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Development of Goods Carrier Robots and Interaction of COVID-19 Patients with Medical Personnel at Politeknik Negeri Jember

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Abstract. Covid-19 virus is the first type of deadly virus found in wuhan city, China. Based on worldometer data that entered until August 25, 2020, in Indonesia, 157,859 people were positively infected with the Covid-19 virus. The increasing number of infected patients is at high risk to nurses and doctors because one of the causes of the infection is by direct contact with patients who are declared positive there is a corona virus. CNN Indonesia on August 25, 2020 recorded as many as 90 medical personnel killed from exposure to the Covid-19 virus. To reduce the risk of coronavirus spreading in nurses or doctors when carrying out the task of treating patients in hospitals or health facilities, Politeknik Negeri Jember designed the manufacture of robots that can bring medical needs or needs of patients to the treatment room. this aims to reduce direct contact between patients and medical personnel. Remote control based on keyboard with radio telemetry is expected to prevent physical contact between medical personnel and patients. So the chances of exposure to the Covid-19 virus are less. The use of an interface in the form of streaming video calls, allows patients to communicate directly with a nurse or doctor (telehealth).

1. Introduction

The covid-19 case stems from a WHO China Country Office report on December 31, 2019 reporting cases of pneumonia in Wuhan City, Hubei Province, China. Then on January 7, 2020, China identified the unknown pneumonia as a new type of coronavirus (novel coronavirus, 2019-nCoV). The increase in the number of cases in 2019-nCoV / COVID-19 took place fairly quickly and there has been a spread outside wuhan region and other countries [1]. CNN Indonesia news on August 25, 2020, in Indonesia there have been 157,859 cases declared positive COVID-19, with 90 cases of COVID-19 being health officials. Doctors and nurses are at high risk of contagion because they come into direct contact with COVID-19 patients. The virus is mainly spread between people during close contact, often via small droplets produced during coughing, sneezing, or talking [2]. In addition carriers of viruses that produce droplets through coughing, sneezing and speech can transmit directly or fall attached to the surface of objects that are then touched by others [2]. In this research developed a wheeled robot to assist doctors or nurses in carrying out their duties in the form of social distancing. The task that can be assisted by robots is to bring the needs of patients and the connection between the doctor and the patient. The robot is designed with a 2-wheel drive system and a combination with a caster wheel, with a robot rack consisting of 4 layers. The ZOOM application is used for patient communication with doctors in

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conducting consultations. The study is expected to contribute to the suppression of the spread of the 2019-nCoV virus-induced disease outbreak in health officials..

2. Related Work

Research in the field of human-robot interaction has done a lot of research on robot waiters. In Singapore, due to its demographic nature and the need to moderate reliance on foreign workers and to increase national productivity, robots in the service sector are being seriously considered. Robots developed using centralized computing handles such as sensors, cameras, speakers, charging battery systems. The design concept is based on the need to minimize human labor but not to replace it. Humans are still needed for personal relationship purpose, to engage the customers and to make their dining a pleasure [4]. In 2015, M Asif, M Sabeel, Mujeeb-ur-Rahman and Z H Khan designed and developed a butler robot that was considered a possible solution for restaurant automation. Robots can be divided into two main types. The first one deals with the teleoperated robots while the second one is autonomous robots [5]. In 2017, Md Kamruzzaman and Md Tareq designed and implanted prototype robot waiters to be able to accept orders through the android app, then collect food and drink from kitchen boy. Then travel to the order destination in order of order. Most of the waiter robots had been designed by using linefollowing technique. But in this design, wheel step counting has been used in the programming of Arduino. To serve tea/coffee according to the user‟s order through wireless communication, an automated system is designed by using a ready-made microcontroller kit "Arduino mega" [3]. Pandemics pose unique challenges to health care delivery. Although telehealth will not solve them all, it's well suited for scenarios in which infrastructure remains intact and clinicians are available to see patients [7].

3. System Design

3.1 Hardware Design

The robot is designed with dimensions length = 50 cm, width = 40 cm and height =120 cm using a differential two wheeled drive system. The rear drive uses 2 PG36 motors and is combined with a caster wheel for the front wheel. Ultrasonic sensors are mounted on the front of the robot to avoid collisions. To be able to control the robot, an ATMega328-based microcontroller module connects with a telemetry to be able to connect to the computer as a central control. ATMega328 is a microcontroller with a maximal clock of 16MHz. This 8-bit microcontroller is tasked with translating instruction data that has been sent from computer to DC motor PG36 to be translated into PWM pulse. DC bts 7960 motor driver is used as PG36 motor driver. The source of the waiter's robot voltage uses a 12 Volt Li-Po batteray. Schematics for sensors, DC motors, regulators and telemetry can be seen in figure 1. For telehealth use android tablets mounted on robots that also serve as eyes on the robot for the directions.

