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Human Following Robot Using Ultrasonic Sensor

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ABSTRACT

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In this report, the moving item is tracked using rotation angle readings from the servo motor and distance values from the ultrasonic distance sensor. You must forecast them in order to choose the right course or go the shortest distance, depending on the surroundings. Therefore, it is necessary to compare the two tracking methods in order to demonstrate that the proposed tracking method, which uses an ultrasonic distance sensor and servo motor as input elements, is more accurate and cost-effective than the tracking method, which uses vision, LRF, and multiple ultrasonic sensors as input elements. Furthermore, it has been demonstrated that using an intermediary filter improves tracking accuracy.

KEYWORDS: Artificial intelligence, IR and ultrasonic sensors, Arduino microcontroller, and human tracking.

1. INTRODUCTION

Mechanical engineering, electrical engineering, information technology, computer science, and other multidisciplinary technical and scientific disciplines are all included in the area of robotics. Robotics entails the creation, maintenance, and usage of robots as well as robotics' use of computer systems for information processing, sensory feedback, perception, and control. In order to help and aid humans in their daily lives while also assuring everyone's safety, robotics attempts to develop intelligent machines. Robotics creates devices that can mimic human behavior and replace people. Robots can be utilized for a wide range of tasks and applications, but today, many of them are employed in risky situations (such as the identification and deactivation of bombs, radioactive inspection, etc.), manufacturing processes, or environments where humans cannot survive (such as space or underwater, etc.). In recent years, robot technology has made considerable advancements. Only a few years ago, such advances looked like a pipe dream. We do, however, require robots that can interact and coexist with people in this quickly changing environment, such as human-following robots. A system that enables robots to see humans and respond appropriately is necessary for this task to be completed accurately. Robots must possess the necessary intelligence to follow people both indoors and outdoors, in busy areas. The image processing used to visually collect data about the environment is quite important. Please remember the following as you move on. The amount of light should be extremely constant and should not change. For the required environment to be tracked, the scope must be specified appropriately. The target shouldn't be too far from the visual sensor since distance is crucial. Avoid using hues near the robot that are the same as the desired color. If not, the robot will become perplexed. To find and follow the target, all of the sensors and modules cooperate.

2. Literature Survey

[1] According to this article, a person with strong eyesight might employ the following strategy depending on the illumination. Laser distance sensors and colour stereo cameras are used in the people tracking technique. Based on the scene image, the HSV colour space of colour stereo cameras, and distance data from laser distance sensors, person detection is possible. We utilise a human service robot and an inverted pendulum robot (Segway RMP) with the proposed human tracking system (Neon). Those conducting tests in both indoor and outdoor settings attest to the effectiveness of the suggested approach.

[2] In this work, we put up a solution to the issue of mobile robots employing multi-sensor data fusion approaches for human recognition and localisation. This remedy is intended for motorised baggage carts. Using an omnidirectional camera to detect target persons visually, this system then employs LRF to find and track those individuals. This method comprises of two phases: identification and localization phase and registration phase. All required information is gathered during the registration step, including patches from clothes. A modified pattern matching technique is used for identification, making it

appropriate for real-time applications. A location history structure is used to implement tracking, keeping track of the whereabouts of all nearby items and recognized people. To evaluate the success of the suggested strategy, we put it into practice in a set configuration.

[3] This post details how methods for locating and monitoring users of service robot apps are currently progressing. Both an LRF and an omnidirectional camera are mounted on the robot. Our method relies on multi-sensor fusion and employs panoramic photos for person identification and LRF for person tracking. Target selection is used in the event where several candidates are identified in order to enhance discriminating. Mobile robots have effectively adopted our strategy. To highlight the effectiveness of the suggested strategy, a simplified subject-following behaviour is used. The usefulness of the method for recognising and tracking persons indoors has been shown in a number of trials.

[4] Following humans is a crucial duty for mobile services and home robots in applications where human-robot contact is a crucial necessity. This article outlines a method for accurately tracking individuals in a domestic setting that combines stereo vision and appearance models. During the automated model acquisition phase, stereo vision aids in getting a very excellent segmentation of the picture for identifying individuals and locating them in the surrounding area. Tasks in a dynamic and congested environment are carried out by the navigation engine and high-level people tracking behavior. To prove the viability of the suggested strategy, experimental findings are shown.

[5] The method for human-robot interaction described in this article combines visual and laser range data. Laser scans are used to extract human legs, while camera photos are used to identify faces. This data is included in a detection procedure that provides the direction and proximity of persons nearby. Mobile robots will ultimately utilize this to approach and communicate with people. Unlike previous applications of a similar nature, our approach operates effectively in real time even with constrained computational resources. Experimental findings demonstrate the system's superior performance.

3. COMPONENTS SPECIFICATIONS

The ATmega328 serves as the foundation for the Arduino Uno microcontroller board (datasheet). It features 6 analogue inputs, a 16MHz ceramic resonator, a USB port, a power connection, an ICSP header, and a reset button. It also has 14 digital input/output pins, six of which may be used as PWM outputs. Start it either by using an AC-DC converter or battery, or by connecting it to your computer via a USB cable. The FTDI USB-to-Serial driver chip is not used on the Uno, which is how it differs from all preceding boards. Instead, a USB to serial converter is included into the Atmega16U2 (and Atmega8U2 up to version R2) software. The board's third revision includes the following new functions:

- Pinout: The shields can adjust to the voltage supplied by the board thanks to the newly introduced SDA and SCL pins that are close to the AREF pin and two other new pins that are close to the RESET pin, the IOREF. The Arduino Due and shields will ultimately be compatible, which runs on 3.3V, and the board that uses the AVR, which runs on 5V. The second pin is unconnected and is set aside for a future use.
- A more robust RESET circuit.
- Atmega 16U2 is used instead of 8U2. The Italian word "Uno," which means "one," was chosen to symbolise the imminent release of Arduino 1.0. Moving forward, the reference versions of Arduino will be the Uno and version 1.0. The Uno is the newest in a line of USB Arduino boards and acts as the standard for the system; you may compare it to earlier iterations by visiting the index of Arduino boards.

