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Object Avoidance Robot

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Abstract- The growing demand for safer roads has prompted many companies to do so develop complete self-driving cars. A self-driving car requires a lot various sensors such as gyroscopes, radars, GPS, total stations, etc. and advanced software. This work will focus on the possibilities of using only light sensing devices for a tracking bot and explore its pros and cons. The purpose is to find out which type of light sensor is more suitable for tracking robot and what are the limitations of a tracking robot using this technology. A demonstrator using two light sensors to control speed and direction and a color sensor will be built to avoid obstacles. In addition to choosing the most suitable sensor for the light tracking robot sensing distance and range of the selected will be tested. Explore different light tracking options and accuracy demonstrator, the vehicle will be placed in an open interior with arranged colors light barriers. The robot will be tested both in a completely dark room and in a lighted room room The intention of the result is to see the differences in the behavior of the robots when interference from ambient light is added as another aspect. Test results are presented and the use of different sensors is discussed. The final conclusion about using light sensing in a tracking robot is that it is easy and inexpensive method but should be used as a supplement to other sensing devices not as a separate method.

Keywords- Ultrasonic Sensor, Artificial Intelligence, Navigation

I. INTRODUCTION

A light-following robot, often referred to as a phototropic robot, is an autonomous machine designed to move towards a light source, emulating the natural phenomenon of phototropism observed in certain organisms. This behavior is achieved through the integration of several core components: light sensors, microcontrollers, motors, and a chassis. Light sensors, such as photo resistors or photodiodes, detect the intensity of light from different directions, which the microcontroller processes to determine the direction of the strongest light source. The microcontroller, functioning as the robot's brain, sends commands to the motors based on the sensor data. These motors, attached to wheels or legs, adjust the robot's movement by varying peed and direction, enabling the robot to turn towards and move towards the light source. The chassis provides the structural framework for holding all the components together. The robot's light-following behavior is managed through a continuous feedback loop. Initially, the light sensors measure light intensity, and the microcontroller compares these readings. For example, if the left sensor detects more light than the right, the microcontroller interprets that the light source is on the left. Consequently it adjusts the motor speeds, slowing down the left motor and speeding up the right motor, causing the robot to turn towards the light. This process is iterative, with the sensors constantly providing data, allowing the robot to adjust its path continuously. However, despite their straightforward design, light-following robots encounter challenges, particularly in environments with multiple or fluctuating light sources. The robots must distinguish the target light source and maintain stability, requiring sensitivity adjustments to avoid erratic movements caused by minor changes in light conditions.

II. ABOUT LIGHT FOLLOWING ROBOT TECHNOLOGY

The Light-following robots utilize sensors to detect and track light sources, often employing photodiodes or light-dependent resistors (LDRs). These sensors detect variations in light intensity, enabling the robot to navigate towards or away from the source. Typically used in applications like automated guided vehicles (AGVs) or in hobbyist robotics projects, light-following robots employ control algorithms to interpret sensor data and adjust motor outputs accordingly. This technology finds utility in diverse fields, from industrial automation to educational robotics, offering a tangible demonstration of Sensor-based navigation systems and fostering exploration in robotics and automation.

III. LITERATURE SURVEY

A literature survey on light-following robots reveals a rich landscape of research spanning various disciplines, including robotics, computer vision, and artificial intelligence. Early works focused on basic light-seeking behaviors using simple photo detectors and feedback control systems. For instance, researchers developed robots capable of moving towards a light source by employing rudimentary algorithms based on light intensity measurements. As technology advanced, more sophisticated approaches emerged, incorporating computer vision techniques for light source localization and tracking.

These robots often utilize cameras to capture images of the environment, employing image processing algorithms to detect and analyze light sources. Machine learning algorithms have also been increasingly applied to improve the robustness and adaptability of light-following robots, enabling them to learn and adapt to diverse lighting conditions and environmental contexts.

Moreover, recent advancements in sensor technology, such as depth sensors and LDR, have enabled robots to perceive their surroundings in three dimensions, enhancing their ability to navigate towards light sources admist complex environments. Additionally, research in swarm robotics has explored collective behaviors, where groups of light-following robots collaborate to achieve common objectives efficiently. Overall, the literature on light-following robots demonstrates a progression from basic light-seeking behaviors to more sophisticated and adaptive systems, driven by advancements in sensing, computational power, and algorithmic approaches.

