

Design and Fabrication of Remote Operated Sanitizer Robot

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ABSTRACT

The world is severely affected by the Covid-19 pandemic health-care workers are hostile to work inside of COVID-19 hospital due to social distancing. Supplying essentials food and delivering medicine in hospitals has a challenge. To address the need of the World health organization and the certified sanitizing system is a solution for personnel and surface decontamination. Sanitization with human efforts is not an easy task. Chances of contacting infections increases which leads to additional spread of Bacteria, Viruses. To overcome the problem developed automatic portable sanitizing equipment for spraying sanitization solution. The portable sanitizer unit is attached to the top of the mobile robot. The system integrates a sprinkler mechanism and is used to distribute air and disinfectant fluid mixture. The mobile robot main components consist of a DC motor, Bluetooth module, Arduino, Motor driver, Submergible pump, Sprinkler, Battery, DC Converters are used. The system is capable of sanitizing the floors of hospitals. The application area can include hospital corridors, medical shops, operation theatre, walking pathways, doctor room, testing center, and patient room, etc.

Keyword: Coronavirus, Sanitization, components, Servomotor, pump.

INTRODUCTION

Corona Virus (COVID-19) is wreaking havoc in the world. Almost every country is suffering from the Corona Virus. WHO has already announced it a Pandemic disease and many cities are under lockdown situations and changed our life style. 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 required direction to cover every corner of the area to be sanitized with the help of live feed from wireless camera module. Now here we are with a new innovation which deals with the world of sanitization without any interference of a human which will be able to reduce the outrage of different kind of viruses to be directly exposed in nature. We create a sanitization robot in the sense of saving human life to minimize direct contact of a virus to save lives. By using certain kind of a robot we will be able to have a safe distant from a containment zone to maintain a precaution from exposure to the virus field. By using the technological ideas using combination of mechatronics and programming in an prototype we are designing a robot which will be able to do a very crucial work of sanitization without any human interference. The main aim of the sanitizer robot is to perform the sanitization without the human contact

Objectives of project:

Objectives of sanitizer spraying robot are:

- Design of remote operated sanitizer spraying robot
- 360 degree rotating spray to cover every angle
- Avoid direct contact of sanitization team with other people
- Will help to maintain social distancing
- Cover risky locations for human
- Also cover difficult locations like area bellow table/ bed

LITERATURE SURVEY

A few research papers related to robots have been reviewed and the following references show influence on the design of the robot. [1] ApekshaWadibhasme, Yedhubooshan M M, have developed a sanitization robot. The objective of this project is minimizing human association as much as possible and thus automating the tasks such as sanitization with the help of robots. In this case, the use of robots can reduce human exposure to pathogens, which has become increasingly important as epidemics escalates. The project uses Autodesk Fusion 360 software for its design and development of the sanitization robot. 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

[2] EnerstEdozie,WantimbaJanat, ZainaKalyankolo, are done the work on, Design and Implementation of a Smart Hand Sanitizer Dispenser with Door Controller using ATMEGA328P, according to this work, ultrasonic sensor (HC-SR04) to detect the presence of a hand. When it detects presence of hand below 10cm, it will trigger the first servo motor to move from 0 degrees to 180 degrees in order to pour the liquid on the hand. It will delay for two seconds before returning back to 0 degrees. After returning to 0 degrees, the electromagnetic lock will de-energize and a green LED will light up immediately, a word “The Entrance Door is Open” will appear on the LCD display then the second servo motor will open the entrance door. We added a delay of six (6) seconds to energize the electromagnetic lock and a delay of two seconds to reset the system. In this system, microcontroller is used to control all the attached devices across the external electronics equipment which are: ultrasonic sensor, servo motor, electromagnetic lock, LCD display and LEDs. The power supply provides the voltage and current required for effective performance of the system. 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.

[3] Ashish Gupta, Rajesh Kumar, are done the work on, Novel design of automatic sanitizer dispenser machine based on ultrasonic sensor,In this paper designed a sanitizer dispensing machine in a plastic cabinet. The system consists of proximity sensor based on ultrasonic principle. The sensor used in the system is SR04 to sense the hands are under the machine or not. The cabinet design was originally fabricated for water RO system and has been modified for the purpose of sanitizer dispensing action. The sanitizer storage section is on the front side upper region. Filters have been removed and the water dispensing tap has also been removed. Mist nozzle has been added at the bottom side of the cabinet. The pump is used to suck the sanitizer and pump it with a pressure to the nozzle. The solenoid valve has also been used to control the opening of nozzle and to facilitate to control the dispensing of liquid sanitizer. Pipes and attachments helped to make it easy to fabricate.