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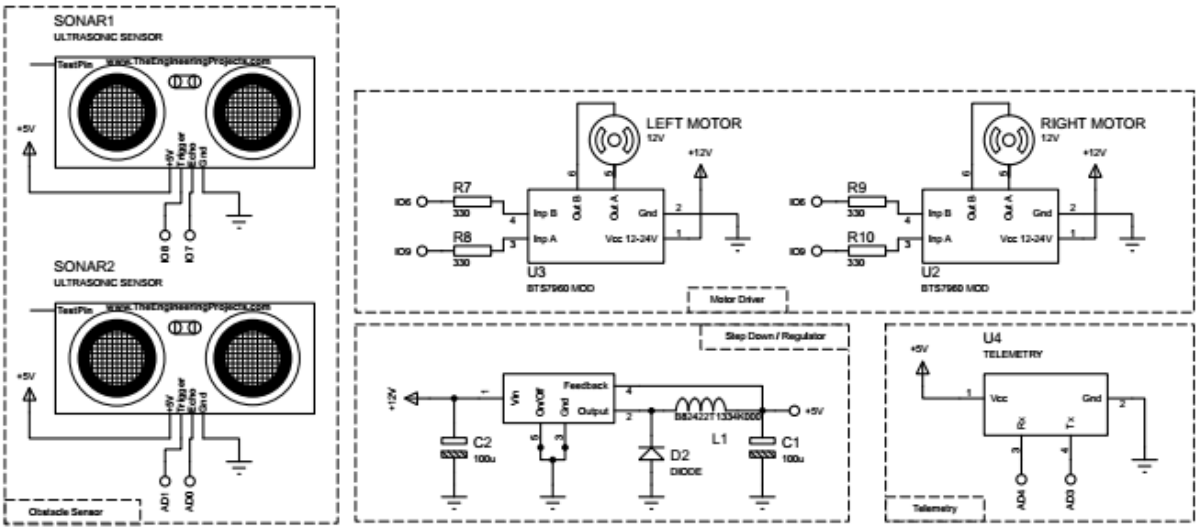

Figure 1. Schematics for sensors

3.2 Software Design

Use of 2 programming languages used in software design. The first is the use of Visual Basic for movement commands. The second is the Arduino IDE programming for microcontrollers. The microcontroller receives commands from the computer and converts the data sent by the computer into PWM data for wheel turning speed. The microcontroller also sends sensor reading data to the computer. For telehealth use zoom application by installing android device on robot that serves as robot path guide and as communication device between health workers and COVID-19 patients. The robot's movement command uses a button on the computer keyboard that can be seen in figure 3.

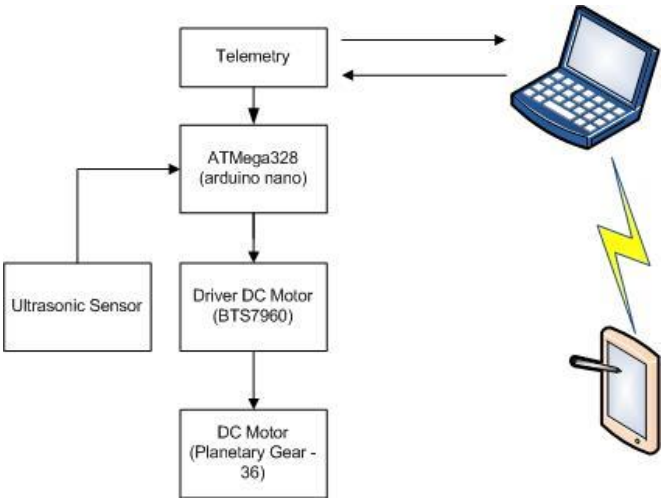

Figure 2. Block Diagram Robot Waiter

No	Button	Movement
1.	W	Straight Forward
2.	A	Turn Left
3.	S	Straight Backward
4.	D	Turn Right
5.	O	Andorid Tablet Tilt (Camera)

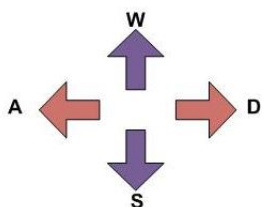

Figure 3. Movement Table

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4. Result and Discussion

The robot's drive wheel uses a 12cm diameter rubber wheel that is copping directly with the DC motor PG36. With a two wheel drive system combined with caster wheels to facilitate the movement of the robot for maneuverability. A robot with a height of 120 cm with maximum height is where to put android tablets for telehealth and road directions. Under the android tablet is a 3 layer rack to carry the needs of patients with the ability to carry a load of 10 kg.

Figure 4. Waiter Robot developed by Politeknik Negeri Jember

Testing is carried out by traveling in the Computer Systems and Control Laboratory with zoom application guide as a road guide by bringing the patient's needs (tissue paper, drinking water and hand sanitizer). The computer as a central control uses the Intel NUC core i7 with the ZOOM application as the host. Under normal walking conditions, android tablets tilt downwards as a road point, when telehealth between health workers and patients, the android tablet looks up by pressing the "O" button on the keyboard. Testing of the robot can be seen in figure 5.

a b

Figure 5. (a) Robot on the move, (b) Robot on telehealth

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5. Conclusion

Test results showed the robot's performance was helpful in reducing healthcare workers' direct contact with patients. From testing the moving robot for 10 minutes, the battery condition showed a decrease in voltage of not much. That is from 12.8 Volts to 11, 9 Volts. In addition, telehealth testing is also recommended to be applied to hospitals that are referrals for covid-19 patient isolation. The downside of the robot is the difficulty in controlling the movement of the robot guided by the results of the zoom app streaming video. This can be improved by multiplying the accustomed to operating the robot waiter so that there is no error seeing and describing the video of the robot's directions.

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