UV Disinfectant Robot

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Abstract- This research paper presents an investigation of UV disinfectant robots, which are used in various settings to sterilize surfaces and reduce the spread of infectious diseases. The paper provides an overview of the technology and its effectiveness, including a discussion of the types of UV light used and their specific wavelengths. Additionally, the paper explores the applications of UV disinfectant robots in healthcare, food service, and other industries, and reviews the available literature on their efficacy. The paper also addresses safety concerns associated with the use of UV light, such as eye and skin damage, and examines potential solutions to mitigate these risks. Finally, the paper concludes with a discussion of the current limitations of UV disinfectant robots and areas for future research and development. Overall, this paper provides a comprehensive overview of the use of UV disinfectant robots and highlights their potential as a valuable tool in the fight against infectious diseases.

Keywords: Ultra Violet Light, Disinfection, Robot, Arduino, Remotely Controlled.

I. INTRODUCTION

The COVID-19 pandemic has highlighted the need for effective disinfection methods to reduce the spread of infectious diseases. Ultraviolet (UV) light has long been recognized as an effective means of sterilization, and the use of UV disinfectant robots has gained popularity in recent years. These robots use UV-C light, which has a wavelength of 200-280 nanometres, to kill microorganisms on surfaces, without the need for chemicals or manual cleaning. This technology has the potential to significantly reduce the risk of transmission of harmful pathogens in a variety of settings, including hospitals, food service establishments, and public transportation. However, while UV disinfectant robots offer many benefits, there are also potential risks associated with their use. For example, UV-C light can cause skin and eye damage if not used properly, and there are concerns about the impact of long-term exposure to this type of light. Additionally, the effectiveness of UV disinfectant robots can vary depending on factors such as the distance from the surface being disinfected, the intensity of the UV light, and the amount of time the robot is in operation. Therefore, it is important to conduct research to better understand the benefits and limitations of UV disinfectant robots, as well as to identify best practices for their safe and effective use. This research paper aims to provide a comprehensive overview of the technology, its applications, and its effectiveness, as well as to address safety concerns and potential solutions. Through this investigation, we hope to contribute to the growing body of knowledge on UV disinfectant robots and their potential as a tool for reducing the spread of infectious diseases.

II. METHODOLOGY

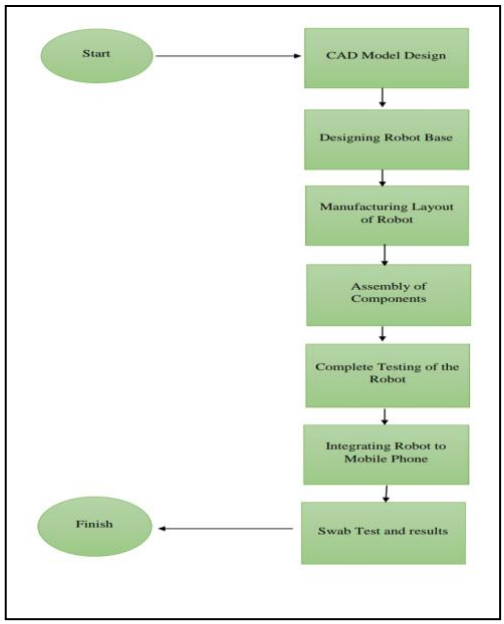

Fig.1. Flowchart of the Project

COMPONENTS

1. ARDUINO UNO

Arduino is an open-source electronics platform designed for creating interactive projects. It consists of a physical programmable circuit board (often referred to as a microcontroller) and a software development environment used to write and upload computer code to the board. The hardware and software are designed to be easy to use, even for people with little or no electronics or programming experience.

Arduino Uno is a popular microcontroller board that can be used for a wide range of projects, from simple LED blinking to more complex robotics and automation applications.

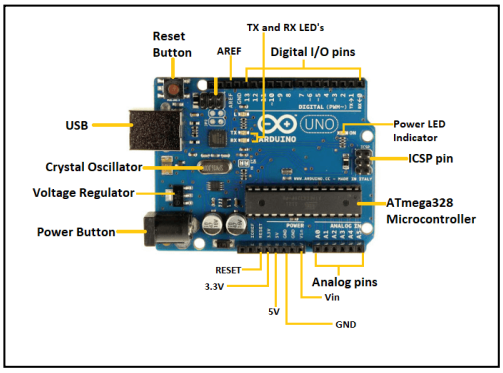

Fig.2. Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Software: Program the Arduino using is Arduino IDE

2. MOTOR DRIVER

VNH2SP30 is a full bridge motor driver intended for a wide range of automotive applications. The device incorporates a dual monolithic high side driver and two low side switches. The high side driver switch is designed using the STMicroelectronic's well known and proven proprietary VIPower M0 technology which permits efficient integration on the same die of a true Power MOSFET with an intelligent signal/protection circuitry. The VIN and motor out are pitched for 5mm screw terminals, making it easy to connect larger gauge wires. INA and INB control the direction of each motor, and the PWM pins turns the motors on or off. For the VNH2SP30, the current sense (CS) pins will output approximately 0.13 volts per amp of output current.