[4] BalakrishnanRamalingam, Jia Yin,have done the work on, A Human Support Robot for the Cleaning and Maintenance of Door Handles Using a Deep-Learning Framework. This work proposes an AI-enabled framework for automating cleaning tasks through a Human Support Robot (HSR).The overall cleaning process involves mobile base motion, door-handle detection, and control of the HSR manipulator for the completion of the cleaning tasks. The detection part exploits a deep-learning technique to classify the image space, and provides a set of coordinates for the robot. The cooperative control between the spraying and wiping is developed in the Robotic Operating System. The control module uses the information obtained from the detection module to generate a task/operational space for the robot, along with evaluating the desired position to actuate the manipulators. The complete strategy is validated through numerical simulations, and experiments on a Toyota HSR platform.

[5] Ankur Bhargava, Anjani Kumar,have done the work on,Arduino Controlled Robotic Arm. This work proposes an 5 Degree of Freedom (DOF) robotic arm has been developed in this project. It is controlled by an Arduino Uno microcontroller which accepts input signals from a user by means of a set of potentiometers. The arm is made up of four rotary joints and an end effector, where rotary motion is provided by a servomotor. Each link has been first designed using Solid works Sheet Metal Working Toolbox and then fabricated using a 2mm thick Aluminium sheet. The servo-motors and links thus produced assembled with fasteners produced the final shape of the arm. The Arduino has been programmed to provide rotation to each servo motor corresponding to the amount of rotation of the potentiometer shaft.

CONSTRUCTION AND WORKING



Working Principal:

The disinfection robot supports automatic and remote operation modes with the automatic mode, users could make a disinfection operation plan according to the established standard requirements, through setting the spraying time, does region on the robot's interactive terminal. The robot would run the disinfection plan automatically according to the parameters set by the users. The frequency of flow valve is automatically adjusted to control the disinfection spraying flow, and the air speed from the sprayer is automatically adjusted to reach the disinfectant spraying distance, so as to realized the unmanned disinfection operation in the breeding environment. The remote control mode, users could send the operation instruction to the robot through the PC or mobile terminal, Which also a high frequency task. In the remote mode, according to the user independent judgment, the disinfection does and spray distance in different working areas could be dynamically adjusted.

Components Used

The Sanitization Robot is mainly consisting of following components which are given bellow,

Arduino Uno

Arduino Uno is ATMEGA328P microcontroller board based. It has 14 digital input/output pins of which 6 can be used as PWM outputs and 6 analog inputs/outputs, a 16 MHz quartz crystal, 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 AC-to-DC adapter or battery to get started.

Its great little solution's for wireless control capable of up to 2Mbps communication with a range from 40 to 100 meter. Has on board antenna. The nRF24L01 is a single chip 2.4GHz trans-receiver with an embedded baseband

Sr.No.	COMPONENTN	NOBs	PRICE/PC	Sub-total Rs/
1	Arduino uno	2	500	1000
2	L293D module	1	130	130
3	Pushbutton switch	9	10	90
4	RF wireless module	2	290	580
5	Servo motor	2	320	640
6	DC motors 12v center shaft	2	210	420
7	Robot wheels	4	50	200
8	5V buzzer	1	25	25
9	LEDs	2	4	8
10	On off switch	2	40	80
11	Water pump 12v	1	200	200
12	battery 12v, 1.3Ahr	1	450	450
13	9v battery& connector	1	25	25
14	Multistand wire	1m	30	30
15	Hardware material	-	1000	1000
16	Acrylic transparent glass	-	1150	1150
Total Cost:				6028

protocol engine (Enhanced ShockBurst™), designed for ultra-low power wireless applications. The nRF24L01 is designed for operation in the world wide ISM frequency band at 2.400 - 2.4835GHz. The nRF24L01 is configured and operated through a Serial Peripheral Interface (SPI.)

Battery 12V, 1.3Ahr 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. Should the battery be accidentally overcharged producing hydrogen and oxygen, special oneway valves allow the gases to escape thus avoiding excessive

pressure build-up. Otherwise, the battery is completely sealed and is, therefore, maintenance-free, leak proof and usable in any position.

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. This DC Motor – 100RPM – 12Volts can be used in all-terrain robots and a variety of robotic applications.

L293D Motor Driver

The L293D is quadruple high-current half-H drivers. The L293NE is designed to provide bidirectional drive currents of up to 1 A 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.