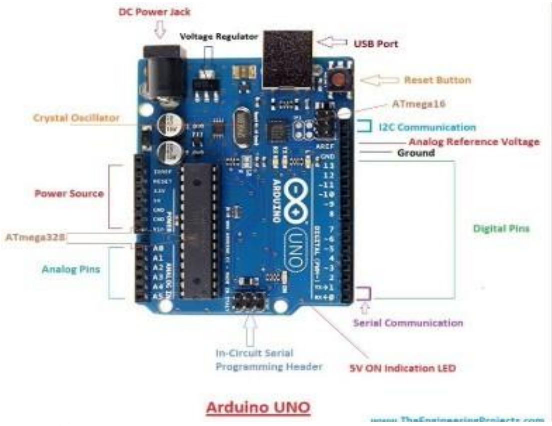

Fig.1. ARDUINO UNO

6.DC MOTORS

Any source of energy may be transformed into mechanical energy or motion by a DC motor. Motors often play a significant part in the construction of a robot, providing the robot with motion. The robot in this instance is propelled by four he-she DC motors.

7.MOTOR SHIELD

A motor driver module called the Motor Shield enables you to use an Arduino to control the motor's direction and speed. Through pin inputs, either an external 6V-15V power supply or the Arduino may power the motor shield directly. The L293D IC is intended to function with the motor driver board in this instance.

8.IR SENSOR

An electrical device that produces light to perceive a certain feature of the environment is called an infrared sensor. IR sensors can gauge an object's temperature or identify movement. These kinds of sensors simply measure infrared radiation; they do not emit it. It is referred to as a passive IR sensor. In general, all infrared-emitting things give out some sort of heat radiation. Our eyes cannot see this sort of radiation, but infrared sensors can pick it up. The detector is merely an IR photodiode that reacts to infrared light with the same wavelength as the output of the IR LED as the emitter (Light Emitting Diode). The output voltages of the resistors and their resistance vary according to the strength of the incoming IR light.

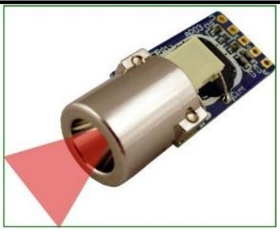

Fig.4. IR SENSOR

9. ULTRASONIC SENSOR

An ultrasonic sensor is a device that uses ultrasonic waves to gauge a distance to a target.Transducers are used by ultrasonic sensors to transmit and receive ultrasonic pulses, which provide data on the proximity of objects. High-frequency sound waves produce an echo pattern when they hit walls and other obstructions.

Frequencies exceeding the range of human hearing are used in ultrasound vibration. A microphone that transmits and receives ultrasonic waves is referred to as a transducer. Like many other ultrasonic sensors, ours transmit pulses and listen for echoes using a single transducer. The location of a sensor measures the sound pulse's distance.

Fig. 3. ULTRASONIC SENSORS

3. METHDOLOGY

The goal is to create a fully autonomous, human-following robot using a rigorous research strategy. This project employs the distributed top-down paradigm. He divided the task into five portions. Each module operates separately from the others. Beginning with fundamental sensor testing, we progressed step by step through a number of stages, including obstacle avoidance, object identification, object tracking, and data transfer. With a decentralised strategy, every module and sensor operates independently. In order to command the robot to move in a certain direction, the data collected from numerous sensors and modules is processed collectively and intelligent judgements are made based on the results. There are two distinct units utilised. A CPU handles processing, while an Arduino board serves as the controller for information from sensors. To exchange visual acquisition data, a serial link is created between the controller and the CPU. The system as a whole was not affected by the breakdown of one of the modules, making this strategy the most successful.

This strategy worked best since a problem in one module would not have an impact on the system as a whole. As a consequence, this delivers the most accurate results available. Tracking people, avoiding obstacles, keeping a set distance from the item, and establishing communication.

The Human Following Robot 81 link between microprocessor and controller is one of the project's main design and development components.

4. RESULTS AND DISCUSSION

The performance of the human following robot was tested in a variety of studies. The infrared and ultrasonic sensors were tested. It was observed that the sensor operated precisely within a 4 meter range. The robot's ability to maintain a certain distance from the target item was next tested. Then, the motor shield, Arduino, and several motors were tested for serial connection. We adjusted the processing and control algorithm as needed based on the findings of these tests and trials. After everything was done, we saw that the outcomes were really pleasing and that the robot followed the human around with flawless accuracy. Thus, the goal of developing a successful human-robot interaction was accomplished.

5. CONCLUSION

This white paper describes a successful human implementation of a robot-following prototype. This robot not only has the ability to perceive, but also has the ability to follow. When building this prototype, care was taken to ensure that the robot's function was as efficient as possible. Tests were run under a variety of conditions to identify and correct algorithmic errors. Another advantage is the various sensors built into the robot. A human-following robot is a vehicle system that can detect obstacles, move and change the position of the robot towards the object, and stay in its path. To accomplish our objective in this project, we will utilise Arduino, a motor for various types of sensors. The task required the team to work together, communicate, and comprehend how

Mechanical systems, electronics, and programming are all related.

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