

360° WIRELESS SANITIZER ROBOT FOR COVID CENTERS AND HOSPITALS

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ABSTRACT

In the pandemic of Novel Corona Virus sanitization is the basic need of surrounding. Though it is extremely dangerous to come in contact with affected patients or area. So, we propose a wireless robotic vehicle with video streaming, which will be able to rotate in any angle to cover every corner & spray sanitizer. This project is specially designed for places like hospitals & COVID centers. To cover every corner like bellow the table/bed. In proposed project, a 360-degree rotating robotic vehicle will be used with battery to satisfy power requirement. On this vehicle a robotic arm will be fitted along with nozzle for sanitizer spray. A sanitizer storage tank will provide sufficient sanitizer for spraying. A rotating Wi-Fi camera is fitted on front side. This robot will be driven by RF operated remote control. Operator can see visual from camera & able to drive robot in required direction to cover every corner of the area to be sanitize. To avoid the collusion of robot, a feature of obstacle detection is added.

Keywords: Microcontroller, Camera, Motor, Remote, Robot, Battery.

I. INTRODUCTION

Corona Virus (COVID-19) is wreaking havoc in the world. Almost every country is suffering from the Corona Virus. WHO has already announced is a pandemic disease and many cities are under lockdown situations and changed our lifestyle. In this current scenario of the global outbreak, it is advised by WHO (world health organization) to maintain healthy hand wash and sanitation habits. In the pandemic of Novel Corona Virus sanitization is the basic need of surrounding. Though it is extremely dangerous to come in contact with affected patients or area. So, we propose a sanitizer spraying robot, which will be able to rotate in any angle to cover every corner & spray sanitizer. This project is specially designed for places like hospitals & COVID centers. To cover every corner like bellow the table/bed. In proposed project, a wireless remote controlled operated robotic vehicle is designed with battery to satisfy power requirement. On this vehicle a robotic arm will be fitted along with nozzle for sanitizer spray. A sanitizer storage tank will provide sufficient sanitizer for spraying. This robot will be driven by operator through wireless remote control. There are switches on remote to drive the robot, to rotate arm & to on/off sanitizer spray. Operator can drive robot in requirement direction to cover every corner of the area to be sanitize with the help of live feed from wireless camera module.

II. LITERATURE SURVEY

Arduino integrated development and HC-05 Bluetooth module used for control and programming. The design of the robot has a smile feature that helps in spreading positivity amidst these times in [1].

The system can sense the proximity with the help of ultrasonic sensor and sends signal to microcontroller. The controller processes the sensor data and actuates pump and solenoid valve. The sanitizer liquid dispenses in [2].

The electromagnetic lock taps directly from the 12v DC power source and then microcontroller and servo motor are fed with regulated DC power supply, which is 5v and 9v respectively in [3].

The complete strategy is validated through numerical simulation, experiments on Toyota HSR platform in [4].

The Arduino had been programmed to provide rotation to each servo motor corresponding to the amount of rotation of the potentiometer shaft in [5].

UV disinfection comes under the category of chemical disinfection. This technology uses UV lamps where UV lamps are used to generate a broad spectrum of 200-300 nm high intensity UV light which kills microorganisms without causing any harm to human beings in [6].

The test results of the design robot are that the robot is able to destroy different types of bacteria in [7].

The system is combined and uses PRI to sense the presence of the human hand and to prevent the transmission of viruses from an entity to a person in [8].

A hybrid system having infrared thermometer along with thermal camera to provide ambient temperature and approximate skin temperature that can be used to detect presence of humans in front of the robot in [9].

