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A Review of Design and Fabrication UV Disinfection Machine

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ABSTRACT: This paper describes the evolving role of robotics in healthcare and allied areas with special concerns relating to the management and control of the spread of the novel coronavirus disease 2019 (COVID-19). The prime utilization of such robots is to minimize person-to-person contact and to ensure cleaning, sterilization and support in hospitals and similar facilities such as quarantine. This will result in minimizing the life threat to medical staffs and doctors taking an active role in the management of theCOVID-19 pandemic. The intention of the present research is to highlight the importance of medical robotics in general and then to connect its utilization with the perspective of COVID-19 management so that the hospital management can direct themselves to maximize the use of medical robots for various medical procedures. This is despite the popularity of telemedicine, which is also effective in similar situations. In essence, the recent achievement of the Korean and Chinese health sectors in obtaining active control of the COVID-19 pandemic was not possible without the use of state of the art medical technology.

I. INTRODUCTION:

In the amidst of this global pandemic, stepping in where humans should not, robots are being used for jobs such as sanitizing hospitals and delivering food and medicines, and have proved to be very much useful and handy. Each and every day as health workers, researchers and governments struggle to control the spread of the virus that has infected more than 22,053,135 people globally and claimed more than 777,489 lives [Last updated: August 18, 2020, 07:11 GMT]. robots are also being deployed for administering treatment and providing support to quarantined patients. The World Health Organization has advised physical distancing for people around the world to prevent community level transmission of Covid-19.

Sanitization, which has become a very important aspect in these pandemic times and plays a very crucial role in preventing us from exposure of this deadly virus and thus helping in eradication of this global pandemic is very important. One of the high-risk zones of exposure to this deadly virus is in the area where people rush to for the cure, that are the hospitals and the medical wards. Sanitization in these areas is indeed challenging and requires very high measures to be taken. But in spite of all these high-end measures taken, there is always a risk associated with it.

The objective of this paper 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 paper uses CATIA V5R20 software for its design and development of the sanitization robot. The design of the robot has a smile feature that helps in spreading positivity amidst these times.

II. LITERATURE REVIEW:

A few research papers related to medical robots have been reviewed and the following references show influence on the design of the smart medical assistant robot. Marcin Zukowski et al [1] have developed a humanoid medical assistant and companion robot dedicated to children hospitals. They have focused on the robot being able to express emotions and communicate with the children by recognizing their faces and using pictures and text on the chest display to tell stories and present educational videos. The 'Bobot' through hospital rooms and performs simple medical tests like measuring patient's body temperature or heart rate and sends live video feed to the doctors and nurses. The robot is run using ODROID XU and XU4 with Ubuntu 14.04 operating system and has a dedicated

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Raspberry Pi 2 computer to animate the robot's eyes.

Marcin Zukowski et al [2] presented the implementation of patients' temperature measurement system for the medical robotic assistant. They have experimented with MLX90614 infrared thermometer and FLIR Lepton thermal camera and found out that the MLX90614 infrared thermometer cannot be used as the only input source of the system and to get more accurate results, robot would need to come as close as less than 0.3 metres to a patient's face. To overcome this they created a hybrid system having infrared thermometer to provide ambient temperature and approximate skin temperature that can be used to detect presence of humans in front of the robot.

The paper by Himadri Nath Saha [5] et.al, propose a IoT Based alarm system for Garbage Monıtorıng and Clearance. This system has a level sensor to monitor the garbage level in the bin and when the level is reached, it alerts the municipality officials. An android app is developed for connectivity. The Microcontroller is Arduino Uno and the system takes energy from a solar panel. This deice has RGB Lights to indicate the exact level of the garbage.

III. PROBLEM DEFINITION:

UV Rays Exposed to human causes various skin& vision problem. So in order to minimize the exposure of humans to there is a need of development of cabinetequipped with UV TUBE

Robots are likely to be cheaper units that can relatively easily and quickly be adapted (eg, from other types of service robots) and that can focus on one aspect of the physical environment (ie, the floor) while humans work in parallel with them, eliminating issues around disinfection time.

Upgrading the cabinet system with UV-C sanitization unit can play a vital role to fight against the COVID-19

IV. OBJECTIVES &SCOPE:

Following are the objective's of our paper work :

Development of cabinet volume 30 liters .

Non contact type operation system

Utilization of UV-C tube for sanitization

Testing complete

SCOPE OF PAPERWORK:

The scope of the present study is to design a smart medical assistant cabinet box by exploring various technologies. The cabinet should be compact for efficient handling and incorporate a quick learning real time environment recognition technology for its locomotion in a crowded hospital.