These developments pave the way for applications in various domains, including search and rescue, environmental monitoring, and autonomous navigation. In summary, the light-following robots reflects a journey of innovation and evolution, from rudimentary light sensors to sophisticated vision-based systems, spanning various application domains and drawing inspiration from both nature and technological advancements. The literature survey on light-following robots reflects the continuous evolution and interdisciplinary nature of robotics research, with contributions from various fields \driving advancements in sensor technology, algorithms, and real-world applications.

IV. PARTS OF THE SYSTEM

1. Arduino UNO

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again

Figure 1: arduino Uno

This IDE is accessible both online and offline, providing a user-friendly platform for coding and development.

2. ML293D Motor Driver

The L293D is a standard motor driver integrated circuit (IC) that facilitates the operation of DC motors in either direction. With its 16-pin configuration, the L293D can control a pair of DC motors simultaneously, allowing movement in both forward and reverse directions. This means that a single L293D IC can effectively manage the operation of two DC motors.

Figure 2: ML293D motor driver

3. TT Gear Motor

The obstacle detection and avoiding robot uses two 200rpm and 12V DC geared motors. The motor used has a 6mm shaft diameter with internal holes. The internal holes are for easy mounting of the wheels by using screws. It is an easy to use

Figure 3: TT Gear Motor

lowcost motor for robotics application An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force. The direction of mechanical force is given by Fleming's Left-hand Rule and its magnitude is given by F = BIL Newton. DC motors are seldom used in ordinary applications because all electric supply companies furnish alternating current.

4. LDR Sensor

Figure 4: Ultrasonic sensor

A Light Detecting Resistor (LDR), also known as a photo resistor or photoconductive cell, is a type of resistor whose resistance decreases as the intensity of light incident on it increases. LDRs are made from semiconductor materials such as cadmium sulfide (CdS) or cadmium selenide (CdSe). When light photons strike the surface of the LDR, they excite electrons, allowing them to move from the valence band to the conduction band, thereby reducing the material's resistance. LDRs are widely used in various applications due to their simplicity, cost-effectiveness, and responsiveness to light.

They are commonly found in devices like light meters, streetlights, alarm systems, and light-activated switches. For example, in street lighting, an LDR can automatically turn on the lights when it gets dark and turn them off when daylight is detected, conserving energy. One of the key characteristics of LDRs is their slow response time compared to other light sensors such as photodiodes or phototransistors. This means that while they are excellent for applications where the light intensity changes slowly, they are less suitable for applications requiring rapid response to light changes. Furthermore, their sensitivity to light and spectral response can vary significantly with temperature and aging, which might require calibration or adjustment in precision applications.

Overall, Light Detecting Resistors are a crucial component in many light-sensitive applications, providing a straightforward and effective means of detecting and responding to changes in ambient light levels involved in the light following robot..

V. RESULT

The light-following robot successfully navigated through the maze, demonstrating its efficiency in sensing and res-ponding to its environment. With precision, it followed the designated path, adjusting its movements as necessary to stay aligned with the light source. Its responsive behavior and accurate tracking show cased the effectiveness of its programming and sensors. Spectators marveled at its ability to maneuver seamlessly, noting its potential applications in various fields, from automated logistics to search and rescue operations. Overall, the robot's performance exemplified the advancements in robotics technology, promising exciting possibilities for future developments.

VI. CONCLUSION

A light-following robot represents a significant step in the field of autonomous systems and robotics, high lighting the intersection of technology, engineering, and artificial intelligence. This type of robot is designed to detect and move towards light sources using sensors and actuators, embodying principles of responsive behavior and environmental interaction. The construction and programming of a light-following robot involve integrating photo detectors, microcontrollers, and motor systems to create a responsive mechanism capable of navigating its surroundings based on light stimuli. Such robots have practical applications in various fields, including automated solar tracking systems, search and rescue missions, and environmental monitoring. The project encourages innovation and problem-solving skills, preparing individuals for advanced studies and careers in robotics and related disciplines. Overall, the creation and deployment of a light-following robot underscore the advancements in robotics, showcasing how intelligent machines can be engineered to perform specific tasks with efficiency.

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