Features:

- Voltage Range: 5.5V - 16V
- Maximum Current rating: 30A
- Practical Continuous Current: 14 A
- Current sense output proportional to motor current
- MOSFET on-resistance: 19 mΩ (per leg)
- Maximum PWM frequency: 20 kHz
- Thermal Shutdown
- Undervoltage and Overvoltage shutdown

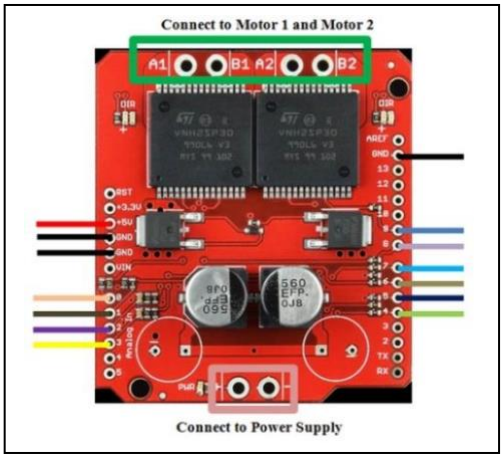

Fig.3. Motor Driver (VNH2SP30)

No.	Colour	Description
VCC		Power Supply
GND		Ground
A0		Enable for motor 1
A1		Enable for motor 2
A2		Current sensor for motor 1
A3		Current sensor for motor 2
D7		Clockwise for motor 1
D8		Counterclockwise for motor 1
D4		Clockwise for motor 2
D9		Counterclockwise for motor 2
D5		PWM for motor 1
D6		PWM for motor 2

3. DC MOTORS

Direct current (DC) motors: Instead of a wall socket, DC motors typically receive power from batteries. DC mechanisms appear in a wide range of sizes and provide highly variable load ranges, plus fast response times and mobility compared to plug-in models. Different factors are responsible or needs to be taken care of while selecting the motor which are torque,

voltage rating, RPM, gear ratio etc. In this project we have used 12V DC motor.

Fig.4. DC Motors

Orange Planetary Gear DC Motor 12V 370 RPM 147.2 N-cm PGM45775-19.2K

- Model: PGM45775-19.2K
- Operating Voltage: 12V DC
- Rated Torque: 100 N-cm
- Rated Speed: 370RPM
- Rated Current: 2.6 A
- Rated Power: 61.85 W
- Gear Ratio: 19.2: 1

Orange HD Planetary Gear DC Motor has the highest continuous and peak torque capability of any gearbox type. They also feature a very compact, low-weight design in their Class.

This is a 12V DC planetary motor that has a gearbox of 45 mm in diameter. The planetary type gearbox of this motor has a 19.2: 1 reduction ratio which produces 370 RPM with a torque value of around 100 N-cm

Features:

- Brushed permanent magnet DC motor
- Variable speed and reversible
- Planetary Gear Box
- Standard brush life of 2000+ hours (varies by application)

4. BATTERY

In this project we have used 12V Lead acid battery. Lead acid batteries are the old workhorse of robots that are reliable, easy to use, and resilient. They are great batteries that can be abused and can be operated with minimal support. The downside is they are very heavy and have a low energy density. They have a high-power density and can output large amounts of current.

To charge lead acid batteries you can just apply a higher voltage to them, and they will charge. For optimal charging results you can get battery chargers that use preset charge profiles and switch between constant-current and constant-voltage modes.

A common cell is 2.1V that when used can safely drop down to 1.95V. This leads to a common battery size of 12V (12.6V down to 11.7V) which is made from connecting six cells in series. If you drain the battery past the 11.7V (or 1.95V per cell) you will probably permanently damage the battery. A common damage mode is to reduce your battery life. For the safety purpose we have use fuse connection.

Fig.5. Battery

5. BLUETOOTH MODULE

In this project we have used the Bluetooth module which is connected to the Arduino uno. It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications.

It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.

It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.

