

ROBO-CURE: How can we save the lives of health care providers, especially nurses while they have direct contact with patients during working in isolation hospitals from infectious diseases.

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DOI: 10.31364/SCIRJ/v10.i1.2022.P0122901

<http://dx.doi.org/10.31364/SCIRJ/v10.i1.2022.P0122901>

Abstract

Due to the Coronavirus crisis that we are living in now, many nurses and health care providers in isolation hospitals have been infected and dying, causing an increase in hospital staff deaths around the world. This is a serious problem as it will cause a shortage of healthcare providers in hospitals. So, our main goal is how can we save the lives of health care providers, especially nurses while they have direct contact with patients while working in isolation hospitals from infection with Covid-19 or any upcoming infectious disease?

Keywords: Health Care, Pandemics, Robots.

Introduction

As the number of confirmed COVID-19 cases accelerates, nurses on the front lines of the healthcare response are finding themselves making high-risk decisions for patients and their personal lives. Only a cough or sneeze from any hospital patient can transmit the infection to the medical staff in the isolation hospital. Also, when a nurse gives a patient his medication, all the safety precautions she takes from the mask to the gloves to the protective suit she's put on cannot also be sufficient to save her from infection. The only solution that most countries have made is to consider nurses and medical personnel in isolation hospitals at the top of the list of people who will receive the Coronavirus vaccine. However, this was not an effective solution because many of the nurses who administered the vaccine experienced fatigue, and some of them lost consciousness. As a result, this is one of the most important problems at the moment that if it is not resolved, the number of nurses who become infected and die could increase causing truly catastrophic problems.




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Materials

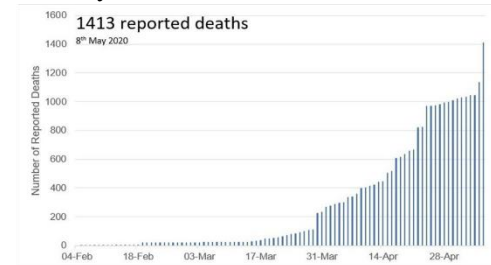
Item	Quantity	Description	Usage	Source of purchase	Image
Acrylic Sheet	2	It is a type of sheets that is color is red.	It made the frame of the prototype.	Electronics store	
Gear motors	4	They are the wheels that need about 4.7V to operate	It is used to make the robot able to move.	Electronics store	
3.7 li-ion battery	2	They are type of batteries	They are used to give electricity to the robot.	Electronics store	

Arduino Uno	1	It is a board	It is the open source that makes the prototype operate.	Electronic store	
Motor driver shield	1	They are a board that connect to the Arduino.	It enables us to connect more sensors to the Arduino.	Electronic store	
Infrared sensor	2	They are type of sensors.	They make the robot move in a specific road to make it know which room it will enter first.	Electronic store	
Servo Motor	2	They are type of motors.	They open and close the drawers.	Electronic store	
Male to female wires	-	They are type of wires	They are used to connect sensors with Arduino	Electronic store	

Ultra-sonic sensor	1	It is a type of sensors	They are used to make the prototype know if there is a barrier Infront of it or not	Electronic store	
Black Adhesive Tape.	2	-	They are used to determine the way pf passing to the robot	Electronic store	
3.7 li-ion battery holder.	1	-	It is used to hold the batteries	Electronic store	

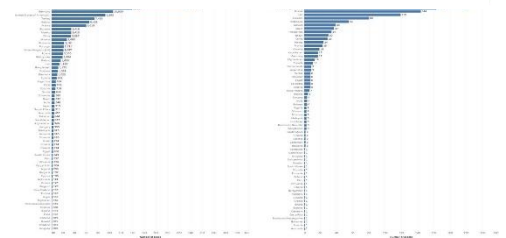
Data Analysis

Around 1,413 nurse deaths have been reported in isolation hospitals as of May 8, 2020, worldwide as shown in Graph 1 of a total of 152,888 healthcare providers who were infected. We estimated that proximately 50 nurses, a maximum, would be affected if we ran our solution because it is clear that robots will not be alone with patients. However, robots will only reduce the number of nurses in isolation hospitals as a result, and nurses' mortality will also decrease. The International Council of Nurses (ICN) estimates that the deaths of healthcare workers worldwide may have reached more than 20,000.



Graph 1

The country in which health care providers contracted the Coronavirus the most in 2020 is Spain, where it refers to about 30,663 healthcare providers as shown in Graph 2; however, Italy has the highest number of deaths among nurses in the country, with statistics indicating about 220 deaths. In Egypt, 268 nurses got infected by this disease and only 8 of them died.



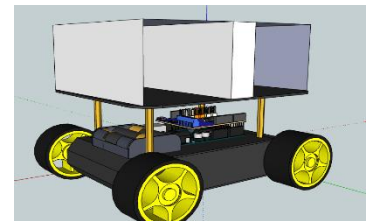
Graph 2

Steps we have taken to solve the problems:

First, we have noticed the problem during quarantine which is that healthcare workers have contracted COVID-19. Then we started thinking about this problem until we came up with this idea. We found that if anyone wore a face mask, they could also be infected. The only solution that can overcome this problem, until a vaccine is found, is to reduce the contact times of health care providers with patients. This can only happen by having robots do the same tasks as nurses and they can serve lots of patients in different rooms.

