Robotic Vacuum/Mopper

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BACKGROUND

The idea behind the project was to create a cost-efficient alternative to the iRobot/Roomba that would have the added functionality to mop the floors. The project consists of an obstacle avoiding robot attached to a vacuum pump on the front and a mop tank in the back. It is intended for basic household use. The product itself is an economical decision compared with its competitors available in the market. The design is fully automatic; it will move on its own and sense objects/obstacles in its way and maneuver around it accordingly. It also has mopping mechanism towards the back side, so that once it vacuums, it will also mop, leaving the floor clean.

Figure 1

PROPOSED SOLUTION

The Robocuum concept of a 2-in-1 vacuum/mop built on the promise of making cleaning fun and easy task. At the same time, it will provide a minimal noise cleaning experience for all its intended users. The focus for the design was to ensure compactness and portability coupled with a surface friendly material. The circuit consists of 6 dc motors, a servo motor, two IR proximity sensors and an Ultrasonic sensor along with a two 3 Volts battery packs and a 7.4 Lithium-ion rechargeable battery hooked to a switch.
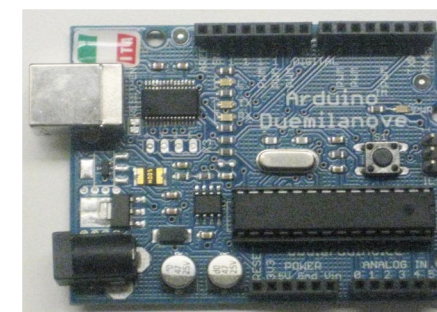
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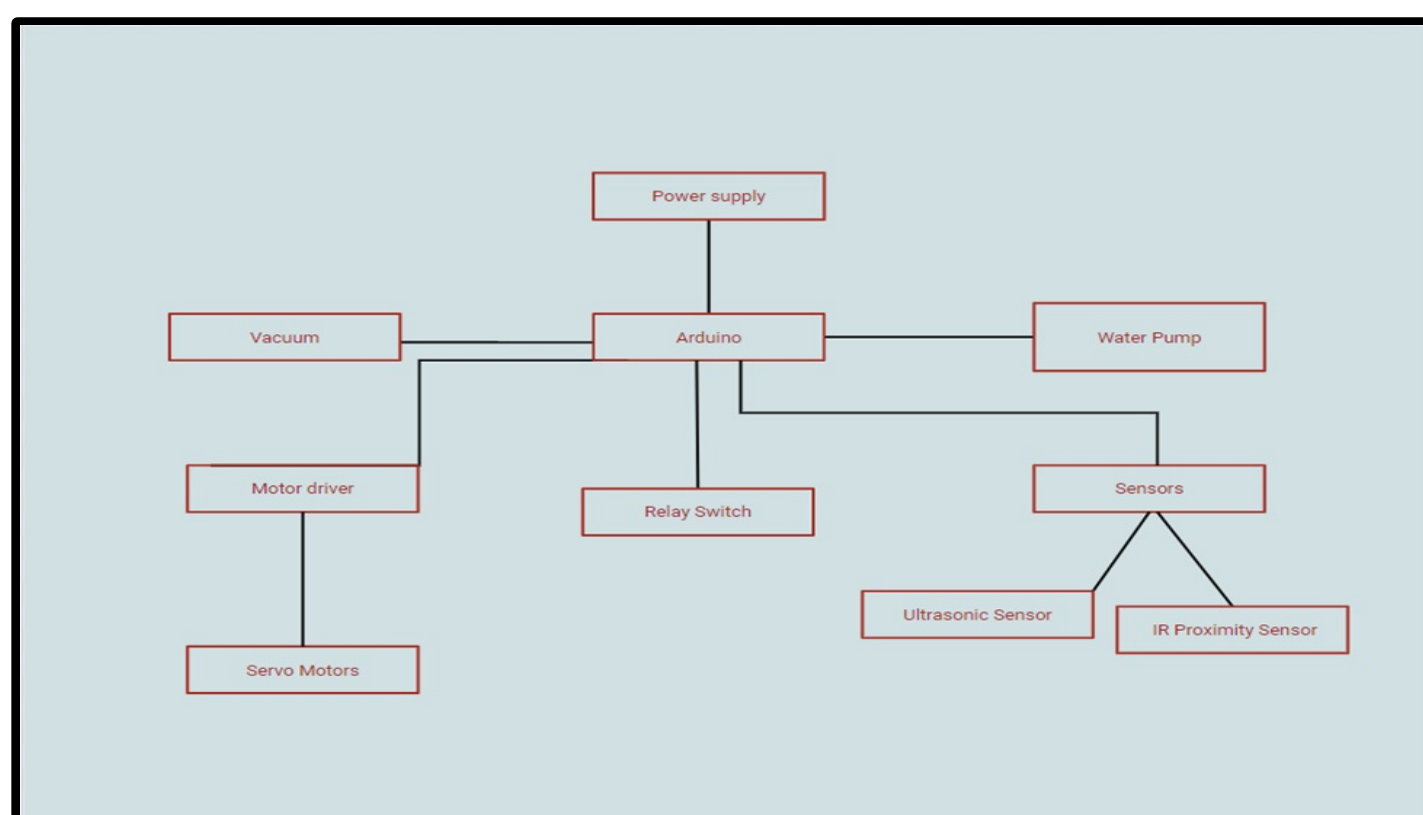
SYSTEM DESIGN