It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

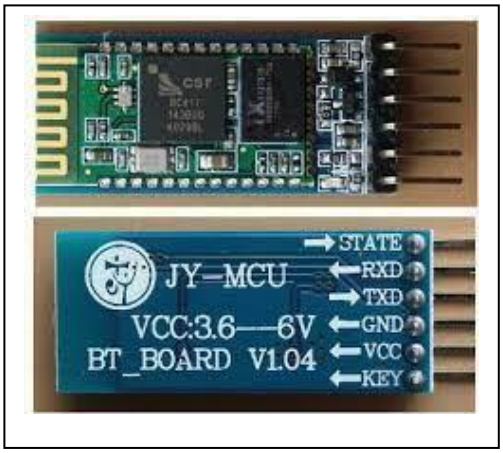

Fig.6. Bluetooth Module (HC05)

It has 6 pins,

1) Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

i. Data mode: Exchange of data between devices.
ii. Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2) VCC: Connect 5 V or 3.3 V to this Pin.

3) GND: Ground Pin of module.

4) TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

5) RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).

6) State: It tells whether module is connected or not.

HC-05 module Information:

- HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.
- This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.
- As HC-05 Bluetooth module has 3.3V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.
- The data transfer rate of HC-05 module can vary up to 1Mbps is in the range of 10 meters.

Specification of HC-05 Bluetooth Module:

- Bluetooth version: 2.0 + EDR (Enhanced Data Rate)
- Frequency: 2.4 GHz ISM band
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Transmit power: Class 2 (up to 4 dBm)
- Sensitivity: -80 dBm typical
- Range: approximately 10 meters (or 33 feet) in open air
- Profiles supported: SPP (Serial Port Profile), HID (Human Interface Device) and others
- Operating voltage: 3.3V to 5V DC
- Operating current: less than 50mA
- Standby current: less than 2.5mA
- Sleep current: less than 1mA
- Interface: UART (Universal Asynchronous Receiver/Transmitter)
- Baud rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, and 460800
- Operating temperature: -20°C to 75°C (-4°F to 167°F)

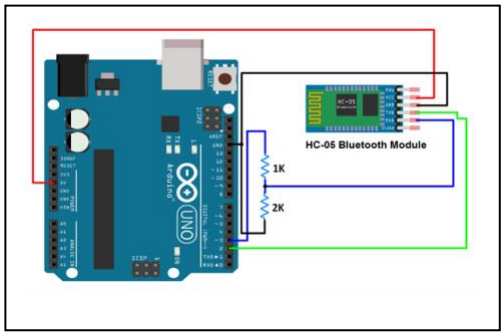

Fig.7. HC-05 Bluetooth Module interface with Arduino

6. BUCK CONVERTER

In this project we have used the 12V to 5V buck converter to power the Arduino UNO.

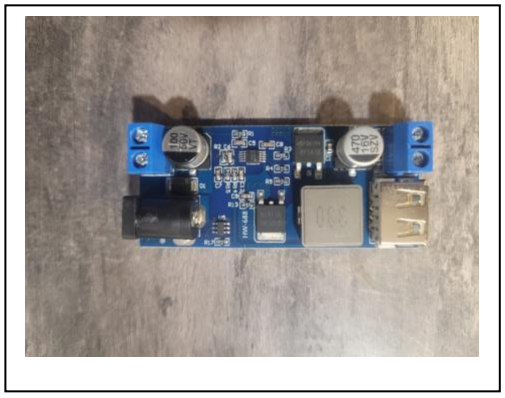

Fig.8. Buck Converter

24V/12V to 5V 5A Power Module DC-DC XY-3606 Power Converter

Features:

- The synchronous rectification scheme, wide voltage, high current, high efficiency.
- With DC plug and terminals, easy to use.
- With USB port, fast-charge identification chip compatible with Android and iPhone mobile phones.

7. INVERTER

Sparkel 12V Compact Inverter which converts 12V DC to 230V AC Pure Sine Wave Output 300W

- High conversion efficiency, smart soft start function, High-precision voltage stability technology.
- Smart, light, and portable designed for home use, Input and output are completely independent.
- Universal socket, suitable for all kinds of plugs, Applicable for resistive/sensitive loads.
- 100% pure sine wave output waveform: designed for sensitive loads (resistive load).
- With the technology of CPU centralized control and SMD inside, Aerospace-grade silence technology.

