Human Following Robocar

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Abstract—A robot is a machine that can do things autonomously as well as supervision. This research paper describes the creation of an autonomous robot car capable of following a human and detecting and avoiding obstacles in its route. The robot car will be built with an Arduino uno, an ultrasonic sensor, an infrared sensor, and other necessary components such as a motor driver, a servo, DC motors, and batteries as a power source. The system is designed to detect and track the presence of an individual based on their movements. Furthermore, the ultrasonic sensor identifies and prevents accidents with objects in the robocar's route. The system's effectiveness will be assessed through experiments in various environments and scenarios, demonstrating its ability to track, follow, and avoid obstacles. Overall, this project demonstrates the potential of combining simple and inexpensive technologies to create an intelligent robot car capable of performing complex tasks.

Keywords—robot, ultrasonic, infrared, Arduino uno, human following, car, motor.

I. INTRODUCTION

Technology, particularly sensors, has advanced rapidly in fields such as industry, home automation, healthcare, robotics, and environmental monitoring over the last several decades. A sensor can detect or measure the physical, chemical, or biological properties of an environment, and then convert the data into an electrical or other detectable signal.

Today, artificial intelligence algorithms are used to create robot systems. These robot systems are fed with a variety of algorithms to fully understand how humans think, and these are further developed with the assistance of sensors embedded within the robot systems. There are many different types of autonomous robot systems, such as puzzle builders, snake robots, walking robots, maze solvers, and so on, but this project will focus on an autonomous human following and object detection and avoidance robotic car.

II. LITERATURE SURVEY

Title of Project & Year	Description	Drawback
Remote and autonomously controlled Arduino-based robotic car with true obstacle detecting and preventing (2018)	This project employs infrared sensors and an Arduino to control a robotic automobile that senses its surroundings in real time and avoids obstacles.	The amount of time required to deal with obstacles is excessive.
Autonomous Office Assistant Robot with Line Following and PID Algorithm (2018)	In this project, the PID algorithm is used to guide the robotic car along a course or line, and ultrasonic sensors are used to detect impediments.	If the line markers are too faint or unreadable, the robot car does not appear to stop or move.
Line Follower Robots Controlling, Working Principle and Applications (2017)	This project discusses and explains the concept of a robotic car that follows a route or line.	Only the operation and the principle are described. The project is not completed.

III. METHODOLOGY

The basic block diagram for the robot system is shown below:

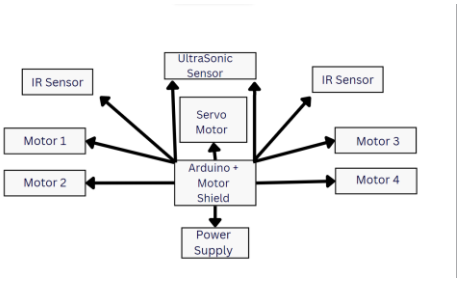

fig1: block diagram of human following robocar

Flow Chart:

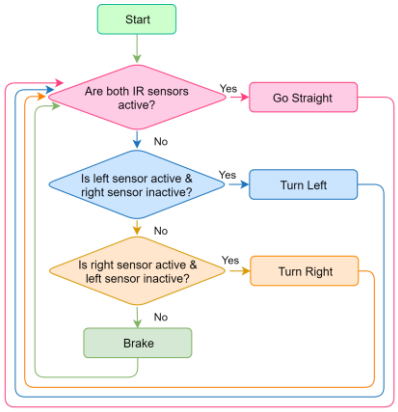

fig2: flowchart of human following robocar

Circuit Diagram:

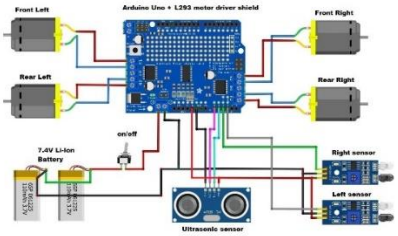

fig3: circuit diagram of human following robocar

HARDWARE COMPONENTS:

i. Arduino UNO: It is a popular open-source microcontroller board that supports a wide range of sensors and actuators, making it an excellent choice for developing interactive projects. It is built around the ATmega328p microcontroller.

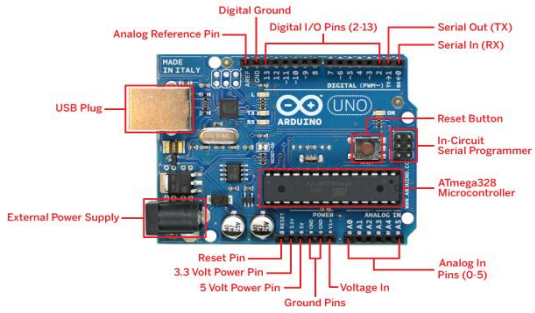

fig4: Arduino board

ii. Ultrasonic sensor: An ultrasonic sensor is a gadget that measures distance using sound waves or locate objects. High-frequency sound waves are sent through a transducer and the echoes that return from objects are then detected. By timing how long the sensor can compute the distance to an object in the time it takes for the echo to return.

