

# **Micro-controller Project Report**

**CSE-306**



**Computer Science and Engineering (CSE)**

**Military Institute of Science and Technology (MIST)**

**Project Title**

**Surface Disinfecting Obstacle Avoiding Robot Using UV Light**

**Group -02**

**Submitted By**

202114003 Abrar Mahir Esam

202114026 Humayra Akter

202114041 Mayesha Tasnim

# Table of content

---

2

<b>SL number</b>	<b>Topics</b>	<b>Page Number</b>
1	Introduction	4
2	Feature	5
3	Equipment	6
4	Methodology	8
5	Result Analysis and Outcome	9
6	Contribution	10

# Introduction

---

**A) Sterilization:** The system is designed to sterilize an enclosed place. Equipped with UV-lights, infectious microbes and pathogens can be easily eradicated within a few seconds. It removes, kills, or deactivates all forms of microorganisms such as virus, fungi, bacteria, spores, and unicellular eukaryotic organisms and other biological agents such as prions present in or on a specific surface, object, or fluid.

**B) No-human intervention:** A fully automated system designed to swipe across the floor within a closed complex without human intervention and thus reducing the risk of contracting communicable pathogens. Autonomous devices are a physical form of autonomous technology. Autonomous technology is about enriching automated systems with sensors, Artificial Intelligence (AI) and analytical capabilities so that they could make independent decisions based on the data they collect.

**C) Obstacle avoidance:** Programmed to automatically detect obstacles in its way and redirect its path to avoid crashing onto them. In robotics, obstacle avoidance is the task of satisfying some control objective subject to non-intersection or non-collision position constraints. IR sensors are widely used for measuring distances, so they can be used for obstacles avoidance. Although IR sensors are faster in response time than ultrasonic sensors, ultrasonic sensors are a better alternative for small devices with relatively slower speed.

**D) Switches off while in proximity to human motion:** The system is designed to automatically switch off UV-lights while in close proximity to human motion so as to avoid exposing human skin to UV rays. PIR sensors detect human presence by detecting the change in infrared radiation across the polarity of the sensor. Due to this, PIR sensors are unable to accurately detect stationary human subjects, which results in false negatives. While stationary human subjects may not be detected, human motion in close proximity clearly is detected and that'd be enough to switch OFF UV-LEDs.

# Features

---

E)

**A) Robust, effective, and efficient autonomous disinfecting device:** In terms of strength, efficiency and effectiveness, the system is held to very high standards. Its ability to swipe across the floor in an enclosed surface disinfecting it from microbes is almost flawless.

**B) Arduino based system:** Arduino has been used as the core control device of the system. Automatic response signals (that are codified via IDE software into Arduino chip) are generated without any external inputs. The system is well placed and designed to automatically move around, avoid objects in its way and turn off UV lights sensing human presence in close proximity.

**C) Obstacle evasion without human intervention:** One of its key features is that it's equipped with an ultrasonic obstacle avoiding sensor that can detect objects at close range. With the Arduino in place, a response signal is generated to abruptly stop the device and change its course avoiding collision.

**D) Equipped with disinfecting UV-LEDs:** The UV-lights are used to disinfect, sterilize and incapacitate microbes, germs and pathogens in close contact. Disinfection being the key feature of this device, use of UV-lights is considered as the safest option.

**E) Cost effective:** Affordability has been a key focus of this project. It has been designed to be both reliable and affordable for people of all walks of life. Devices similar to it are available in the market albeit at a very high price beyond the affordability of lower-middle class populace.