Specification:

- Weight: 0.5 kg
- Dimensions: 20 × 12.8 × 6.8 cm
- Model No: SPSCAR-30012D
- Rated Battery Voltage: 12V
- Rated Power: 300W
- Surge Power: 600VA
- Rated Current Bulb Load: 32A
- No Load Current: < 600mA
- Efficiency: > 91%
- Waveform: Pure Sine Wave
- AC Voltage: 230VAC
- Frequency: 50Hz
- Battery Type: Lead Acid/LiFePO4
- Input Voltage Range: 10.5V to 14.0V
- Low Voltage Alarm: 10.5V
- Battery Under Voltage Shutdown: 10V
- Battery Low Voltage Recovery: 11.5V
- Battery Overvoltage Protection: 14.5V
- Battery Reverse Connection Protection: Yes, Fuse
- Fuse Rating & Size: 25A 2pc
- Output Short: Turn Off Output and resume after restart
- Overload Protection: Turn Off Output and resume after restart
- Over Temperature: Output off above 85 Degree & On Below 70 Degree
- USB Port: 5V 1.0A
- Cooling Way: Temperature Controlled Fan
- Indications: Power On, Overload
- Working Environment Temp: -40 to 70 Degree C
- Working Humidity Environment: 20% to 95% RH
- Storage Temperature/Humidity: -40 to 85 Degree C/10% to 90% RH
- Digital Display: Yes

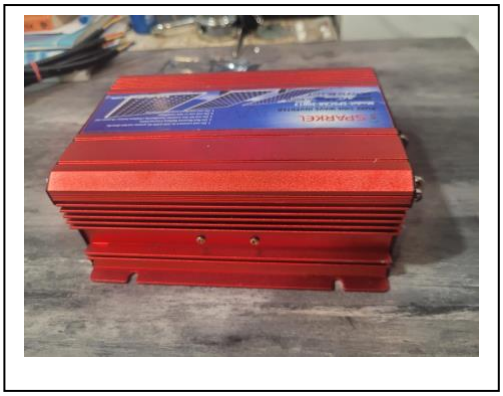

Fig.9. Inverter

8. MCB

An MCB is an automatically operated electrical switch. Miniature circuit breakers are intended to prevent damage to an electrical circuit as a result of excess current. They are designed to trip during an overload or short circuit to protect against electrical faults and equipment failure.

Fig.10. MCB

Mini circuit breakers are triggered by overcurrent - electrical current that exceeds a designated safe current and makes use of a relatively robust mechanical mechanism designed to minimize failures and false alarms.

Excess current causes the bimetallic strip within the MCB to heat, bend, and trip. This releases a switch that moves the electrical contact points apart to confine the arc (electrical discharge). The arc is divided and cooled by an insulated metal strip called the arc chute. The contacts close again once the fault has been fixed and the MCBs are reset.

An MCB is designed to protect against both overloading and short-circuiting. These are detected differently using separate processes. Overload protection is provided by the bimetallic strip using thermal operation, whereas short-circuit protection is provided by the tripping coil via electro-magnetic operation.

If the discharge is especially high, the MCB will trip (activate) very quickly – within one-tenth of a second. When the overcurrent is closer to the safety limits, the component will be slower to respond.

9. BALLAST

Philips EBS 118 230 SH UV Lamp Ballast/Choke

Compact, lightweight, high-frequency electronic ballast designed for TL (6-18 W) and compact fluorescent PL (7-24 W) lamps.

Fig.11. Ballast

Benefits:

- Optimum lamp lifetime compared with electromagnetic gear circuits is achieved in applications with long burning hours (IEC cycle)
- Energy savings of more than 25% (at equal luminous flux) compared with electromagnetic gear
- Enhanced design freedom thanks to compact form

General Information:

- Design Square Housing
- Automatic Restart Yes

Operating and Electrical:

- Input Voltage 220 to 240 V
- Input Frequency 50 to 60 Hz
- Operating Frequency (Min) 42 kHz
- Ignition Method Warm Start
- Crest factor (Max) 1.85
- Power Factor 100% Load (Nom) 0.6
- Ignition Time (Max) 1 s
- Mains Voltage Performance (AC) 221-254V
- Mains Voltage Safety (AC) 216-264V
- Constant Wattage Deviation Not specified
- Power Losses (Nom) 3.5 W

Wiring:

- Connector Type Input Terminals WAGO 251 universal connector [Suitable for both automatic wiring (ALF and ADS) and manual wiring]
- Connector Type Output Terminals WAGO 251 universal connector [Suitable for both automatic wiring (ALF and ADS) and manual wiring]
- Wire Strip length 9.0-10.0 mm
- Input Terminal Cross Section 0.50-1.50 mm^2
- Output Terminal Cross Section 0.50-1.50 mm^2

