

IoT Cleaning Robot

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ABSTRACT

Cleaning is an essential part of our day-to-day lives. Cleaning effectively should be an important part of a larger plan to create healthier indoor environments by removing contaminants that can cause illness. Lack of hygiene and cleanliness is an open invitation to infection. A clean environment allows for a safe work environment. People like to work in clean surroundings. Employees will not make additional effort to dress up to impress knowing that the workplace is dirty and smelly. This may indicate that owners and managers do not care about the environment in which they work. Robotic cleaners have received significant attention in robotics research in recent years due to their effectiveness in assisting humans in floor cleaning applications in homes, hotels, restaurants, offices, hospitals, workshops, warehousing, and universities, among other places [1]. This document describes the design, development and production of the Clean Sweeper prototype. The subject robot works autonomously as well as in manual mode. The Clean Sweeper prototype lets the user operate the system from being within the prototype's Bluetooth range.

Keyword: - IoT, Arduino UNO, HC-06 Bluetooth Module.

1. INTRODUCTION

Clean Sweeper is autonomous and smartphone-controlled robot that cleans the floor of your home! The rotating mops on the front of the robot can do the job perfectly. There is also a water pump and reservoir that can be activated to throw water on the floor and moisten the mops for a thorough clean.

The project sends commands to the most commonly used microcontroller, the Arduino UNO, using Bluetooth communication via an HC-06 Bluetooth module. The robot is powered by a 12V lead acid battery, which is the optimal voltage for all of the motors used here. The driver motor pair is 100rpm, while the mops are 75rpm plastic ones. The best part is that the mops were made from old CDs and rags, and they work perfectly.

In this project, the Arduino Uno is the microcontroller. All the commands are stored in the Arduino Uno in the form of Program. The programming language used for this project is C++. Arduino Uno is the most popular microcontroller used for IoT Projects. The Arduino Uno is a microcontroller board that was designed by Arduino.cc and is based on the Microchip ATmega328P microprocessor.

The board has a number of digital and analogue input/output (I/O) pins that can be used to connect to various expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and is programmable via a type B USB cable using the Arduino IDE (Integrated Development Environment).

2. OBJECTIVE

The objective of this project is to design the manual and automatic floor cleaning robot to reduce the human workload. Because of this project, the cleaning time will be reduced and the cleaning robot is at an affordable price. This project can be developed according as per the user's requirement. If the user needs automatic robot, then the user can get fully automatic robot and if the user needs manual robot so that the user doesn't need to clean the floor physically but user can only command with a smart phone and the floor.

This project includes numerous features such as it has 2 rotating mops on the front side of the cleaning robot so it can clean the floor properly. It has an Ultrasonic Sensor attached to the front side of the cleaning robot to detect obstacles and to avoid accidents while cleaning. The cleaning robot has a pump and water container installed. Using the pump, the water will be sprayed in the front of the mops to make the mops wet.

3. SCOPE OF PROJECT

The project's goal is to create a manual and automatic device that can be controlled by a person or the internet of things to clean the floor, and we only need to click a start button of the robot in a smartphone application. This project's scope includes a large floor area.

4. PRINCIPAL COMPONENTS OF PROJECT

1. Arduino UNO
2. HC-05/06 Bluetooth module
3. Ultrasonic Sensor
4. L293D motor driver board
5. Servo motor
6. 12V Sealed lead acid rechargeable battery
7. 12V Water pump
8. TIP31C NPN power transistors
9. 75rpm Plastic geared motors
10. 100rpm DC Geared motors

5. ASSEMBLY OF PROJECT

The project is being built on a ply board. Two wheels are attached to the plywood's back side. In addition, there are two plastic geared motors on the front side. A small roller in the front middle part of the plywood is used to support the plastic geared motors. The weight of the plywood and the components in the front is transferred to the roller. A motor driver controls the movement of motors. This motor driver is programmed with Arduino software and powered by a 12-volt battery.

12V Sealed lead acid rechargeable battery is for the power supply. The 12V Sealed lead acid rechargeable battery is connected to the Arduino UNO. And then Arduino UNO supplies the power supply to other components used.