➤ **Software:**

**Arduino IDE (for windows)**

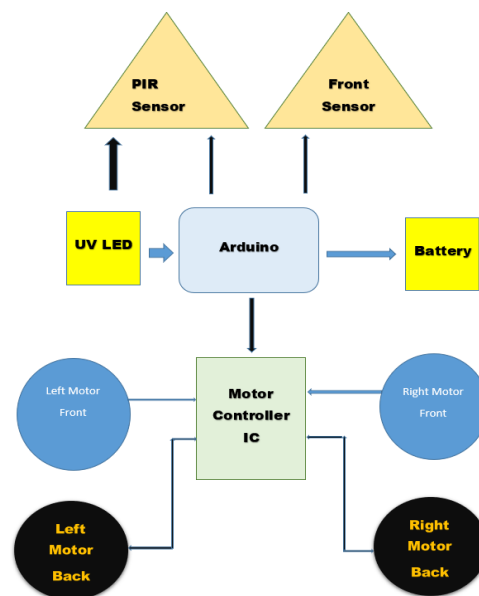
➤ **Hardware:**

Purpose	Component Name	Quantity
Obstacle Avoiding Robot	4 Wheel Robot Car Chassis (4-gear motors, two chassis board, 4 wheels)	1
	Arduino Uno R3	1
	L293D Motor Driver Shield	1
	Servo Motor	1
	18650 li-on battery	2
	Ultrasonic Sensor	1
Sterilization And Human Motion Detection	Arduino Uno R3	1
	UV LED	1
	Battery 9 volt	1
	PIR Motion Sensor	1

# Methodology

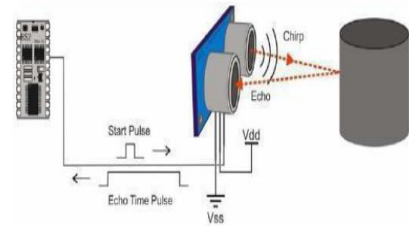
---

13

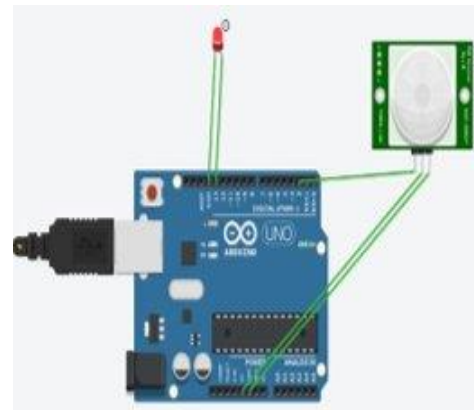
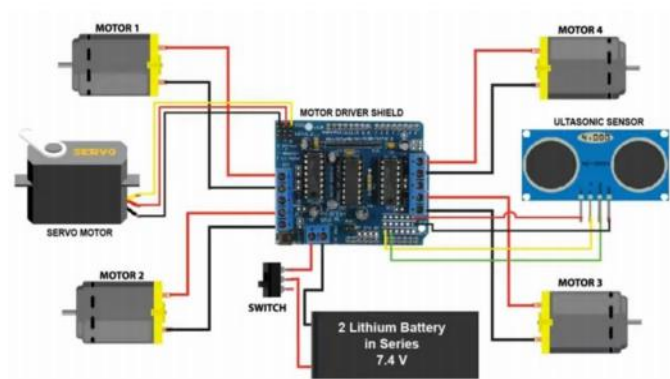


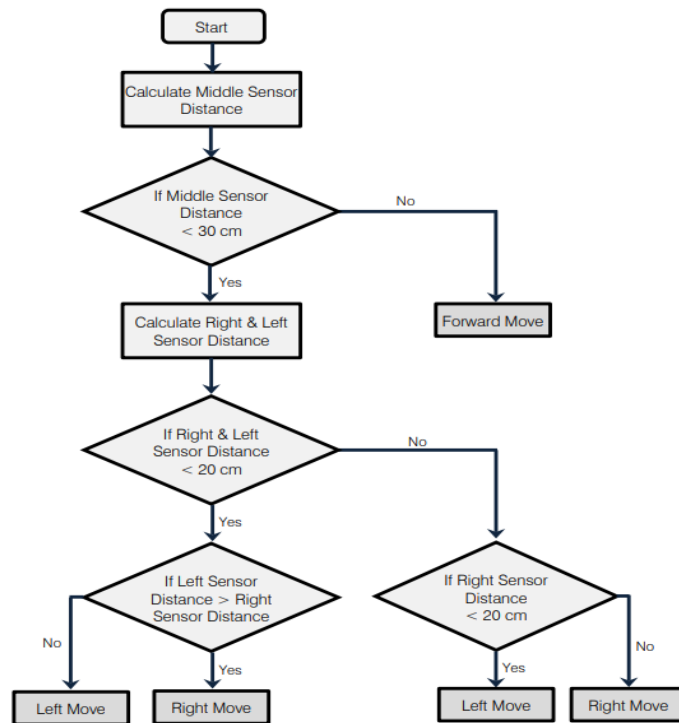
The automobile uses the ultrasonic sensor to detect objects. Initially the system starts with one sensor i.e., ultrasonic, but as car have some blind spots in its left and right direction. Robot is designed in such a way that it detects the obstacle inside a particular range. Suppose there is something inside the range, then that is referenced as an obstacle. The smart vehicle avoids it and changes its direction. At the forepart on the left and right sides the sensors (ultrasonic) are embedded. They produce an ultrasonic- pulse after every 300ms. Whose echo comes back from the nearby obstacle after collision. We make use of the lapse of time between the ultrasonic pulses and its reflection, the Arduino computes the separation from the obstacles from where the reflection is arriving at the speed of 340m/s. Whenever the sensors recognize the presence of