System characteristics:

- Rated Ballast-Lamp Power 18 W

Temperature:

- T-Ambient (Max) 40 °C
- T-Ambient (Min) 0 °C
- T-Storage (Max) 85 °C
- T-Storage (Min) -40 °C
- T-Case Maximum (Max) 75 °C
- T-Ignition (Min) 0 °C
- Emergency Operation
- Battery Voltage Lamp Ignition 198-254 V
- Battery Voltage Lamp Operation 176-254
- Approval and Application
- EMC Immunity Standard IEC 61547
- Humidity Standard IEC 61347-2-3 clause 11
- Hum And Noise Level Inaudible
- Net Weight (Piece) 0.040 kg

10. UVC CONNECTOR

4 Pin SE HQ-0 Screw Type UV Lamp Holder/Connector with Wire (UL Certified)

- Made in USA high quality UV lamp holders for superior performance of UV lamps.
- Body Material: PBT with a V-0 Flame Class rating. RTI 140 degree C and UV Stabilized.
- These 4-Pin UV Lamp Holders are UL Listed / UL Certified.
- These lamp holders are technically qualified for 660V and power up to 600W.

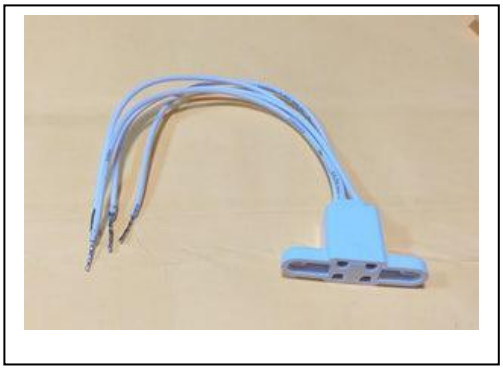

Fig.12. UVC Connector

11. PHILIPS UVC TUBES

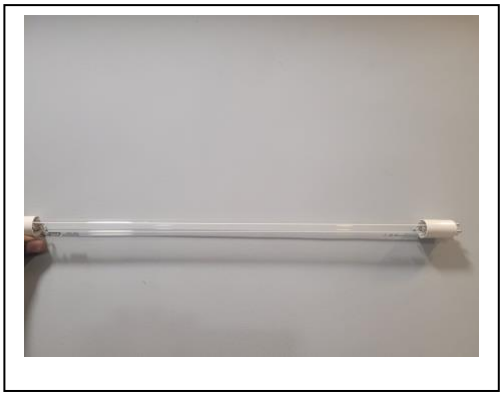

Fig.13. Philips TUV 20W 4P SE UNP/32 T5

TUV T5 lamps are single- or double-ended UVC (germicidal) lamps used in professional water and air disinfection units. The small 16 mm diameter of the lamp allows for a small system design and design flexibility. TUV T5 lamps offer constant UV output over their complete lifetime, for maximum security of disinfection and high system efficacy.

Benefits:

- Security of effective disinfection over the useful lifetime of the lamp
- Good environmental choice because of lowest amount of mercury.
- High system efficacy because it is not required to over-design the purification system to maintain effectiveness of disinfection

Features:

- Short-wave UV radiation with a peak at 253.7 nm (UVC) for disinfection

- Lamp glass filters out the 185 nm ozone-forming radiation
- High Output versions available for optimum UVC output per lamp length, allowing for further reduction of system size
- Small diameter
- Protective inside coating ensures almost constant UV output over the complete lifetime of the lamp.
- High temperature and UV-resistant lamp bases
- Warning sign on lamp indicates that the lamp radiates UVC

Applications:

- Deactivation of bacteria, viruses and other micro-organisms
- Industrial water disinfection equipment, e.g., for food & beverage industry
- Residential drinking water units
- Air treatment systems
- Small municipal water treatment systems
- Swimming pool units

General Characteristics:

- Cap-Base: 4 Pins Single Ended
- Cap-Base Information: 4 Pins Single Ended
- Main Application: Disinfection
- Useful Life: 11000 hrs.