III. SYSTEM DESCRIPTION

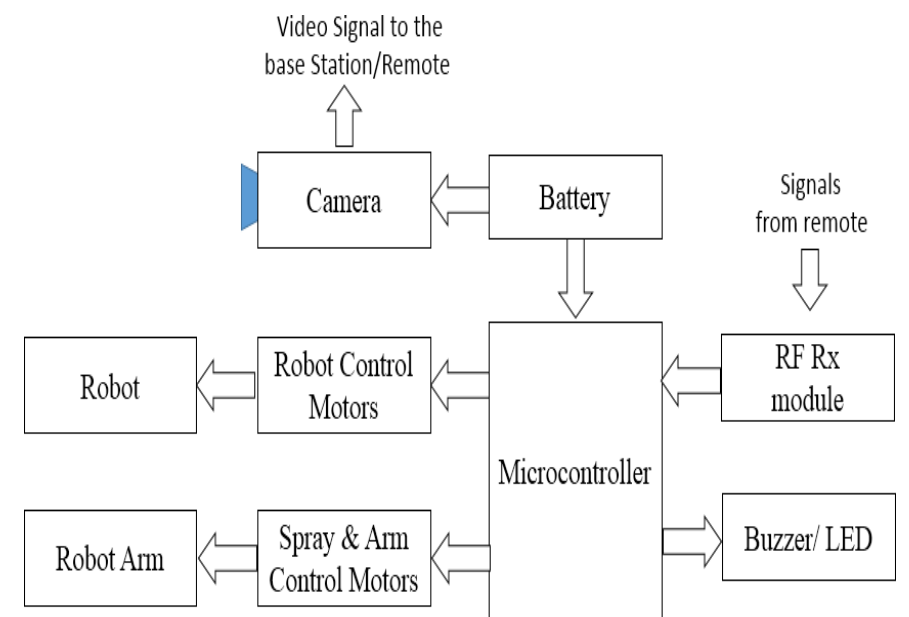


Figure 1: Robot Block Diagram

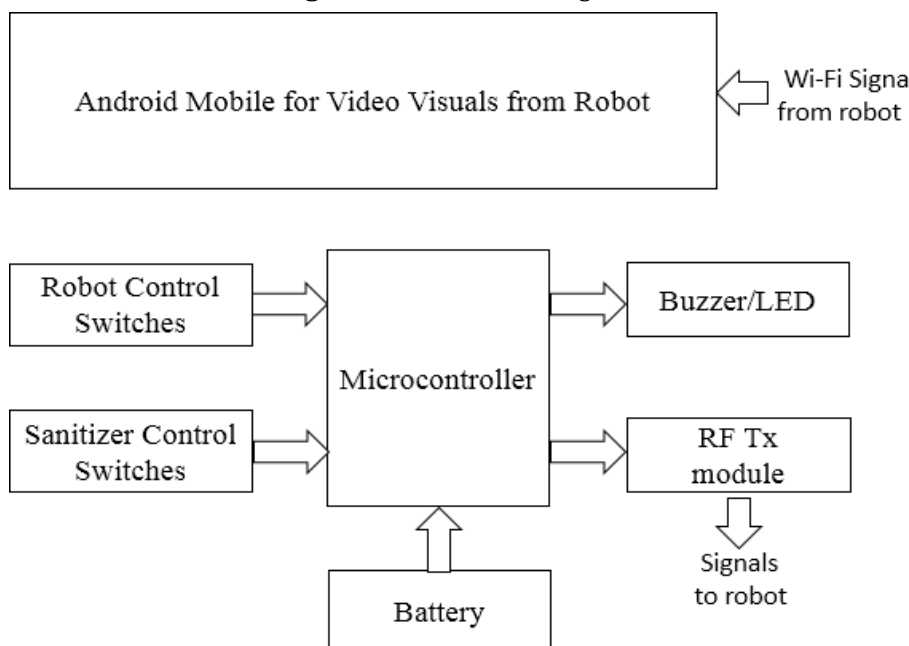


Figure 2: Remote Block Diagram

Atmega328 Microcontroller: A microcontroller is heart of every automation system. It is a small, low cost and self-contained on chip computer. Microcontrollers usually must have lower-power requirements since many devices they control are battery-operated.

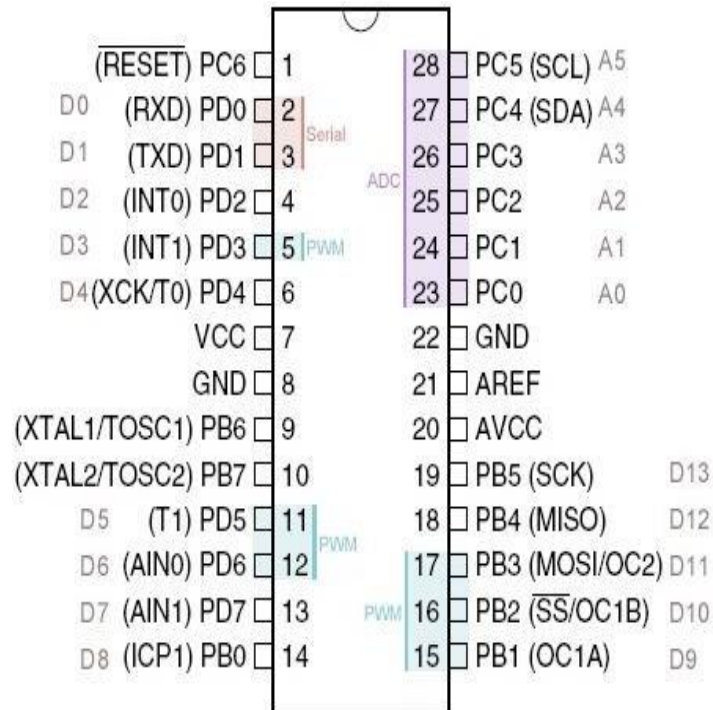


Figure 3: Pin diagram of Atmega328 microcontroller

Battery 12V, 1.3Amp-hr sealed lead acid: The rechargeable batteries are lead-lead dioxide systems. The dilute sulfuric acid electrolyte is absorbed by separators and plates and thus immobilized gases to escape thus avoiding excessive pressure build-up.