Arduino UNO Board
Arduino UNO board allows easy pin connections to the DC motors and the sensor module along with a free download Arduino IDE software to write and program Arduino code.
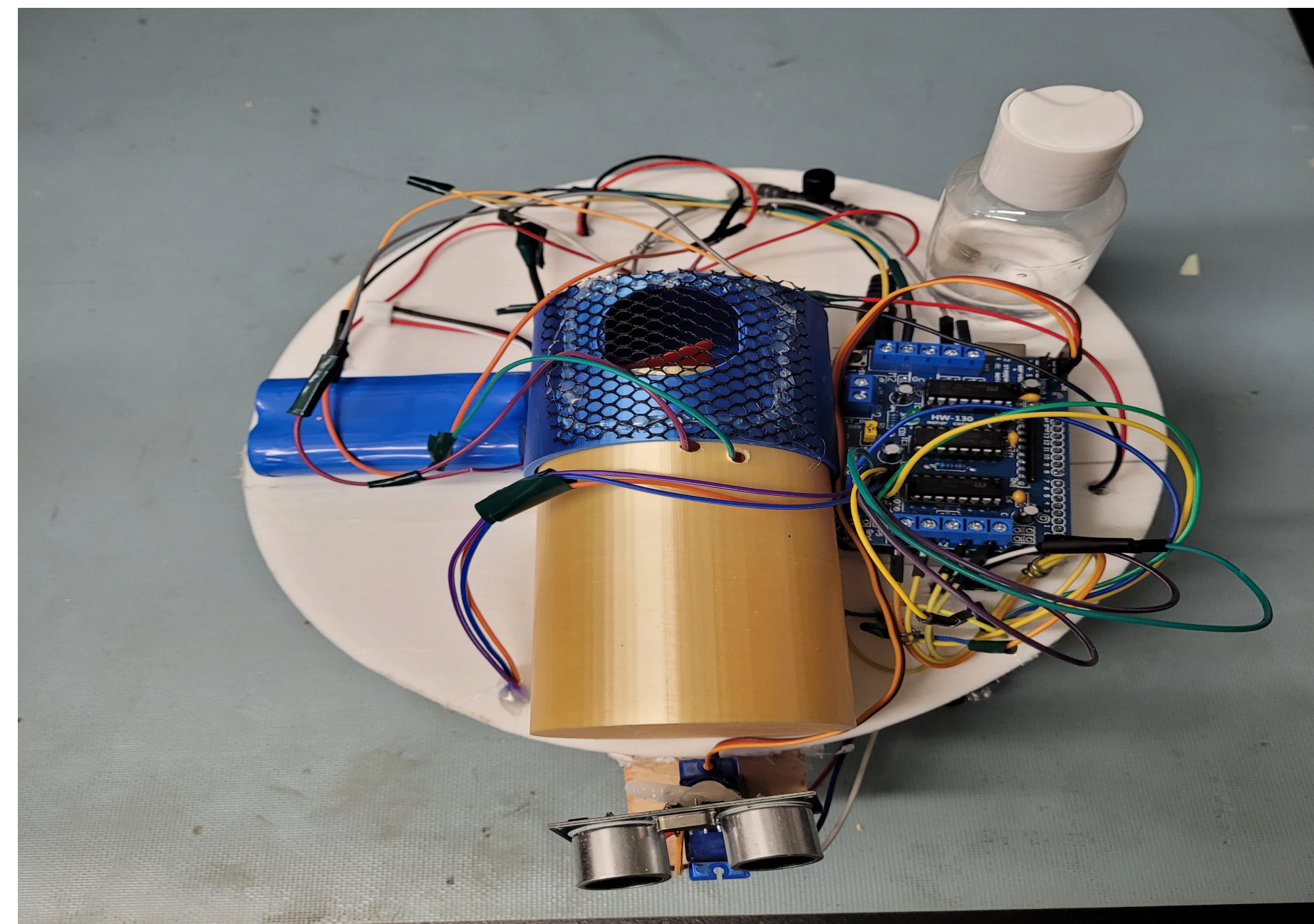
L293D DC Motor Drive Shield
The L293D shield is a driver board based on L293 IC, which can drive 4 DC motors and 2 stepper or Servo motors at the same time.

5V DC Motor
The DC Motor is rated 5V which operates at a max current of 350 mA. It has an RPM value of 200 revolutions and weighs about 0.25 pounds.

Figure 3

7.4V Battery Supply
Serves as the connection point between the Arduino and the various components. Allows for easy swap in/out of faulty components making repairs in the future easy.

Water Container
This water container holds the water for the mop

4 DC Gearbox Motors
The liquid crystal display pins are connected to the Arduino UNO board with jumper wires and allows for the user to see the time left of charging set by them.

Vacuum System
The vacuum system has 3 parts: the fan motor holder, outlet tube and the detachable dust collector. The size and dimensions of the platform was (9'' x 9'' x 0.2''). Vacuum fan motor holder was (6'' x 3'') with the inside being hollow. The vacuum outlet tube was (3'' x 0.5''). The outer casing was (9'' x 9'' x 3.5'').

HC-SR04 Ultrasonic Sensor
This 4-pin sensor module has an operating voltage between 3.3 V to a maximum of 5 V and current levels of <20 mA. It has a measuring range from 2 cm to 400 cm with an accuracy level of +/- 0.3 cm

IR Sensor
This has an operating voltage of around 3 V with max voltage of 5V from a DC power source, and it can operate at -55ºC to +125ºC. It has a measuring range from 20 cm to 150 cm with an accuracy level of +/- 2 cm.

Micro Servo Motor
Servos are motors that allow you to accurately control the rotation of the output shaft.

FUTURE DIRECTION

- Explore integrated circuit options to reduce size of Device
- Introduce Voice Assistant Feature for enhanced user experience
- Redesigning the vacuum system for an increased flow of air
- Utilizing a strong air pump or motor
- Provide access to a phone application
- Generate power for the system using a single battery pack with appropriate voltage regulation

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REFERENCES

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