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SMART DELIVERY ROBOT USING ARDUNIO

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ABSTRACT

Autonomous Robot is one of the most important aspects of Robotics. Our autonomous robot is actually a line follower robot which is able to follow either a black or white line that is drawn on the surface consisting of a contrasting color. It is designed to move automatically and follow the made plot line. The oath can be visible like a black line on a white surface or it can be invisible like a magnetic field. It will move in a particular direction Specified by the user and avoids the obstacle which is coming in the path. Autonomous Intelligent Robots are robot that can perform desired tasks in unstructured environments without continuous human guidance. It is an integrated design from the knowledge of Mechanical, Electrical, and Computer Engineering. IR sensors based autonomous line follower robot design and Fabrication procedure which always direct along the black mark on the white surface. The robot uses several sensors to identify the line thus assisting the bot to stay on the track. The robot is driven by DC motors to control the movements of the wheels.

The idea of autonomous robot evolved as an alternative for the classical driver-based transport mediums. Classical transport mediums possess many limitations in terms of reliability and cost of operation. Based on the principles of robotics, line follower robot provides some promising solutions to various difficult problems in transport systems. These kinds of robots are expected to fulfil the future needs of transportation to solve various difficult problems in the field of transportation. Such line follower robots provide greater efficiency than the classical transport mediums for certain very important applications.

In this research work, Arduino based Autonomous Robot for Load, Unload and Transportation Application; our aim is to design a line follower robot which can transport a small quantity of load to various destinations inside a campus by following black line on a bright surface. Basically, the robot we have made has two main parts. First one is the robot chassis with the delivery tray and the second one is the IoT enabled communication setup and RF based security for the open close setup of delivery tray. Robot can be called for delivery service by using the Android app, to any location inside the campus. The function of the delivery tray is to take the goods and holding it securely. Then the bot will go to the other end of the line and stops. Then the robotic delivery tray will open only after the verification of receiver. After this the robot will go to the starting position and then the whole process repeats again.

1. INTRODUCTION

Robotics has achieved its greatest success to date in the world of industrial manufacturing. Robot arms, or manipulators, comprise a 2-billion-dollar industry. Bolted at its shoulder to a specific position in the assembly line, the robot arm can move with great speed and accuracy to perform repetitive tasks such as spot welding and painting. In the electronics industry, manipulators place surface-mounted components with superhuman precision, making the portable telephone and laptop computer possible.

Yet, for all of their successes, these commercial robots suffer from a fundamental disadvantage: lack of mobility. A fixed manipulator has a limited range of motion that depends on where it is bolted down. In contrast, a mobile robot would be able to travel throughout the manufacturing plant, flexibly applying its talents wherever it is most effective.

The autonomous robot is a robot that performs behaviours or tasks with a high degree of autonomy, which is particularly desirable in fields such as space exploration, household maintenance (such as cleaning), waste water treatment and delivering goods and services. Some modern factory robots are "autonomous" within the strict confines of their direct environment. It may not be that every degree of freedom exists in their surrounding environment, but the factory robot's workplace is challenging and can often contain chaotic, unpredicted variables. The exact orientation and position of the next object of work and (in the more advanced factories) even the type of object and the required task must be determined. This can vary unpredictably (at least from the robot's point of view).

An autonomous line follower robot is basically a robot designed to follow a line or path already predetermined by the user. This line or path may be as simple as a physical black line on the floor or as complex path marking schemes e.g., embedded lines, magnetic markers and laser guide markers. In order to detect these specific markers or lines, various sensing schemes can be employed. These schemes may vary from simple low-cost line sensing circuit to expansive vision systems. The choice of these schemes would be dependent upon the sensing accuracy and flexibility required. From the industrial point of view, line following robot has been implemented in semi to fully autonomous plants. In this environment, these robots' functions as materials carrier to deliver products from one manufacturing point to another where rail, conveyor and gantry solutions are not possible. Apart from line following capabilities, these robots should also have the capability to navigate junctions and decide on which junction to turn and which junction ignore. This would require the robot to have 90 degrees turn and also junction counting capabilities. To add on to the complexity of the problem, sensor positioning also plays a role in optimizing the robot's performance for the tasks mentioned earlier.

Autonomous line follower robots with pick and placement capabilities are commonly used in manufacturing plants. These move on a specified path to pick the components from specified locations and place them on desired locations. Basically, a line follower robot is a self-operating robot that detects and follows a line drawn on the floor. The path to be taken is indicated by either a white line on a black surface or by a black line on a white surface. The control system used must sense the line and manoeuvre the robot to stay on course while constantly correcting the wrong moves using feedback mechanism, thus forming a simple yet effective closed-loop system.

2. MATERIAL AND METHODS

AT mega 2560 controller board ,HC SR-04 Ultrasonic Sensor, Geared DC Motor,L293D Motor Driver ,RC 522 RFID Reader,16x2 LCD display ,ESP 8266 Wi-Fi module,6ch IR Array sensor, Servo Motor ,Buck Converter,12v Li-ion battery

Study Design:Companies like Starships, Door Dash, and Kiwi deployed their outdoor delivery robots with 90% autonomous navigation facility. These robots can navigate through large through footpath using certain path planning algorithms.