Electrical Characteristics:

- Lamp Wattage: 20 W
- Lamp Wattage Technical: 20 W
- Lamp Voltage: 45 V
- Lamp Current: 0.45 A

UV-related Characteristics:

- UV-C Radiation: 6.0 W

Product Dimensions:

- Reference Length A: 430 (max) mm
- Overall Length C: 437.7 (max) mm
- Diameter D: 19.3 (max) mm

III. MODELLING

1. MOVING BASE

The part is moved by two wheels powered by DC geared motors (A differential drive robot). There are two caster wheels at the front and the back to maintain the balance. We will place the electronic control system and the battery, which is a 12V 35Ah Lead Acid battery inside the ground vehicle. Arduino Mega will be powered with the main battery through a voltage regulator module to reduce the voltage from 12V to 5V. A four-channel RC radio receiver with PWM outputs will be connected to the Mega board. Motors will be driven through a dual-channel H bridge motor driver which is connected to the Arduino board. An inverter is connected between the UV lights and the battery and will be controlled using a relay switch connected to the Arduino board.

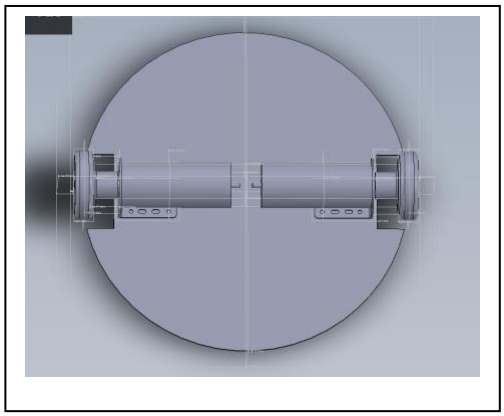

Fig. 14. Model of Moving Base (Top View)

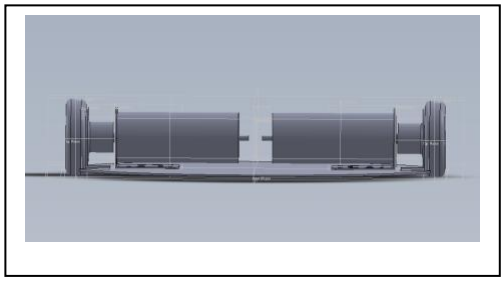

Fig.15. Model of Moving Base (Front View)

2. UV LIGHT TOWER

We will use Fluorescent UV bulbs which require a separate electronic ballast unit to power up the bulb. The light tower contains 4 UV bulbs that are placed around a Mild Steel rod. All electronic ballasts will be

placed inside the Mild Steel rod. The UV tower will be fixed on top of the ground vehicle.

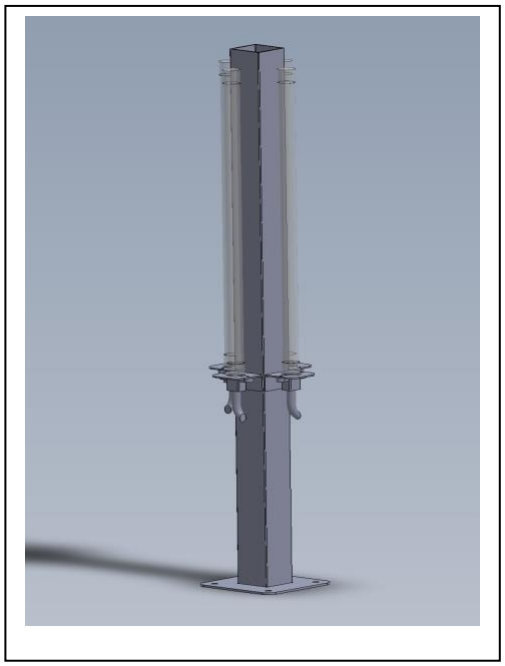

Fig.16. Model of UV Light Tower

3. COMPLETE MODEL

The UV Light tower will be placed over the moving base and all the components will be placed inside the moving base cylinder. The whole model will be built with Mild Steel.

Fig.17. Complete Model of the Robot

4. CIRCUITRY

The following figure shows all the connections that we have done to make the model robot work.

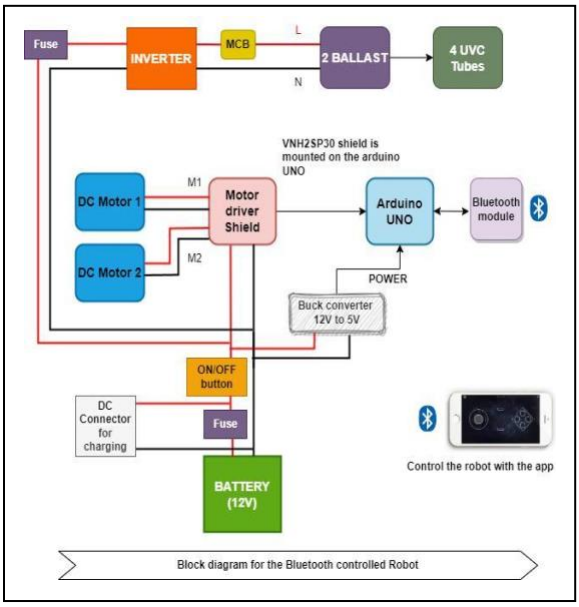

Fig.18. Circuitry of the model

5. WORKING

The above circuit diagram helps us to understand how the different electronics are connected and working together. This robot is powered by a 12V lead acid battery. The charge left in the battery is indicated by the battery indicator on the robot.

