from these sensors is used to provide early warnings to motorcyclists, either through sound or visual signals, of vehicles that cannot be seen in the side mirrors. In some advanced systems, blind spot monitoring not only provides warnings but can also intervene to implement safety measures, such as controlling the steering or brakes to avoid accidents. This blind spot monitoring technology has been introduced in automotive systems, such as the one used in the Volvo S80 Sedan in 2007, which employs the Blind Spot Information System to enhance driver safety (Ajay & Ezhil, 2016). Therefore, this project aims to adapt similar technology for motorcycles, providing motorcyclists with a higher level of protection by reducing the risk of accidents caused by blind spots.

In general, cameras are used on vehicles as imaging systems to capture the driver's view or the vehicle's exterior view. This camera collects visual data of the vehicle's surroundings, including blind spots and approaching objects. The signals collected by this camera are sent to the vehicle's system for analysis and used to alert the driver to the presence of other vehicles or obstacles that may not be directly visible. This technology enhances safety by providing drivers with early warnings, enabling them to take preventive measures to avoid accidents (Chen & Chen, 2009).

3. METHODOLOGY

This study aims to produce an electronic circuit that functions well and meets the specified requirements through five main steps: component selection, circuit construction, simulation, testing, and troubleshooting. Each step is crucial to ensure the efficiency and effectiveness of the developed circuit.

3.1 Component Selection

Component selection is the first critical step in ensuring circuit efficiency. Components such as resistors, capacitors, and transistors are selected based on value, technical specifications, as well as other factors such as quality, reliability, physical size, and cost. Selecting the right components ensures the circuit functions optimally and meets the specified functional requirements.

3.2 Circuit Construction

After the components are selected, the circuit is constructed by designing the initial circuit sketch. The circuit design is iteratively improved until an optimal solution is reached that meets the study's objectives. The construction of this circuit requires precision in connecting components and verifying each part's function.

3.3 Simulation

Circuit simulations are conducted using software such as Tinkercad to evaluate the circuit's functionality virtually before construction. This simulation enables early detection of weaknesses or potential issues in the circuit design and allows the study of system performance in a safe, controlled virtual environment.

3.4 Testing

After the circuit is built, testing is conducted using equipment such as multimeters and oscilloscopes to ensure the circuit functions according to the specified specifications. This testing also helps ensure the circuit is stable and safe for real-world use.

3.5 Problem Solving

If there are any defects or failures, the troubleshooting process involves identifying the root cause, such as a broken connection or a damaged component. Corrective actions such as component replacement or design modification will be implemented to ensure the circuit functions properly. This process is repeated until the circuit functions stably and meets the specified technical requirements.

Therefore, the methodology of this study provides a systematic approach to the development of stable and efficient electronic circuits. By following these steps, the circuit's performance can be ensured to be consistent and in accordance with the technical requirements outlined in this study.

4. RESULTS AND DISCUSSION

This anti-blind-spot side mirror will function at a distance of less than 2.5 meters (Table 1). When an object is within 2.5 meters or closer, the ultrasonic sensor will detect it and send a signal to the LED and buzzer. Figure 2 shows the schematic diagram of the circuit, and Figure 3 shows the fully connected circuit with the ultrasonic sensor. This system was tested using a program written in the IDE to ensure all components function properly before uploading to the Arduino controller. Once the system is powered on with the power supply connected to a motorcycle battery (12V), the ultrasonic sensor emits ultrasound waves within a certain range. The sensor data will be processed by the controller, which will blink the LED in response to an object or obstacle detected within 2.5 meters (Figure 4).

TABLE 1: Study results

Ultrasonic Sensor (distance/m)	Result
<2.5 meter	LED will light up
>2.5 meter	LED does not light up

