The Vacuum Cleaner Robot 2.0
FSR-based Robotic Vacuum Cleaner Robot

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INTRODUCTION

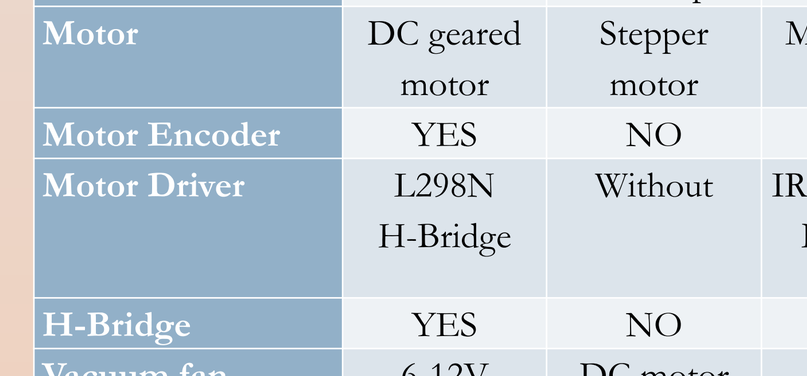
The 'Internet of Things'(IoT) is becoming an increasingly growing topic in our daily life. 'IoT' refers to the integration of hardware and software which enable the physical devices to connect and exchange data, resulting in efficiency improvements and reduced human exertions. Robotic vacuum cleaner is one of the 'IoT' projects which has certainly improved the quality of life since all the cleaning task can be done effortlessly. More quality time can be well spent with more important task. In this project, the author has proposed an idea of using Force Sensing Resistor (FSR) as the object detection sensor and integrate it with a robotic vacuum cleaner. Likewise, the robotic vacuum cleaner would be able to make decision whether to continue moving forward or change moving direction if it hits on obstacle. This project took idea of 'Roomba' by iRobot and some modification has been made in order to produce a robotic vacuum cleaner that is price affordable at the same time able to function efficiently.

LITERATURE REVIEW

A detailed literature search was undertaken to explore and understand the common features and various type of sensor application on the robotic vacuum cleaner.

Robotic Vacuum Cleaner	Author's Project	Project 2.1 [1]	Project 2.2 [2]	Project 2.3 [3]
Microcontroller	Arduino Mega ADK	Mega32 MCU	Arduino Uno	Arduino Uno
Sensor	Force Sensor	Accelerometer & bumper	SharpDistance Sensor&IR sensor	Ultrasonic Sensor
Motor	DC geared motor	Stepper motor	Micro-metal gear motor	DC geared motor
Motor Encoder	YES	NO	NO	NO
Motor Driver	L298N H-Bridge	Without	IRF520 MOS FET Driver Module	L293D Motor Driver Shield
H-Bridge	YES	NO	YES	NO
Vacuum fan	6-12V DC motor + fan blade	DC motor + Sweeper	Fan Blower	6-12V DC motor + fan blade
Battery	9.0V (Arduino) 9.0V (Fan) 7.4V (L298N)	6.0V (Arduino) 9.7V (Sweeper)	LiPo Battery	6.0V (Arduino) 11.7VLiPo Battery (Fan)
Design	Round shape	Round Shape	Square with round edges	Round shape

METHODOLOGY



Prototyping Methodology was used by implementing Analysis, Design and Implementation phase concurrently and repeatedly. Besides, the author also keep modified and do testing on the project based on the feedback and advices received from the supervisor until the best outcome of project is delivered successfully.

Planning – Research on similar projects
Analysis – Identified the hardware and software components to be used in the project
Design – Design circuit diagram and flowchart
Implementation – Assemble all the parts and components
Testing – Debugging in coding , Soldering , Checking on all parts to ensure the project is working .

AIM AND OBJECTIVES

The aim of this project is to develop a robotic vacuum cleaner which uses Force Sensing Resistor (FSR) as obstacle detection sensor to carry out cleaning task.

The objective of this project are shown as follows:

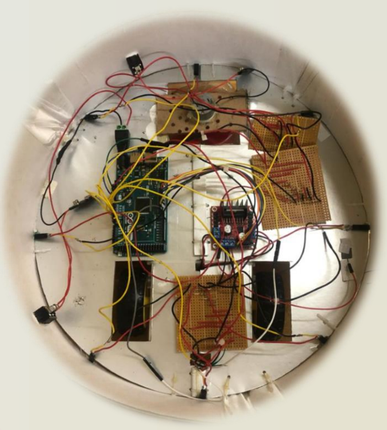
i. Research about the working principle and type of force sensors available.

ii. Identify the most appropriate components to construct the vacuum cleaner robot such as the sensor, motor, microcontroller, control circuit, fan and software, etc.

iii. Write algorithm that control the movement of vacuum cleaner robot .

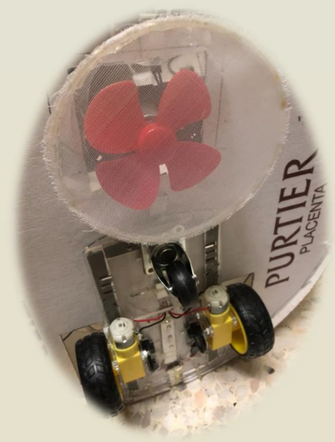
iv. Assemble the hardware components according to the circuit diagram.

RESULTS AND DISSCUSSION



Internal Top View

Outer View



Bottom View

The final outcome of the project was able to perform its function as intended and the aim and objectives that was proposed in the proposal are being met. The cleaning task can be carried out autonomously as the FSR-based robotic vacuum cleaner is able to change its direction if any obstacle is detected. The encoder function works and allows the robotic vacuum cleaner to drive straight instead of turning around at a particular spot. In additional, all the dirt ,dust particles or hairs are being collected while the robotic vacuum cleaner moving around.

One of the major weakness of this project is the FSR sometimes does not work properly if it does not hit the obstacle at the right angle or when it hits on a soft contacting surface. The force reading is insufficient for the robotic vacuum cleaner to make response. Nevertheless, adding more FSR on the robotic vacuum cleaner and soldered the wires onto the PCB board has narrowed down the false possibilities.

CONCLUSION

In conclusion, the final outcome of the FSR-based robotic vacuum cleaner has successfully attained the aim and objective of the project. The major enhancement from the previous project done is by adding the encoder function which allows the robotic vacuum cleaner to drive straight. Moreover, the author has successfully proved that Force Sensing Resistor can be used as obstacle detection sensor on the robotic vacuum cleaner. For future works, the author suggested that replacing the chassis with a harder material such as 3D printing in order to make the project more durable and water-proof.

REFERENCE

[1] D. D. Hanny Carp-Martinovici, "Robotic Vacuum Cleaner," [Online]. Available: https://people.ece.cornell.edu.

[2] CesNieto Technology, "DIY Vacuum Robot," CesNieto, [Online]. Available: http://www.instructables.com/id/Build-Your-Own-Vacuum-Ro

[3] L. W. Xing, "The Vaccum Robot Cleaner," 2017.