The robot itself typically consists of a chassis, wheels, motors, sensors, and a Bluetooth module. The Bluetooth module allows the robot to receive commands from the controller device and to communicate back with the device. It has 2 DC motors connected to the wheel and 2 castor wheels to support the drive. The PWM signals from the Arduino controls the motor movement with the help of the motor driver. We need an application to be configured as serial data ‘0’ to move the robot in forward direction, data ‘1’ to move the robot backward, data ‘2’ to move the robot in right side, data ‘3’ to move the robot in left direction and ‘4’ to stop the robot.

UVC tubes can be turned ON/OFF from the button on the robot. Since UVC tubes work on AC supply we need to convert the battery DC voltage to AC voltage so we have used the 300W pure sine wave Inverter. This UVC needs ballast/chock to turn it ON. As we are using the AC supply on the robot, we have connected

MCB at the output of the Inverter. Safety to be ensured while working with AC supply.

6. CODE

The code is written in Arduino uno atmega328p microcontroller in the Arduino IDE. This microcontroller can be programmed using the USB connection to the board.

Let's understand the code one by one.

```
#define BRAKE 0

#define CW    1

#define CCW   2

#define CS_THRESHOLD 5   // Definition of safety current (Check: "1.3 Monster Shield Example").

//MOTOR 1

#define MOTOR_A1_PIN 7

#define MOTOR_B1_PIN 8

//MOTOR 2

#define MOTOR_A2_PIN 4

#define MOTOR_B2_PIN 9

#define PWM_MOTOR_1 5

#define PWM_MOTOR_2 6

#define CURRENT_SEN_1 A2

#define CURRENT_SEN_2 A3

#define EN_PIN_1 A0

#define EN_PIN_2 A1

#define MOTOR_1 0

#define MOTOR_2 1

int state;

short usSpeed = 18;  //default motor speed

unsigned short usMotor_Status = BRAKE;
```

This part is used to initialize functions with the pins associated and add the library.

Next is the setup loop where we declare the pins as output or input

9600 is the baud rate for Bluetooth and Arduino.

```
void setup()

{

 pinMode(MOTOR_A1_PIN, OUTPUT);

 pinMode(MOTOR_B1_PIN, OUTPUT);

 pinMode(MOTOR_A2_PIN, OUTPUT);

 pinMode(MOTOR_B2_PIN, OUTPUT);

 pinMode(PWM_MOTOR_1, OUTPUT);

 pinMode(PWM_MOTOR_2, OUTPUT);

 pinMode(CURRENT_SEN_1, OUTPUT);

 pinMode(CURRENT_SEN_2, OUTPUT);

 pinMode(EN_PIN_1, OUTPUT);

 pinMode(EN_PIN_2, OUTPUT);

 Serial.begin(9600);   // Initiates the serial to do the monitoring

 Serial.println("Begin motor control");

 Serial.println(); //Print function list for user selection

 Serial.println("Enter number for control option:");

 Serial.println("4. STOP");

 Serial.println("0. FORWARD");

 Serial.println("1. REVERSE");

 Serial.println("2. RIGHT");

 Serial.println("3. LEFT");

}
```

```
void loop()

{
```

This is the loop function where the main code runs continuously.

```
if(Serial.available() > 0){

   state = Serial.read();

 }
```

This loop is waiting for data to be received from the Bluetooth.

```
 if (state == '0') {

   digitalWrite(EN_PIN_1, HIGH);

   digitalWrite(EN_PIN_2, HIGH);

   Serial.println("Forward");

   usMotor_Status = CW;

   motorGo(MOTOR_1, usMotor_Status,
usSpeed);

   motorGo(MOTOR_2, usMotor_Status,
usSpeed);

   digitalWrite(MOTOR_A1_PIN, LOW);

   digitalWrite(MOTOR_B1_PIN, HIGH);

   digitalWrite(MOTOR_A2_PIN, LOW);

   digitalWrite(MOTOR_B2_PIN, HIGH);

   delay(200);

   digitalWrite(MOTOR_A1_PIN, LOW);

   digitalWrite(MOTOR_B1_PIN, LOW);

   digitalWrite(MOTOR_A2_PIN, LOW);

   digitalWrite(MOTOR_B2_PIN, LOW);

}
```