V. METHODOLOGY:

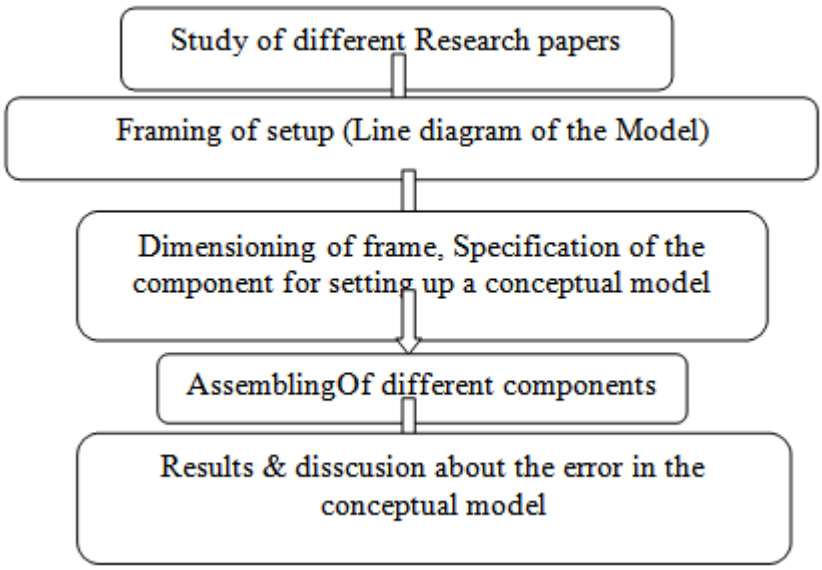

Fig. 1 Flow Chart For Working Process

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VI. SYSTEM DESIGN &COMPONENT:

Inourattempttodesignaspecialpurposemachineweha veadoptedaveryaverycarefulapproach,thetotaldesig nworkhasbeendividedintotwoparts mainly;

- System design
- Mechanical design

Systemdesignmainly concernswiththevariousphysicalconstraintsand ergonomics, spacerequirements,arrangement of various componentson the mainframeofmachinenoofcontrolspositionofthese controlsease of maintenancescopeoffurtherimprovement ; weight of m/cfrom ground etc.

In Mechanical design thecomponent in two categories.

- Design parts
- Parts to be purchased.

Fordesignpartsdetaildesignisdoneanddimensionsthu s obtainedare comparedtonexthighestdimensionwhicharereadily availableinmarketthis simplifies the assemblyas wellas postproduction servicingwork.

Thevarioustoleranceonworkarespecified inthemanufacturing drawingstheprocesschartsareprepared&passedontot hemanufacturing stage.Thepartsaretobepurchaseddirectly are specified&selectedfrom standard catalogues.

6.1 SystemDesign:

In system design wemainlyconcentrateon the followingparameter

6.1.1 Systemselection basedon physical constraints:

Whileselectingany m/citmustbecheckedwhetheritisgoing tobe usedinlargescaleorsmallscaleindustryinourcare itistobeusedin small scale industryso spaceisamajor constrain .Thesystem is to be verycompact it can beadjusted to cornerof aroom. Themechanical design has direct norms with thesystem design hence theforemostjobistocontrolthephysicalparameterssot hatthe distinction obtained aftermechanical designcan bewellfitted into that.

6.1.2 Arrangement ofvarious component:

Keeping intoviewthespacerestrictionthecomponentsshould belaid such that theireasyremoval or servicingis possible moreovereverycomponent shouldbeeasily seen&noneshouldbehiddenevery possiblespaceisutilized in component arrangement.

6.1.3 Components ofsystem:

Asalreadystatedsystemshouldbecompacten oughsothatitcan beaccommodatedatacornerofaroom.Allthemoving partsshouldbewell closed &compact Acompact system gives abetter look &structure.

6.1.4 Man –m/cInteraction:

Thefriendlinessofm/cwiththeoperationisan importantcriterionof design.It is application of anatomical

Following aresomee.g.of this section

- Design of machine height
- Energyexpenditurein hand operation
- Lighting condition of m/c

6.1.5 ChancesOfFailure:

Thelossesincurred by ownerincaseoffailureofacomponentare importantcriteriaofdesign.Factorofsafetywhiledoing themechanicaldesign iskepthighsothatthere are lesschances offailure there overperiodic maintenanceis required to keep the m/c troublefree.

6.1.6 ServicingFacility:

Thelayoutofcomponentsshouldbesuchthate asy servicingis possibleespecially thosecomponentswhichrequiredfrequentservicingca nbe easilydisassembled.

6.1.7 Weight OfMachine:

The totalweightofm/c dependsupontheselectionofmaterial componentsaswellasdimensionof components.Ahigher weightedm/c is difficultfortransportation&incaseofmajorbreakdow nitbecomesdifficult to repair.

6.2 Mechanical Design:

Mechanicaldesignphaseisveryimportantfromthevie wofdesigner aswholesuccessofthepaperdependsonthecorrectdeig nanalysisofthe problem.

Many preliminary alternatives are eliminated during this phase. Designershouldhaveadequateknowledgeabove physicalpropertiesof material,loadsstresses,deformation,andfailure.Theor

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iesandwearanalysis, Heshould identifythe external and internal forcesactingon themachine parts

Theseforces maybe classifiedas;
a) Dead weight forces
b) Friction forces
c) Inertiaforces
d) Centrifugal forces
e) Forcesgenerated during power transmission etc

Designershouldestimatetheseforcesvery accurately by using design equations .If hedoesnothavesufficient information to estimatethem heshould makecertainpractical assumptionsbasedon similarconditions which will almostsatisfy thefunctionalneeds.Assumptionsmustalwaysbeonthesafer side.

