BARRIER ELUSION ROBOT WITH ULTRASONIC SENSOR USING AURDINO UNO

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Abstract: - The industry for autonomous vehicles is growig. According to studies nine out of ten traffic accidents are due to the human factor, if the safety can get good enough in autonomous cars they have the potential to save thousands of lives every year. But obstacle detecting autonomous robots can be used in other situations as well, for example where the terrain is inaccessible for humans because of different reasons. In this project, a self-navigating obstacle detecting robot was made. The robot uses ultrasonic sensors to detect obstacles and avoid them. In this project an algorithm of the navigation of the robot was created and implemented to the Arduino. For driving the wheels, two servo motors were used. The robot consisted of four wheels, two in the back to which the servo motors were attached and two caster wheel in the front. This made it possible to implement differential drive which enabled quick and tight turns.

Keywords: - Mechatronics, Autonomous Robot, Ultrasonic Sensors, Servo Motors, Arduino UNO.

I. INTRODUCTION

Autonomous vehicles can be used for a lot of different purposes and the industry is growing. With autonomous vehicles follows new challenges and safety is one that is very important. If the safety is good enough autonomous vehicles have the potential to save thousands of lives every year. Studies show that nine out of ten traffic accidents are due to the human factor. Other benefits of autonomous vehicles could be improved energy efficiency and reduced driving costs. This report presents how an obstacle detecting autonomous robot was developed. Autonomous robots are freely moving and can operate without direct human supervision. They are capable of making their own decisions based on what it perceives and has been programmed to recognize. An obstacle detecting autonomous robot has many applications. The technique can be implemented in cars for example. If the control system is fast enough it can decrease the speed quick and avoid accidents with obstacles that occurs rapidly. With the traffic becoming more complex with new situations the requirements on the control system and algorithms increases. Autonomous robots can also be used in situations where it is dangerous or in any other way inappropriate for humans to be. The first step of this project was to formulate the research questions. The next step was to gather information about autonomous robots and obstacle detection. This was done by reading articles and investigating projects from previous years related to the subject. From the literature study, components that were needed for the prototype could be determined.. When the construction was completed, the Arduino software Integrated Development Environment (IDE) was used to program the algorithm. To avoid collisions, the robot must be able to identify all obstacles in its path. In order to achieve this, the robot was equipped with sensors to detect objects. Tests were made where obstacles were placed in front of the robot while it was driving forward to investigate what the best placement of the sensors was.

II. LITERATURE SURVEY

1. 2002 IEEE International Conference on Industrial Technology, 2002. IEEE ICIT '02. The robot is equipped with low-resolution optical sensors and electronic compass and is driven by stepper motor. Thus, there are three guidance modes: target tracking using optical sensors, directional guidance using compass, and dead reckoning. There are another optical sensor equipped on board to detect obstacles. The vehicle is controlled based on the information from these sensors. In the proposed technique, the control algorithm is switched to wall following mode when facing an obstacle. This technique is very simple but efficient. Several simulation and experiments demonstrate good performance even though using low-resolution sensors.
2. Navigation of a sonar-equipped mobile robot with real-time local map building. A Fujimori, Y Ogawa
First Published August 1, 2007 A navigation technique for a sonar- equipped mobile robot with real-time local map-building in unknown environments. A navigation algorithm is constructed with the proposed local map-building and reactive obstacle avoidance behaviours. The obtained local map could be used to build and/or update a global map of the environment. It is used to plan a desirable path for the next run. In navigation experiments using a commercial mobile robot named Pioneer-I, the built local map was effective for navigation in several environments compared to a reactive navigation technique without map-building, especially in complicated environments.
3. Obstacle avoidance and navigation in robotic systems: A land and aerial robots study Mohammad Fraiwan , Ahmad Alsaleem , Hashem Abandeh , Omar Aljarrah Published in: 2014 5th International Conference on Information and Communication Systems (ICICS) Autonomous airborne systems have generated a lot of interest in civilian and military applications. The operation of such systems involves routing and navigation toward targets and obstacle avoidance. In this paper, these problems were

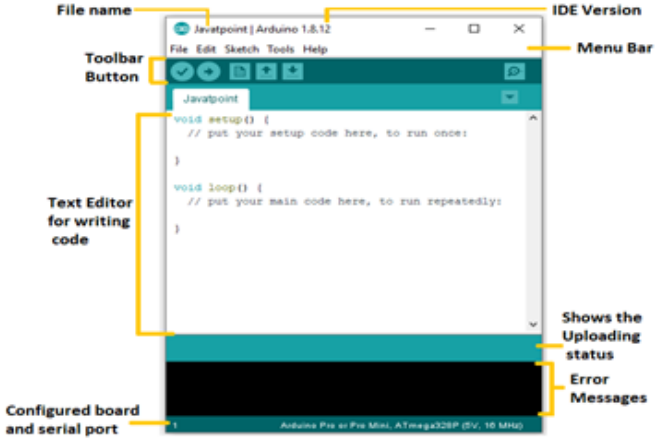
tackled and solutions were applied to land-based robots as well as a quadrotor aerial system. The quad-rotor flight path navigation and routing was programmed based on GPS and onboard measurement data

4. Obstacle Avoiding Robot: A Lego EV3 Robot Vignesh Jathavara , Vignesh Jathavara Published in: 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT) Robot can be made capable of operating in the real world environment without any form of external control for an extended period of time. A robot with cognitive capabilities include perception processing, attention allocation, anticipation, planning, complex motor coordination, reasoning about other agents and perhaps even about their own mental states. Robotic cognition embodies the behaviour of intelligent system in the physical world. Ultimately the robot must be able to act in the real world. In our project, a robot was built to sense any obstacle in its path avoids it and resumes its running involving the pre-computation of an obstacle free path. The robot utilizes ultrasonic sensor to identify its target by taking advantage of the robot's hard wire morphology