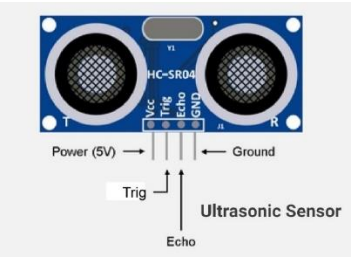

fig5: Ultrasonic Sensor

iii. Infrared sensor: A device that detects infrared radiation in its surroundings is known as an infrared sensor. In order to work, infrared radiation is created and measured, which is a form of electromagnetic radiation with wavelengths longer than visible light. Using a specific wavelength range, the sensor detects and measures objects' proximity, movement, or temperature.

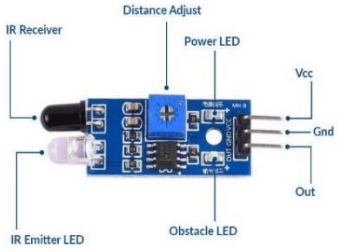

fig6: Infrared Sensor

iv. Motor Driver IC: The speed and direction of a motor are controlled by an electrical component known as an integrated circuit (IC). It is a sophisticated semiconductor that converts digital signals from a microcontroller or other control device into high-current impulses capable of driving a motor.

fig7: Motor Driver IC

v. DC Motors: Electric motors that transform electrical energy into mechanical energy are known as direct current (DC) motors. They produce a magnetic field by acting between a spinning and stationary component known as the rotor and the stator. When a current flows through one or more wire coils in the stator, they generate a magnetic field. The rotor is a permanent magnet or an electromagnet that is drawn to the magnetic field produced by the stator and rotates as a result.

fig8: DC Motors

vi. Jumping wires: These are the connecting wires that are used to connect all components and ensure that data flows smoothly.

fig9: Jumping wires

vii. Push button / Switch: To turn on the power flow to the system.

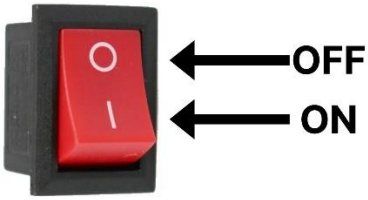

fig10: Switch

viii. Wheels: Wheels are external body parts that are required for the robot car to move smoothly.

fig11: DC Motor Wheels

ix. Battery: The robot car system and all of its equipment are powered by a battery. Make sure these batteries are rechargeable so we don't have to keep changing them, which will save money and make the project more cost effective.

fig12: Battery

x. Servo Motor: A servomotor is a rotational or linear actuator that can regulate angular or linear position, velocity, and acceleration precisely. It consists of an appropriate motor connected to a position feedback sensor.

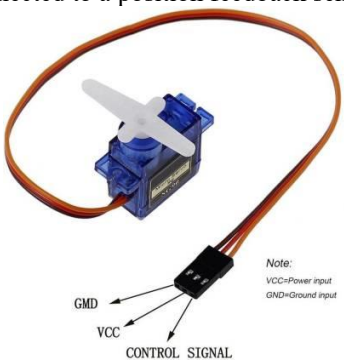

fig13: Servo motor

SOFTWARE COMPONENTS: -

i. Arduino IDE: - It is an integrated development environment in which one writes code for a system based on their needs and specifications.
ii. Tinker cad: - For virtual simulation of the robot car, as well as to ensure that the code is running properly and performing the functions.
iii. Proteus: - Similar to Tinker Cad, it is used for simulation.

IV. PROPOSED METHODOLOGY:

- Gathering the necessary components: The first step in constructing the human-following car is to obtain the necessary components, which include an Arduino Uno microcontroller, an infrared sensor, an ultrasonic sensor, DC motors, a motor driver, a servo motor, a power source (batteries), and other necessary components.
- Designing the robot car: The design of the robot car should be planned and sketched, including component placement, dimensions, and overall appearance. Weight distribution, balance, and

manoeuvrability should all be considered in the design.