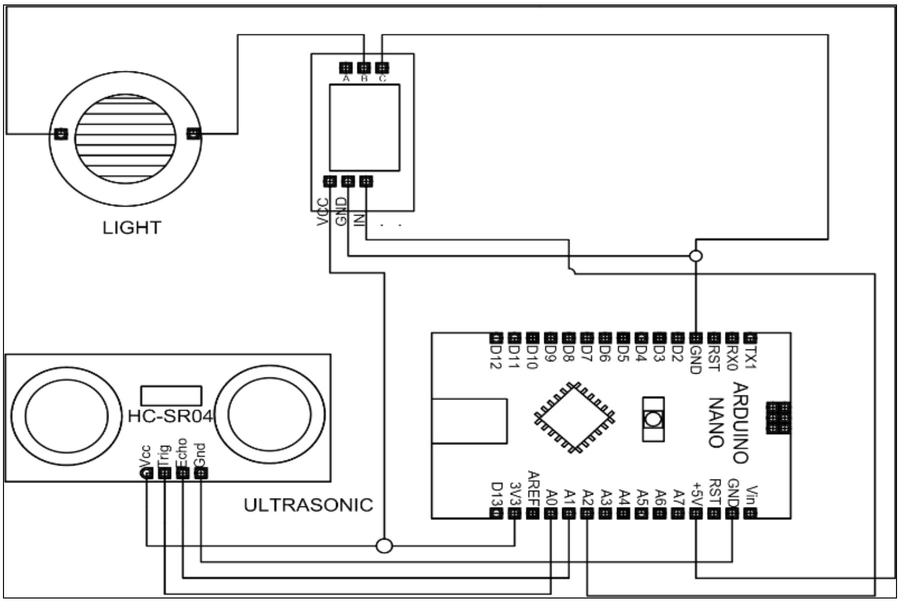

FIGURE 2: Schematic diagram

FIGURE 3: Developed circuit along with the ultrasonic sensor

FIGURE 4: LED lights up after detecting within a 2.5-meter range

This system uses ultrasonic sensors to detect objects around the motorcycle and control the LED as a warning to the rider. If the object is within 2.5 meters, the LED will light to warn that the object is too close and dangerous; if the object is more than 2.5 meters away, the LED will not light, indicating a safe condition. This system provides early warnings to riders, allowing them to take safety measures such as slowing down or not changing lanes, and helps reduce the risk of accidents caused by blind spots. Ultrasonic sensing works well for detecting objects within a specified range, and the LED visual indicator provides quick feedback. Improvements can be made by adding a sound signal, such as a buzzer, as an additional warning, and by increasing the detection range or sensor accuracy for more complex situations and denser traffic.

5. CONCLUSION

This study shows that ultrasonic sensor technology for detecting objects and controlling LEDs has great potential to enhance motorcycle rider safety. By providing early warnings through LEDs, this system enables riders to take preventive actions earlier and avoid accidents. At a distance of 2.5m, the ultrasonic sensor can operate and help riders be more aware of their surroundings. In addition, reducing the risk of accidents caused by blind spots is one of the main advantages of this system. However, improvements such as adding sound signals and increasing the detection range will make this system more effective and provide better protection for motorcyclists.

REFERENCES

Ajay, T. S., & Ezhil, R. (2016). Detecting blind spot by using ultrasonic sensor. International Journal of Scientific & Technology Research, 5(5), 195-196.

Chen, C. T., & Chen, Y. S. (2009). Real-time approaching vehicle detection in blind-spot area. In 2009 12th international IEEE conference on intelligent transportation systems (pp. 1-6). IEEE.

Elhabian, S. Y., El-Sayed, K. M., & Ahmed, S. H. (2008). Moving object detection in spatial domain using background removal techniques - State-of-art. Recent Patents on Computer Science, 1(1), 32-54.

Han, B., Roberts, W., Wu, D., & Li, J. (2007). Motion-segmentation based change detection. In Algorithms for Synthetic Aperture Radar Imagery XIV (Vol. 6568, pp. 206-217). SPIE.

Hassan, M. H. A., Tan, F. Y., Abdullah, M. A., Radzuan, N. Q., & Kassim, K. A. (2020). Does a circular convex blind spot mirror increase the driver's field of view? Journal of the Society of Automotive Engineers Malaysia, 4(1), 44-49.

Ibrahim, M. K. A., Jamil, H. M., Manan, M. A., & Hanowski, R. J. (2019). Roaming the virtual lanes: Motorcyclists' lane filtering-splitting manoeuvres and exposure to road crashes. Journal of the Society of Automotive Engineers Malaysia, 3(2), 229-235.

Kassim, K. A., Laili, M. A., Johari, M. H., Ahmad, Y., & Jawi, Z. M. (2019). ASEAN NCAP's study on the effectiveness of passenger car Blind Spot Technology (BST) to detect motorcycles. Journal of the Society of Automotive Engineers Malaysia, 3(2), 123-138.

Khalid, M. A., Zulkipli, Z. H., Solah, M. S., Hamzah, A., Ariffin, A. H., Amir, A. S., ... & Khamis, N. K. (2021). A review of motorcycle safety technologies from the motorcycle and passenger car perspectives. Journal of the Society of Automotive Engineers Malaysia, 5(3), 417-429.

Zaman, F. K., Abdullah, S. C., Razak, N. A., Pasya, I., Johari, J., & Kordi, N. E. (2020). Risk of vehicle blind spot towards motorcyclist safety in Malaysia: Assessment on perceptions of behaviour. Journal of the Society of Automotive Engineers Malaysia, 4(2), 168-179.