Effects of Different Colours on the Distance Sensor

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***Abstract*—This study examines the effect of colour on the performance of the Infrared Distance Sensor, a sensor often used on robots for object detection and distance measurement. Little has been researched its response to different colours, although colours play a significant role in the formation of sensory perception. This article aims to fill this research gap by examining how colour affects sensor readings at different distances. Analysis of the data on sensory reactions reveals intriguing patterns.**

I. Introduction

The infrared distance sensor is a component used for accurately measuring the distance to objects, for example detecting a person approaching an automatic sliding door or a hand placed under an automatic soap dispenser. It is also often used in Botball [1] tournaments. The infrared distance sensor achieves this by shining infrared light [2] at the object whose distance from the emitter is to be determined and measuring the angle of the reflected infrared light. As the reflection of the infrared light is influenced by different factors, including colour [3], it could be expected to see different sensor output values when comparing differently coloured objects placed at the same distance from the sensor. The extent of the influence that various colours have on the sensor's output has not been researched so far. This study aims to help understand the sensor's exact behaviour in different conditions, thereby possibly increasing accuracy and reliability.

II. Study of Literature

When infrared light hits an object, some of it is reflected. The sensor detects the reflected infrared light. [4] The infrared distance reader measures the time that the emitted infrared light takes to get to the object and return from there. Based on the measured angle of the reflected light, the distance to the object is calculated. This is done using the speed of light and the time it takes to travel around. The calculated distance is then passed to the Wombat.

III. Given Environment

The environment was well-lit to simulate real-world conditions and provide optimal visibility. A bright fluorescent light source illuminates the test area, providing sufficient brightness throughout the test. In this context, experiments are carried out to study how the infrared responds to different colours using available materials.

To conduct the experiment, everyday materials, including duct tape, a block of wood, and sheets of different colored papers are being used. The red lines in Fig. 1 represent the different distances where the sensor is placed.

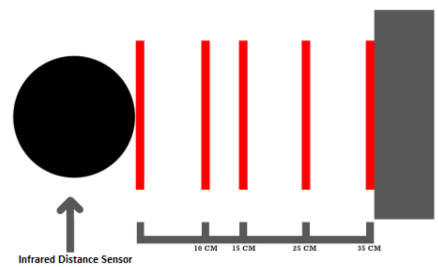

Fig. 1. Experiment setup

The experiment involves placing coloured paper on a wooden block using duct tape. A wooden block serves as a stable platform for placing coloured paper at different distances from the sensor. The Wombat is used to interact with the infrared distance sensor and collect data. This setup allows for the simulation of real-life scenarios in which robots rely on sensors to sense and interact with their environment.

During the experiment, the robot is programmed to record for twenty seconds at a time and relay that data. Every twenty seconds, the robot is placed one stripe closer to the block of wood with the coloured paper. By repeating this test with different coloured paper, one can compare the sensor responses and evaluate the different readings found in colour.

IV. Results and Analysis

At closer distances, small differences in readings are observed depending on colour. As distance increases, greater differences appear, especially between specific colours. The sensor shows higher sensitivity for some colours at longer distances, with green and purple returning higher measurement values compared to other colours. By comparing the results, several observations can be made. First, at closer distances, the colour readings show minimal differences, with most readings falling within a narrow range, as seen in Fig. 2 and Fig. 3. As the distance increases, the effect becomes apparent. For example, at Fig. 4, the readings for green and purple are