This if statement is the condition when the state is 0 (means when 0 is send from the app to the Bluetooth) then it will execute this command as the enable pins will be high and the motor will get clockwise direction movement with the speed set on usSpeed. Then the digitalWrite function make the motor pin high)

Same logic is used for all other state 1, 2, 3, 4

Else the motor will be in steady position or stop.

```
else

{

   digitalWrite(MOTOR_A1_PIN, LOW);

   digitalWrite(MOTOR_B1_PIN, LOW);

   digitalWrite(MOTOR_A2_PIN, LOW);

   digitalWrite(MOTOR_B2_PIN, LOW);

}
```

This function is used to for the direction of motor

```
void motorGo(uint8_t motor, uint8_t direct,
uint8_t pwm)  //Function that controls the
variables: motor(0 ou 1), direction (cw ou
ccw) e pwm (entra 0 e 255);

{

 if(motor == MOTOR_1)

 {

  if(direct == CW)

  {

    digitalWrite(MOTOR_A1_PIN, LOW);

    digitalWrite(MOTOR_B1_PIN, HIGH);

  }
```

```
  else if(direct == CCW)
  {
   digitalWrite(MOTOR_A1_PIN, HIGH);
   digitalWrite(MOTOR_B1_PIN, LOW);
  }
  else
  {
   digitalWrite(MOTOR_A1_PIN, LOW);
   digitalWrite(MOTOR_B1_PIN, LOW);
  }
analogWrite(PWM_MOTOR_1, pwm);
 }
 else if(motor == MOTOR_2)
 {
  if(direct == CW)
  {
   digitalWrite(MOTOR_A2_PIN, LOW);
   digitalWrite(MOTOR_B2_PIN, HIGH);
  }
  else if(direct == CCW)
  {
   digitalWrite(MOTOR_A2_PIN, HIGH);
   digitalWrite(MOTOR_B2_PIN, LOW);
  }
  else
  {
   digitalWrite(MOTOR_A2_PIN, LOW);
   digitalWrite(MOTOR_B2_PIN, LOW);
  }
  analogWrite(PWM_MOTOR_2, pwm);
 }}
```

IV. RESULTS AND DISCUSSION

In this present work, built a model for Ultraviolet Rays Disinfectant Robot. UV Light is the new disinfection technology used for sterilization purpose. A lot of problems can be solved with the use of this unit. There is no intervention of human while cleaning the area. With the use of this unit i.e., UV Disinfectant Robot, we can get the area disinfected up to 99.99 %. This unit can disinfectant the area in 200 sq. ft. in 20-25 minutes. Ultra Violate rays kill the bacteria by destroying their DNA. UV Light Causes Skin and other fatal permanent diseases to human being. The sterilization and disinfection process can be made autonomous with the use of UV Disinfectant robot

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CONCLUSION

UV disinfectant robots have emerged as a promising technology for reducing the spread of infectious diseases in a variety of settings. They offer several advantages over traditional cleaning methods, including the ability to sterilize surfaces without the need for chemicals or manual cleaning, and the potential to reduce the risk of human error. However, there are also potential risks associated with the use of UV disinfectant robots, such as skin and eye damage, and the effectiveness of the disinfection process can vary depending on a range of factors. Through a comprehensive literature review and analysis of available research, this paper has provided a

comprehensive overview of the technology, applications, and effectiveness of UV disinfectant robots, as well as safety concerns and potential solutions. The results indicate that while UV disinfectant robots can be effective in reducing the spread of harmful pathogens, their efficacy can be impacted by factors such as the distance from the surface being disinfected, the intensity of the UV light, and the amount of time the robot is in operation. Additionally, safety concerns must be carefully considered and addressed to ensure the safe and effective use of UV disinfectant robots. Overall, the use of UV disinfectant robots represents an important step forward in the fight against infectious diseases, and further research and development in this area is needed to optimize their effectiveness and safety. By continuing to investigate and refine this technology, we can help to reduce the spread of harmful pathogens and improve public health outcomes

FUTURE ASPECTS

The model can be made autonomous so that it can navigate any room without the need of any tracks nor human assistance. The model can be used for other service purposes like Serving medicines, food, handing out Equipment etc. The model can be further used in hotels and industrial fields.

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