MATERIAL SELECTION &METHODOLOGY:

Strength	Elasticity
Stress	Plasticity
Stress	Ductility
Brittleness	Malleability
Toughness	Resilience

When a part is subjected to a constant stress at high temperature for long period Of time, it will undergo a slow and permanent deformation called creep. This property is considered in designing internal combustion engines, boilers and turbines.

COMPONENTS &SPECIFICATION:
UV LIGHT:

Material Selection:

The proper selection of material for the different part of a machine is the main objective. In the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:
1. Availability of the materials.
2. Suitability of materials for the working condition in service.
3. The cost of materials.
4. Physical and chemical properties of material.
5. Mechanical properties of material.

The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:

UV light connected to separate power supply via relay and switched on by electronic trigger generated from Arduino. Here UVC lights are being used as it is effective for the destroying pathogens and other bacterial, virus present in air and moisture. From relays UVC lights are connected and when trigger from Arduino is given, switch is closed in relay and UVC lights are ON.

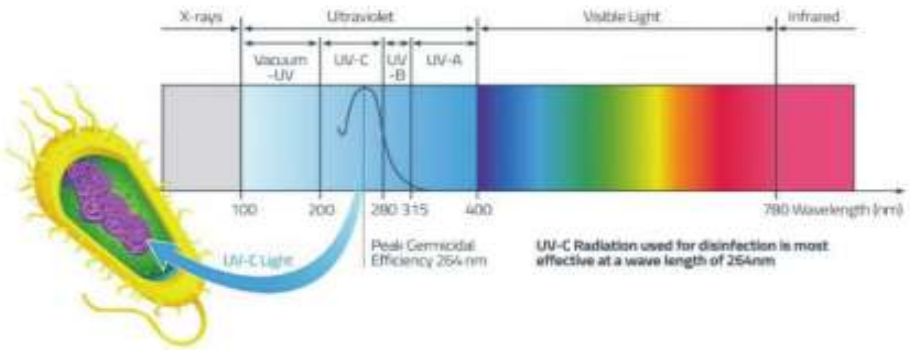

Fig . UV Light

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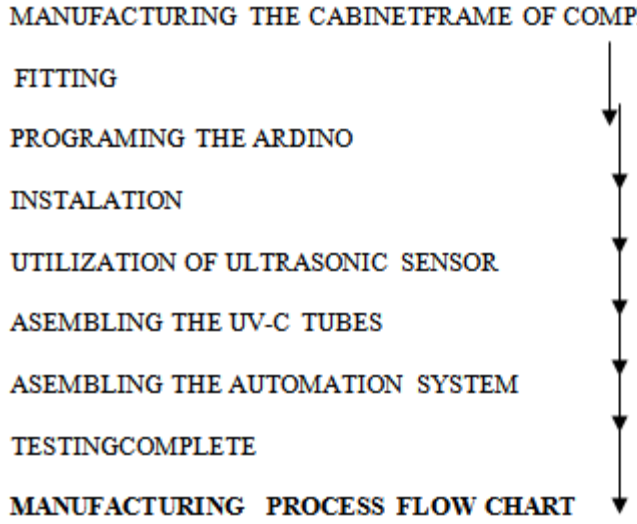
Fig.. UV-C device working. A video showing the setting up of the device is included in the supplementary material.

MANUFACTURING:



WORKING:

Working is very easy for handling. Controlling is easily and effortlessly.
0Object once placed on the surface of cabinet , the object get sanitized. Disinfection process remain ON until the object in inside the disinfection area.Duration of disinfection can be adjusted by controlling the speed of the cabinet.

Working steps of system :

Turn ON the power supply .
Open the cabinet door.
Place the object that needs to be sanitized inside the cabinet.
Now close the door.
Now wave the hand on the surface of sensor ,it will activates the UVC tubes for 15 sec.
This on duration of UV tube can be adjusted as per user demand.

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COMPONENTS USED:

Sr. No	Component Name	Qty
1	Cabinet Box	01
2	Acrylic Door	02
3	Power Supply Adapter	01
4	Automation Control Box	01
5	UV-C Tube	03
6	CabinetWire Mesh Belt	04
7	Power Supply Wire For UV-C	5 Meter

Table: Component Used

VII. CONCLUSION:

This study presents a comprehensive overview of the robotics potential in medicine and allied areas with special relation to the control of the COVID-19 pandemic. Effective management of COVID-19 can significantly reduce the number of infected patients and casualties as witnessed in the case of the Chinese outbreak. Since, it has currently turned out to be a global challenge, technologically advanced countries can aid others by donating support equipment and robotic infrastructure to enable a good outcome in controlling this disease. This review substantiates that the introduction of medical robotics has significantly augmented the safety and quality of health management systems compared to manual systems due to healthcare digitization. Classification of medical robots is only done using application-based categories to fit every aspect of hospital service ranging as well as fault tolerant control and dependable architectures for reliable and safe operation within the healthcare facilities.

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