obstruction within the threshold distance, the car diverts its path. Apart from general movements, the car is arranged to manage the typical scenario where all the ultrasonic-sensors have objects inside the particular distance. In that case, the robotic car must turn back about 10ms then validate the separation from obstacles through sensors (left and right).



The device is designed to differentiate the separation and turns according to the greater distance. **Detector for Obstacle Avoidance** There are numerous numbers of sensors which are available for the detecting the presence of the obstacle. Some of the popular sensors used are: Infrared Sensor, Ultrasonic Sensor. It is used to calculate the range in its area of nearly hundred to thousand points. For this project we are making use of ultrasonic for detecting the presence of obstruction and its ignorance. Ultrasonic sensor consistently produces the high range signals, if the presence of object is detected these signals are reflected and it is the excitation to the sensors.

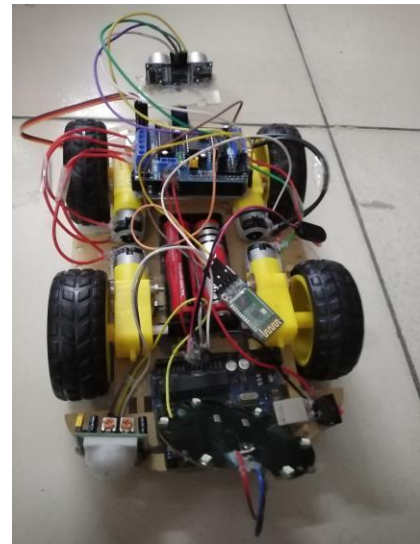




A PIR sensor detects human motion in close proximity (25 cm) and sends signal (analog) to Arduino which then formulates a response signal that turns OFF the UV-LEDs. The lights are turned back ON again once no human motion is detected within the 25 cm range.

## Result Analysis and Outcome

The system worked as expected. All the modules discussed have worked out almost flawlessly. The ultrasonic and infrared sensors implemented have been able to detect obstacles on the robot's path by sending signals to an interfaced microcontroller i.e., Arduino equipped with Motor Driver Shield. The microcontroller redirects the robot to move in an alternate direction by actuating the motors in order to avoid the detected obstacle.



The system is designed to automatically switch off UV-lights while in close proximity to human motion so as to avoid exposing human skin to UV rays. PIR sensors detect human presence by detecting the change in infrared radiation across the polarity of the sensor. Due to this, PIR sensors



are unable to accurately detect stationary human subjects, which results in false negatives. While stationary human subjects may not be detected, human motion in close proximity clearly is



detected and that'd be enough to switch OFF UV-LEDs

The device has been able to properly swipe along the surface within an enclosed space and disinfect pathogens using UV-Lights. Operating in a semi-automatic mode, the robot with inbuilt ultraviolet (UV) lights disinfects rooms and surfaces. With motion sensors, the system distinguishes humans from other visible objects to prevent damage to human health. The robot effectively destroys harmful microorganisms, causing the COVID-19 disease.