First, we checked that all the components which are going to be used for the project are in working condition and we make sure that there is no fault in the components. After that we took two old CD's and a cleaning cloth. We cut the cloth in a circular shape a little bit bigger than CD size. We stitched elastic to the corner of the cloth so that it can fit onto CDs properly. Then those CDs are attached to the plastic wheels with the glue gun. And here our mop is ready. We attached those mops to the plastic gear motors which will be attached to the front of the plywood.

Two wheels are powered by dc motors, which are controlled by the motor driver L293D via Arduino programming and pin connections.

The digital write pin is used in Arduino software to provide input. We provide motor driver input from the Arduino digital write pin for operation. For Arduino to function, various pins are assigned.

Table -1: Arduino Uno pins assigned to L293D

SN.	Digital write pins of Arduino Uno	Pins of L293D
1	D10	In 4 (Right motor '+')
2	D11	In 3 (Right motor '-')
3	D6	In 1 (Left motor '+')
4	D9	In 2 (Left motor '-')

The Arduino is used to program motor drivers. The motor driver is programmed to control the motion of dc motors. When the ultrasonic sensor sends a signal to the Arduino, the motor driver operates the motors for a right or left turn, and then the motor moves forward.

The pins of HC-06 Bluetooth Module are connected to Arduino UNO. Following table displays which pin of HC-06 Bluetooth Module is connected to which pin of Arduino UNO.

Table -2: Arduino Uno pins assigned to HC-06 Bluetooth Module.

SN.	Digital write pins of Arduino Uno	Pins of HC-06 Bluetooth Module
1	RXD	TXD
2	TXD	RXD

We soldered the circuit of "TIP31C NPN power transistors" onto the PCB board. We soldered the 5-volt pins together on one part of the PCB board so that the 5-volt power supply should go from one source. We soldered the ground pins together on the second part of the PCB board.

The pins of Ultrasonic Sensor are connected to the Arduino UNO so that Arduino can transmit and receive the data from the Ultrasonic Sensor. Following table shows that which pin of Ultrasonic Sensor are connected to which pin of Arduino UNO.

Table -3: Arduino Uno pins assigned to Ultrasonic Sensor.

SN.	Digital write pins of Arduino Uno	Pins of Ultrasonic Sensor
1	A0	Echo
2	A2	Trig

Table -4: Arduino Uno pins assigned to Other Components.

SN.	Component Name	Digital write pins of Arduino UNO
1	Pump	D4
2	Plastic Gear Motors (Mops)	D5
3	Servo Motor	D3

6. WORKING

Clean Sweeper robot has a 12V Sealed lead-acid rechargeable battery. First step is to connect the 12V Sealed lead-acid rechargeable battery with Arduino Uno and connect Bluetooth with the HC-06 Bluetooth Module and make hole circuit controllable remotely with Bluetooth Serial Controller Application. When we send a motion signal from the Bluetooth Serial Controller Application, the program set by the Arduino Uno will launch a given command motion.

We can give 9 commands from Bluetooth Serial Controller Application.

Table -5: Commands given by application.

SN.	Commands	Description
1	'F'	Gives command to go Forward
2	'B'	Gives command to go Backward
3	'R'	Gives command to go Right
4	'L'	Gives command to go Left
5	'S'	Gives command to Stop
6	'M'	Gives command to turn on Mop
7	'm'	Gives command to turn off Mop
8	'P'	Gives command to turn on Pump
9	'A'	Automatic Mode

7. MODEL

**Fig -1:** Front view of Model.**Fig -2:** Side view of Model.

8. CONCLUSION

We have completed the manually controlled and autonomous IOT floor cleaning robot model prototype, and this project presents implementing an Internet of Things-controlled, manual and automatic cleaning system. In today's world, time is an important aspect for people. People aren't getting much time from work to do household work. So for those people, this product can be helpful. And If people have time but they are not physically able to clean the floor, then this product's manual mode will help them to clean. In the Manual mode of IoT Cleaning robot, if there is obstacle in between the way of robot and still if user gives command to go forward, then robot will not respond to that command because of obstacle.

9. REFERENCES

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