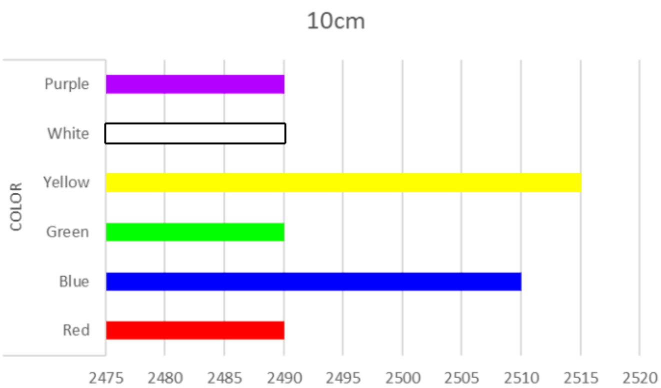

Fig. 2. The result for 10cm

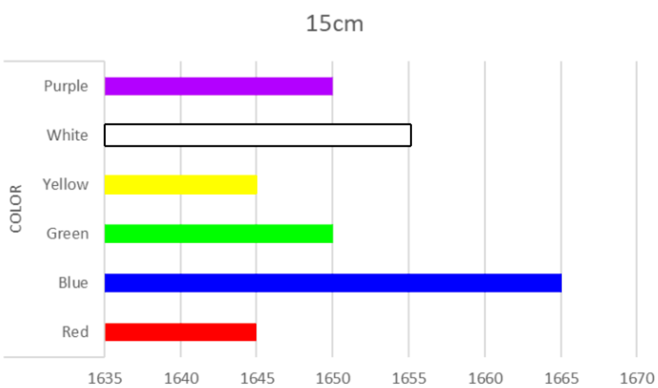

Fig. 3. The result for 15cm

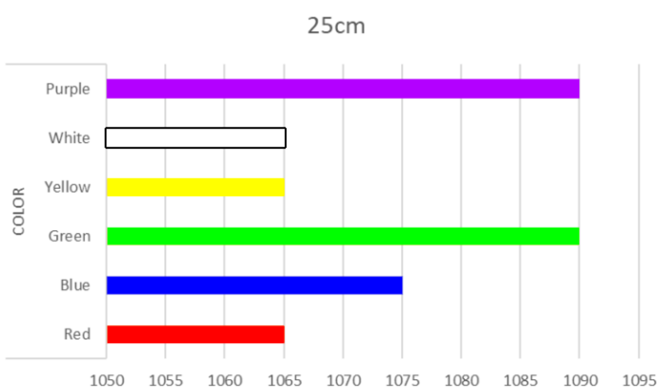

Fig. 4. The result of 25cm

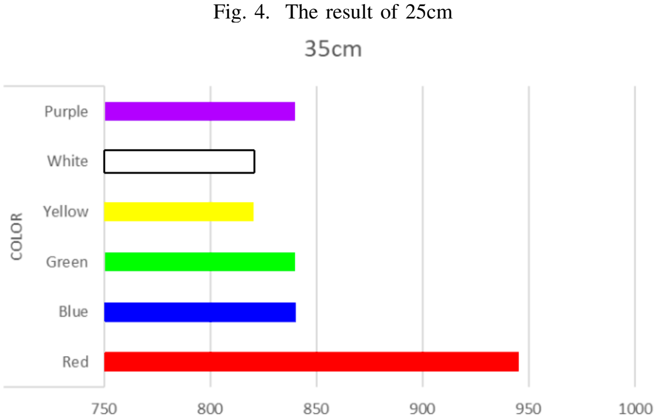

Fig. 5. The result of 35cm

slightly higher than the readings for the other colours, as observed in Fig. 4 and Fig. 5. This suggests that the sensor may be more sensitive to certain colours, such as green and purple, at greater distances. Additionally, at Fig. 5, the readings for blue paper are significantly reduced compared to other colours, indicating a potential limitation in the sensor's ability to accurately detect blue objects at greater distances.

V. Optimizing Sensor Performance: Lessons Learned from Colour Sensitivity Analysis

As distance increases the differences become apparent. The analysis demonstrates a higher sensitivity to certain colours at greater distances. Green and violet show a slight increase in readings in contrast to other colours at a distance of 25 cm. This results highlight potential limitations in sensor performance, especially when detecting certain hues over long distances. By understanding how colour affects sensor readings, customized solutions can be developed to improve the reliability and efficiency of robotic systems in various fields. The infrared distance sensor colour perception study provides a basis for future research and development aimed at optimizing the sensor.

VI. Conclusion

When observing the infrared distance sensor response to different colours and distances, provide promising results for optimizing sensor performance in robotics applications. The experiment reveals patterns in the sensor readings, highlighting the dynamic interaction between colour and distance measurements. This involves considering the importance of color motion through sensors when designing and deploying robotic applications. This experiment illustrates potential limitations in recognition performance, especially when detecting certain colours over long distances. Understanding the complex relationship between colours and sensors has paved the way for the development of solutions to improve the reliability and efficiency of robotic systems in various fields, especially in distance reading. The infrared distance sensor colour perception research lays a strong foundation for future research and development aimed at optimizing sensor performance and expanding the capabilities of robotic technology.

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