III. CONSTRUCTION

1. Software

The code for the microcontroller was created in Arduino IDE



Arduino IDE source:Javatpoint

2. Hardware

a) Arduino UNO

The microcontroller used in this project is an Arduino Uno. Arduino is an open source platform. The Arduino boards are easily programmed on the Arduino Software (IDE). Arduino Uno is based on the microcontroller ATmega328P which has a flash memory of 32 kB. It has 14 digital input/output pins and six of these can be used as PWM outputs. The board can be connected to a computer with a Universal Serial Bus (USB) cable to power it or to an external power supply, the recommended voltage input is 7-12 V. If it is powered with less than 7 V it may become unstable and more than 12 V may cause the voltage regulator to overheat and damage the board.

Arduino Uno

b) HC-SR04 Ultrasonic Sensor

These sensors can identify a distance from 2-400 cm. They require a current consumption of 2 mA and a 5 V power supply. One sensor was placed in each direction of the robot; in the front, to the left, to the right and in the back. The robot is programmed to stop when an obstacle occurs within 15 cm ahead of it, To minimise the risk of the robot hitting an obstacle due to miscalculations it is good to make it stop when there is still some distance left to the obstacle. The sensor to the right then controls if there is an obstacle to the right, if there is no obstacle there, the robot turns right. If there is an obstacle to the right, the sensor to the left controls if there is an obstacle in its way, the robot turns left if no obstacle has been detected there. In the case it occurs to be obstacles both in front of the robot and to the left and right the sensor in the back will check if there is an obstacle behind. If there is, the robot stops and if it is not it reverses

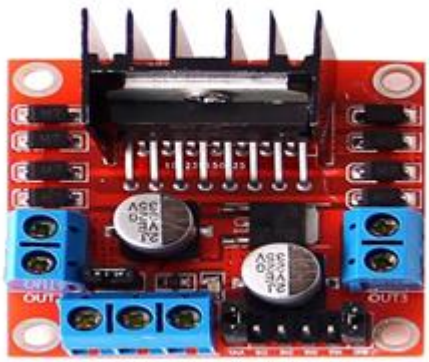
HC-SR04 Ultrasonic Sensor

b) Servo Motor

Two servo motors of model Tower Pro SG-5010 were used for the two wheels that were driven with differential drive, they can be seen in figure. This servo motor is continuous and can turn 360°. Its dimensions are 40.8 x 20.1 x 38 mm and its weight 40 g. It requires a 4.8-6 V power supply

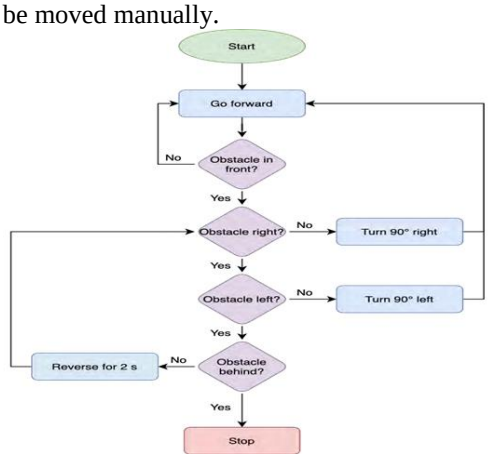
Servo Motor

d) L298D Motor Driver Shield
L293D is a monolithic integrated, high voltage, high current, 4-channel driver. Basically, this means using this chip we can drive DC motors with power supplier up to 36 Volts, and the chip can supply a maximum current of 600mA per channel. L293D chip is also known as a type of HBridge. The H-Bridge is typically an electrical circuit that enables a voltage to be applied across a load in either direction to an output, e.g. motor.



IV. METHODOLGY

A flowchart was created to describe the algorithm that the robot uses. The flowchart can be seen in figure 3.1. The robot started with driving forward. If it encountered an obstacle in front of its path it checked if there was an obstacle to the right, if not it turned 90° to the right and then continued to drive forward. In the occasion it was an obstacle to the right as well the robot checked to its left and if there was no obstacle there it would turn 90° left and continue forward. In the case where there were obstacles both in front and to both sides the robot would check behind and if the way was free there it would reverse and then again check its right and left sides. If a situation occurred where there were obstacles all around the robot the motors would stop and the robot would have to be moved manually.



V. APPLICATIONS

The bot can be used as follows
1. Used as a robot capable of autonomous navigation.
2. Used as a maze solving robot.
3. Used as a rescue vehicle in dangerous environme
4. Used to reduce accidents due to human error.
5. Used for militarized to reduce the risk of human casualties.
6. Used for mapping unknown landscapes.
7. Used during search and rescue operations.

VI. RESULT

The barrier avoiding robot designed can detect obstructions like obstacles and barriers using the ultrasonic sensor and change its path to avoid them. The servo motor helps in providing a wider field of view for the robot

VII. CONCLUSION

The above Arduino controller and ultrasonic sensor were studied and the HcSR-04 ultrasonic sensor was selected, as the controlling result are satisfying for its use in the automobile prototype system bring developed. It was used to sense the obstacle and avoidance them. On successful implementation of obstacle avoidance algorithm was successfully carried out too with minimal errors, by coding the algorithm in python. Obstacle avoidance is a very good application to be used in vehicle preventing many accidents and loss of life.

VIII. ACKNOWLEGMENT

We would like to thank all those who have directly or indirectly encouraged us to take up this project. Specially the authors of different research papers referred during writing this paper.

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