Figure 4: Sealed Lead Acid Battery

DC Motor: These motors are simple DC motors featuring gears for the shaft for obtaining the optimal performance characteristics. They are known as center shaft DC geared motors because their shaft extends through the center of their gear box assembly. These standard size DC motors are very easy to use.



Figure 5: DC Motor

L293D Motor Driver: The L293D is quadruple high-current half-H drivers. The L293NE is designed provide bidirectional drive currents of up to 1A at voltages from 4.5 V to 36 V. This device is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high current/high voltage loads in positive-supply applications.

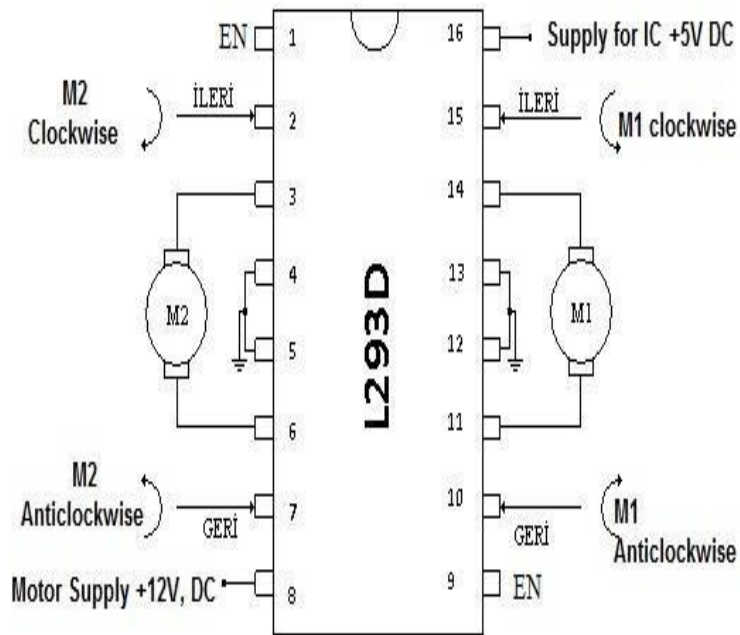


Figure 6: L293D IC

Servo Motor: The tower Pro SG90 1.2 kg-cm 180-degree rotation servo motor rotates 90 degree in each direction making it 180-degree servo motor. It is a digital servo motor which receives and processes PWM signal faster and better.



Figure 7: SG90 Servo Motor

ESP32 Cam Module: The ESP32 CAM Wi-Fi Module Bluetooth with zero V 2640 Camera Module to MP for face recognition has a very competitive small dash size camera module that can operate independently as a minimum system.



Figure 8: ESP32 CAM module

Submersible Motor Pump: Uses advanced electronic components and high quality wear-resistant shaft. Smooth operation, high efficiency, good of performance, long service life. Can be a long time continuously work, low noise, safety and environmental protection. Widely used in industry, scientific research, aerospace industry.



Figure 9: Submersible Motor Pump

IV. RESULTS AND DISCUSSION

Calculation: -

1. Robot motor selection

for speed of 50m/min with wheel of 10cm diameter, needed motor rpm will be,

$$\begin{aligned} \text{wheel circumference} &= 2 \times \pi \times r \\ &= 2 \times 3.14 \times 0.05 \\ &= 0.31\text{m} \end{aligned}$$

So, rpm = Distance/Circumference

$$= 50/0.31$$

$$= 161 \text{ rpm}$$

$$= \sim 150\text{RPM} \quad (1)$$

Overall robot weight contains below considerations:

Table: Robot Weight

Sr. No.	Part Name	Approx. Weight (in Kg)
1.	Robot body	0.5
2.	Sanitizer tank	1.0
3.	Electronics & Battery	0.6
4.	Robot arm with Motor	0.4
5.	Robot motor & wheels	0.7
	Total Weight _____	3.2Kg

So, from above table, approximate weight of robot is 3.2Kg. to run this robot, minimum 2 motors of 2Kg torque will be sufficient. _____ (2)

So, from above calculations, standard consideration parameter for motor selection are:

- Robot torque required= ~3.2kg
- Power source= 12v DC
- Precision required= No
- Speed required= 150RPM

So, DC motor of 12V, 150RPM are used.