Submersible Motor Pump

Uses advanced electronic components and high-quality wear-resistant shaft. - Smooth operation, high efficiency, good 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.

Servo Motor



This high-torque standard servo can rotate approximately 180 degrees (90 in each direction). It has inbuilt gear & feedback mechanism to perform control action. The S3003 180 Degree Rotation Servo Motor rotates 90° in each direction making it 180° servo motor. It is a Digital Servo Motor which receives and processes PWM signal faster and better. It equips sophisticated internal circuitry that provides good torque, holding power, and faster updates in response to external forces. They are packed within a tight sturdy plastic case which makes them water and dust resistant which is a very useful feature in RC planes, Boats, and RC Monster Trucks etc. It equips 3-wire JR servo plug which is compatible with Futaba connectors too.

Wheel

It will show the actual representation of one type of vehicle wheel demonstration.

Advantages of system

- **It Helps to maintain social distancing** – It will help to avoid direct contact of sanitization team with other people & will help to maintain social distancing.
- **Covers difficult locations** – Can easily cover difficult locations like area bellow table/ bed with the help of rotating arm.

- **Mobility** – The biggest perk of mobile sanitization/disinfection robot is the fact that you can move them to the threat, or the area you want to disinfect. All you have to do is put the unit in one room, allow it to run, then move it to another area. If you have multiple rooms to disinfect at different times of the day, moving the sanitization/ disinfection robot unit between spaces is easy.
- **Operate on any schedule** – Instead of using ceiling or wall mounted disinfecting products that operate on a schedule, mobile sanitization units can be used when it's convenient for you. This is especially beneficial in areas that are used frequently, like hospital rooms, hotel rooms, or airplanes. When you know the room is empty, you can run the germicidal/ sanitization.
- **Easy to use** – With proper training, it's easy to operate mobile sanitization robot unit.

Disadvantages of system

- **Move room to room** – Mobility may be a big advantage for mobile sanitization robot disinfection units, but it can also be a con. If you have multiple rooms you want cleaned at the same time, it might be better to disinfection products that are either wall mounted or ceiling mounted and can run on a timer or with controls. Plus, if you have an extremely large building, relying on one mobile disinfection unit may not be a reality to clean all of the areas you need.
- **Time constraints** – While some mobile disinfection operate on a timer, you may want to use your unit in an area that's frequently occupied. The room should be empty while the system is running to limit exposure.
- **Batteries wear down fast** –all dispensers rely on batteries to operate. So, they require regular and timely maintenance in terms of refilling or recharging the batteries.
- **Sanitization storage capacity**-Sanitization disinfection robot contains sanitizer liquid in storage tank is in less specific quantity. So, it requires to refill periodically

CONCLUSION

- In the pandemic of Novel Corona Virus, sanitization is the basic need of surrounding. This robot will be extremely helpful for sanitization. Since it is extremely dangerous to come in contact with affected patients or area, work of sanitization can be done from some distance using sanitizer spraying robot
- Viruses such as COVID-19 are transferrable through touch and contact. There are WHO guidelines to clean or sanitize regularly to reduce the risk of infection. In the pandemic of Novel Corona Virus, sanitization is the basic need of surrounding. This robot will be extremely helpful for sanitization.
- In this project we studied the ground situation and understood the problem during sanitization and manual working. On the bases of this we decided the specifications of system. This robot is very much useful and help to make situations safe. It also helps to increase speed of sanitization and cover more area easily.

Future scope

- Almost all the sectors were impacted badly during the pandemic. And the sanitization was one of the important process to stop fast-growing and spreading strains of COVID-19 Viruses during the pandemic.
- Sanitizing machines can be seen in some places, but they will become a common thing in the future. Companies around the globe are using Artificial Intelligence to enhance and automate the sanitization process.
- Robotic disinfection will work in an unmanned and standardized fashion, without the need for ongoing human presence at the disinfection site.
- By increasing radio trans-receiver range, increasing sanitization storage tank capacity and mounting camera on sanitization robot we can cover large area distance in conveniently.
- Cleaning robots will be key in the future of public sanitation using autonomous solutions will reduce the risk of virus transmission and increase the efficiency of cleaning.
- Robots and robotics have entered the healthcare arena in a dramatic manner. Countless needs are being addressed in new and different ways, and sometimes, for the first time! Robots, already, have wide-ranging healthcare applications within surgery, ambulation in the disabled, hospital operations, neuromuscular rehabilitation, and emotional care and aging care, to name a few. Robust, exciting research of new applications of robotics in healthcare is thriving.

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