Solution

Our solution was chosen based on the data we found. Giving the vaccine to health care members in isolation hospitals is not the best solution now because the vaccine may cause health complications because some of them have already lost consciousness after taking it. The only solution to lowering the death rate among nurses and healthcare workers is just by finding an alternative for them that will not be affected by the virus.



These robots, Figure 4, showing a 3D design of them, could be an alternative for nurses to prevent them from coming into contact with infected patients. These robots can give patients the required medication as the drawers will be numbered with room numbers, and when the robot reaches the room, the drawers will be opened and given medication for the patient in this room.

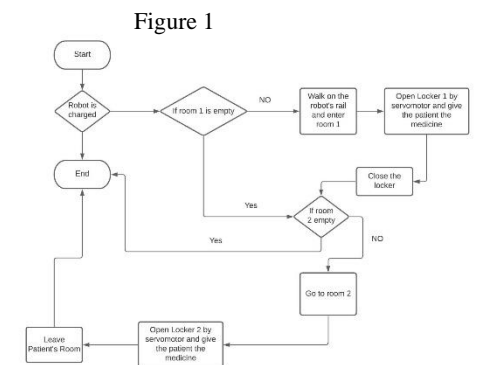


Figure 2

Detailed description to the mechanism of the robot summarized in figure 5

The robot will move on a specific track due to the presence of the infrared sensors. The ultrasonic sensor will make the robot determines the distance so it will know where to stop in order to give the patient his medicine. The drawers will be opened and closed according to the room the robot is in due to the presence of the servo motors. For instance, when the robot goes to room 1 the servo motor will open the drawer 1 that contains the patient's medicine, and after the patient took the medicine from the drawer, it closes, and the robot leaves the room.

Additional information

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Large hospitals have approximately 500 rooms in minimum; As a result, not only one robot will be used in one hospital, but about 50 robots will be used to act as one robot that can serve up to 10 rooms to save time. The cost of the prototype is around 750L.E

The Prototype



Figure 3

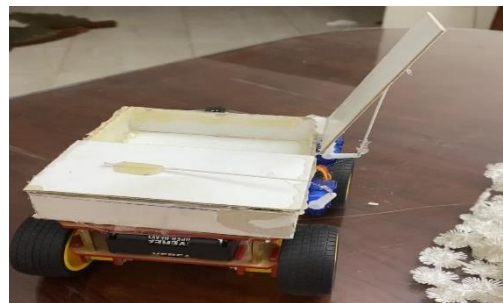


Figure 4

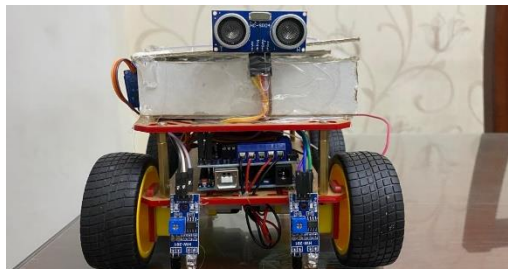


Figure 5



Figure 6

Conclusion

In conclusion, the robot will solve the disaster that most countries on different continents now face. Nurses are a valuable thing, so we must take care of them. These cutting-edge robots will prove to work great in hospitals during pandemics just like we live in now.

Robots will work just like nurses to reduce direct contact between patients and nurses, thus reducing the likelihood of contracting the virus.

This robot is cheap, and its components are very simple. Also, it can have lots of drawers for any number of rooms, but it is recommended to make the robot serve only 10 rooms to save time and prevent any kind of delay.

Application

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The idea of such a robot that could replace health care staff will take us to another level. Robots will not be affected by the spread of any pandemic or viruses other than that they are programmed to deal with the seriously ill. The bright side of this project is that the robot will be coded, which prevents errors or delays in such tasks. Many features can be added to the robot, for example, photographing difficult situations, reporting the impact of new inventions, or even working without rest or food for a while. The handling of the robot is safe in practice, both for children and the elderly. As for the margin, some safety instructions must be taken so that the error does not exceed 5%, such as letting minuscule amounts of nurses. The robot should undergo a monthly checkup and report on its capabilities. Additionally, some operations have to be performed under human supervision.

Future Research

Our Prototype is only just the beginning. We recommend the following:

- 1) How could we develop the performance of the robot?
- 2) Make the robot itself use electricity from solar cells instead of batteries.
- 3) How could we develop the robot to serve more rooms at the same time?
- 4) How could we make the design of the robot more applicable for other tasks like monitoring the temperature of the patient.

Make ultraviolet station rooms in the isolation hospitals to kill the virus itself stuck on the robot after finishing its task to prevent virus spreading

Differences

Many robots have been made from great companies since the beginning of corona virus pandemic, so how we are different?

- 1) These robots did not give patients their drugs; however, they only do the traditional things like doing the PCR test as an example.
- 2) All of these robots are very expensive and not all isolation hospitals around the world can afford to pay for them; However, our prototype costs less than \$ 50.
- 3) These robots are difficult to modify, so companies tend to build them again if they want to develop them; However, our prototype mainly relies on Arduino as the main source, so anyone can develop it without barriers since the Arduino is open source.

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