Voltage and Current Calculations

Table: Voltage and Current requirement for robot components:

Sr. No.	Component	Number used	Voltage requirement (In volts)	Current required (In mAmp)	Total current (In mAmp)	Power required (In m Watt)
1.	Arduino	1	12	50	50	600
2.	DC motor	2	12	200 (max)	400	4800
3.	MG servo	1	5	210 (max)	210	1050
4.	Micro servo	1	5	150 (max)	150	750
5.	RF transmitter	1	3.3	20 (max)	200	66
	Total				830	7266

So, from above observation for complete system,

- Voltage required is 12V, 5V, 3.3V
- Maximum current required is 830 m Amp = 0.8 Amp
- Maximum power required is 7266 m Watt= 7.2 watt

By using 12V external input supply, 5V and 3.3V can be taken from Arduino supply port pins. So no needs to use any extra supply.

With 12V and 7.2-watt power, current required is

Maximum current needed = $7.2/12$

=0.6 Amp

So 12V, 1.3 sealed lead acid battery is suitable for the robot.



Figure. 10: Robot Structure

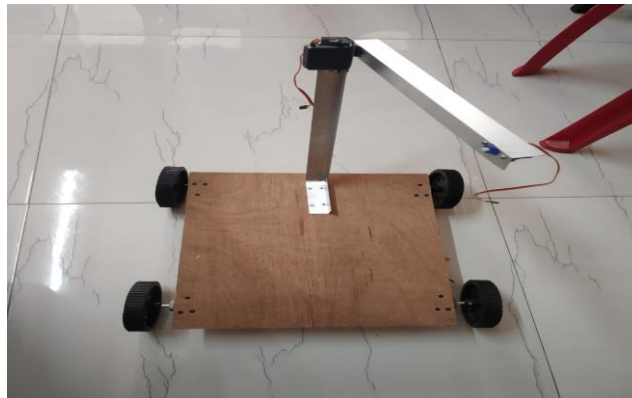


Figure 11: Arm Structure

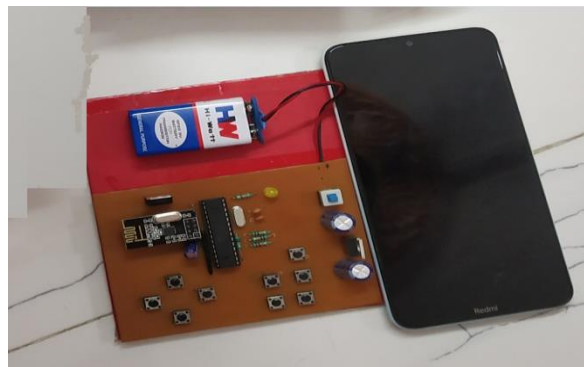


Figure 12: Remote

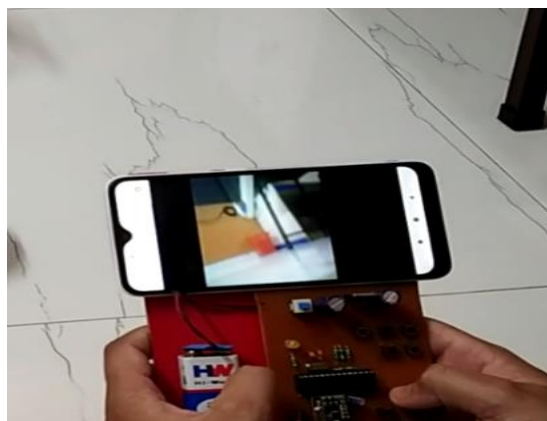


Figure 13: Remote showing live feed from robot

V. CONCLUSION

In the pandemic corona virus, sanitization is the basic need of surrounding. So this robot will be helpful for sanitization purpose. It is very danger to come in contact with covid patients and affected area. Our robot is useful for covering all area and sanitize every area properly in each direction.

Advantages:

- It will help to avoid direct contact of sanitization team with other people & will help to maintain social distancing.
- This robot can easily cover difficult locations like area bellow table/bed with the help of rotating area.

Limitations:

Though project prototype working successfully, it needs to be more powerful and heightened to cover large objects. Also, the wireless transmitter range is need to be increased to make it work on field.

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