3. HARDWARE

Line follower robot detects white surface with the help of sensor and then feeds the signal to Arduino. Then according to the output given by sensors Arduino drives the motors. Sensors i.e., IR sensors modules namely left sensors and right sensor are used in this set up. The robot will move forward when both right and left sensors are on white path. The robot will turn left when the left sensor is on black path and right sensor on white path. A complete opposite process occurs when the right sensor is on black path. On detecting the surface except black robot continues moving forward. When both sensors are on black surface the robot will stop. As depicted in the figure 1, sensors are used to identify the line. For line identification logic, two IR Sensors with IR LED and photodiode are mounted. The light emitted by IR LED will be detected by photo diode, whenever they come near to a reflective surface. The image (fig number) below portrays the working of a quintessential IR Sensor (IR LED – Photodiode pair) in front of a white surface and a black surface. As the reflecting percentage of the light color surface is high, the infrared light emitted by IR LED will be maximum reflected and will be recognized by the Photodiode. The light gets completely sop up by the dark black surface and finds it difficult to reach at photodiode due to low reflectance. By the identical mechanism, we setup the IR Sensors on the Line Follower Robot such that the two IR Sensors are on the either side of the black line on the floor. When the robot moves forward, both the sensors wait for the line to be detected. Consider this, if the IR Sensor RM identifies the black line, it signals that there is a right curve (or turn) ahead.

4. PROPOSED METHODOLOGY

Robotics is a field which is a combination of electronics and mechanical Engineering. This field was invented to substitute the human and to replicate their actions. Involving robots in various environments are very common these days. Here we propose an efficient and cost-effective method of involving robotics as a substitute of delivery boy in college campus environment which is the basic requirement for functioning of any commercial establishments. For designing a robot, we need motors, controllers, and driver circuits for running a motor. Arduino is an open-source devices stage subject to easy to-use hardware and programming. Arduino sheets can understand inputs - light on a sensor, a finger on a catch, or a Twitter message - and transform it's anything but a yield - actuating an engine, turning on a LED, passing on something on the web You can direct your board by sending a lot of bearings to the microcontroller on the board. To do so you utilize the Arduino programming language (thinking about Wiring), and the Arduino Software (IDE), considering Processing. Arduino insinuates an open-source devices stage or board and the item used to program it. Arduino is intended to make gadgets more open to specialists, architects, specialists and anyone keen on establishing intelligent items or conditions. The Arduino Robot is the primary authority Arduino on wheels. The robot frame is included two sequentially associated stages, every one of which includes an ATmega32U4 and goes about as an autonomous Arduino board. The upper stage, called the Control Board, incorporates a five-button keypad, handle potentiometer, shading LCD, SD card peruse (with SD card), buzzer, and advanced Wi-Fi module. The lower stage, or Motor Board, controls the two coordinated DC engines and incorporates five reflectance sensors that can be utilized for line following or edge recognition. The robot dispatches completely collected and incorporates a USB link, rechargeable batteries, and a divider connector for charging.

The proposed goods delivery robot is of the following modules.

- Line Follower Robotic Chassis with goods tray.
- Ultrasonic Sensor for detection the obstacle.
- RF ID card reader for access verification.
- Servo motor for open close function of delivery box.

- An IoT Module for taking orders and sharing delivery status to users remotely.
- An LCD display board for showing the status.
- A buzzer for indication.

5. RESULT AND DISCUSSION

Our research work is an innovative idea of intelligent system which has basically line detection feature and will provide help in various fields like industry sectors, service sectors and offices, colleges, hospitals and other commercial establishments. The sensors in this system are a type of infrared sensor that senses the line and gives the feedback to the microcontroller unit.

- The battery activates the circuit.
- The sensor transmitter transmits the frequency, which reflects from the surface. Sensor receives the reflected frequency and gives it to the microcontroller.
- The microcontroller processes it and gives the signal to motor driver IC
- Motor driver IC rotates the motors as per the signal receive and then the wheels rotate.
- Wi-Fi modules enable the system connectivity to internet which makes the system available online and can be operated using android application remotely.
- Servo motor controls the open close setup of the delivery tray.
- Ultrasonic sensor detects the obstacles in the path of robot and alerts the user's real time through the mobile app.
- RFID Reader allows the system to read the users unique ID card to make the authorization, and helps to provide the end-to-end security.

While testing the robot we have uncovered various things. Although the robot can carry approximately up to 500 g but due to the structure of the gripper of robotic arm it cannot hold items having larger area. So, we have successfully carried out experiments with smaller load.

6. CONCLUSION

When we implemented the work in real life, we have found that the robot is suitable for transferring a small quantity of load. These kinds of robot are useful for many applications, not only for industrial use but also for domestic use too.

Some advantages of these robots are:

- Robot movement is automatic.
- It is used for long distance applications
- Simplicity of building.
- Fit and forget system.
- End to end authorization for improved security.

These kinds of automated line follower robots can be used in home and industrial automations too these robots can be used as automated equipment carriers in industries replacing traditional conveyer belts. These robots can also be used as automatic cars on roads with embedded magnets. These can also be used at homes for domestic purposes like dusting, floor cleaning etc. These can be used in public places like shopping malls, museums etc. to provide path guidance.

The importance of implementing automation technologies is increasing rapidly Robotics and automation will offer great benefits to humanity in the future. Robotics and automation enable great advantage for people to do works in a short period. Since India has second largest man-power in the world, automation is not replacements of the human power but it is an important supplement that caters the need of various operations

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