- Building the chassis: The chassis of the robot car should be built once the design has been finalised. This can be accomplished with metal, plastic, or wood. The chassis should be strong enough to support the weight of the components and keep the robot car stable.
- Wiring the components: The components should be wired and connected in accordance with the schematic diagram. This includes connecting the motors to the motor driver, the sensors to the microcontroller, and the system's power source.
- Programming the microcontroller: The Arduino microcontroller should be programmed to control the robot car's movements and behaviour. The code should include instructions for reading sensor data, calculating distances and angles, and controlling the motors and servo motor.
- Testing and debugging: After assembling and programming the robot car, it should be tested and debugged. This includes testing the robot car's movement and behaviour, ensuring the accuracy of sensor readings, and identifying and correcting any errors or bugs in the code.
- Evaluation: Experiments in various environments and scenarios should be conducted to assess the effectiveness of the human-following car. The evaluation should show the system's ability to track and follow a human while avoiding obstacles in its path.
- Documentation and dissemination: The process of building and testing the human-following car, including design, construction, programming, and evaluation, should be documented. This documentation can be disseminated in a variety of ways, such as research papers, technical reports, or online tutorials, to assist others who are interested in building similar systems.

The human who is following Infrared sensors are used by robot cars to track and follow people along the track, while ultrasonic sensors are used to find paths and avoid obstacles.
Four of the fourteen digital pins on the Arduino board are used to power the car's dc motors, which are attached there for movement. (D10, D11, D12, and D13)

Movement	D10	D11	D12	D13
Forward	1	0	0	1
Backward	0	1	1	0
Left	1	0	1	0
Right	0	1	0	1

Depending on sensor detecting and signal processing, these DC Motor actuators are used to drive the robot car ahead, backward, left, and right.
There is also a servo motor integrated along the head of the robot, which assists the ultrasonic and infrared sensors in moving around their necks according to the angle set by the programme, as well as finding appropriate pathways and followings.

Ultrasonic and IR Sensor Principle: -
The ultrasonic sensor for the robot vehicle system is mounted on top, or on the servo motor's head, and is linked to two infrared sensors.
Within a 4-meter range, the ultrasonic sensor must operate precisely. The operation of ultrasonic sensors requires the computation of time differences. (Trigger and echo pins are used.)
Infrared sensors determine the distance between two objects by using infrared radiation. When the transmitter's beam finds an object, it returned to the recipient with an aspect after reflect, commonly known as the triangulation technique. This assists in the estimation of the robot's distance travelled and avoids any further inaccuracy in the robotic movement caused by displacement. The IR sensor regulates motor movement, while the ultrasonic sensor detects and stops the motors.

V.SCREENSHOT OF PROJECT:

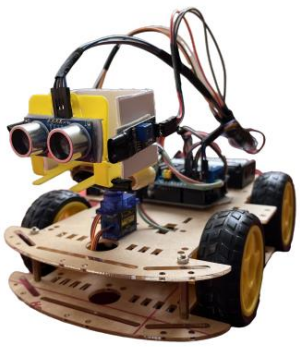

fig14: picture of human following robocar

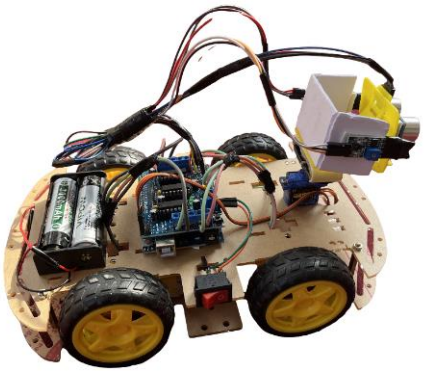

fig15: picture of human following robocar

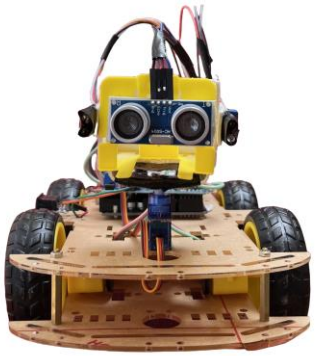

fig16: picture of human following robocar

VI. APPLICATIONS:

With rapid growth of technology in the present era, we were able to interpret that we need such robots. With minor modification they can act as a human companion. And can also be used for performing limitless task that can be done in library to carry loads or in healthcare industry to assist doctors with their equipment's or as a fun toy in a life too.

VII. RESULTS:

Currently, our project work has been completed to the point where we have successfully integrated all of the components except the IR sensor, and our ultrasonic sensor detects obstacles, avoids them, and automatically finds a path for itself. We will modify it as soon as possible for further integration and development for both automatic detection and human following.

VIII. CONCLUSION & FUTURE SCOPE:

This demonstrates a successful implementation of a prototype of the robot's obstacle avoidance as well as human following capabilities. It was critical to remember that the robot's tasks should be as effective as feasible while constructing the prototype.

A human-following robot is a vehicular system that can identify impediments, move, and alter its location in relation to the subject to stay on track. This project achieves its purpose by utilising an Arduino, motors, and a multitude of sensors. This project allowed the team to collaborate, communicate effectively, and gain a better understanding of how mechanical systems, electronics, and programming are all linked.

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