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Paramedic Assistant Robot : Feature Review from Generation 1.0 to 3.0

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***Abstract*—The increasing number of Covid-19 patients in the Surabaya, East Java area has affected the performance of the medical personnel who treat them. The medical personnel tire easily as the patient increases over time. The concrete action of this condition is Paramedic Assistant Robot. The method used in designing this paramedic assistant robot is as follows: 1) Formulating problems and the value of the robot's function, 2) Designing the robot's electrical unit, 3) designing the robot's communication unit and network, 4) designing the robot's mechanical unit, 5) the overall manufacturing process unit, 5) assembly process, 6) trial phase. The development resulf of feature each generation from 1.0 to 3.0 increase significantly. For the maneuver, from remote control and joystick become autonomous system. It means that the artifial intellegent also improved. For generation 3.0 robot diveded into two robots, namely robot for service and robot for monitoring. Robot generation 1.0 has no measurement instruments, while robot generation 2.0 and 3.0 has measurement instruments wheather integrated with the robot or seperated.**

Keywords—paramedic, robot, assistant, covid-19

I. INTRODUCTION

Coronavirus is a virus that can cause disease in animals or humans that attacks the respiratory tract. More and more patients in the hospital have an impact on the performance of medical personnel in doing their job. Medical personnel will tire easily because they always treat patients. Apart from needing personal protective equipment, they also need tools that can help treat patients from a care perspective to meeting their logistical needs. The tool is an assistant robot that can work by implementing social distancing procedures between medical personnel and patients. According to [1] regarding Low Cost Scalable Hands-Free Robotic Medicine, it is a robot that helps medical personnel in managing patient medications. This robot helps store medicines and deliver them to patients at the hospital. According to [2] about the MERC food delivery robot. This robot helps medical personnel when delivering food to treated patients. This robot is also set to be able to determine a good menu for the patient and how much food the patient should consume. According to [3], [4], [7] regarding assistant robots that are used for patient surgery, it makes it easier for medical personnel to perform operations and shortens operation time. With this operation assistant robot, the operation success rate is 99%. According to [5] regarding the food delivery robot Transcar and Helpmate are very helpful for medical personnel in managing the schedule of food distribution to patients. This robot is programmed to deliver food according to a schedule determined by the hospital. According to [6] the autonomous system robot can help hospitals in treating elderly patients. This robot can entertain them by communicating with elderly patients. This robot is designed to perform interactive communication with patients. According to [8] about using the Mixed-Observability Markov Decision Process (MOMDP) formula approach, it was found that robots collaborate with human tasks. The robot will carry out the tasks assigned by humans when the robot is programmed to recognize the human. According to [9], humanoid robots can help patients relax because they are able to interact and provide suggestions regarding what actions the patient takes during the treatment process. According to [10] that urological and gynecological robots are widely used to assist general surgical operations (gastric surgery, gallbladder, pancreas, spleen, colon and rectum, or hernia), urological surgery (prostate or kidney surgery) and gynecological surgery (ovarian surgery). or uterus). The use of robots for surgical purposes (surgery) is used to reduce the surgical performance of medical personnel, thereby saving time. The purpose of this study is to design and develop a Paramedic Assistant Robot to help with the logistical and care needs of Covid-19 patients. The robot can be controlled by a wireless remote control and can be driven by a paramedic. The robot is equipped with a camera so that patients and their families can communicate with each other.

II. RESEARCH METHODS

The method used in designing this paramedic assistant robot is as follows: 1) Formulating problems and the value of the robot's function, 2) Designing the robot's electrical unit, 3) designing the robot's communication unit and network, 4) designing the robot's mechanical unit, 5) the overall manufacturing process unit, 5) assembly process, 6) trial phase, 7) application of robots to emergency hospitals for COVID-19 patients. The following is a block diagram of the method used.

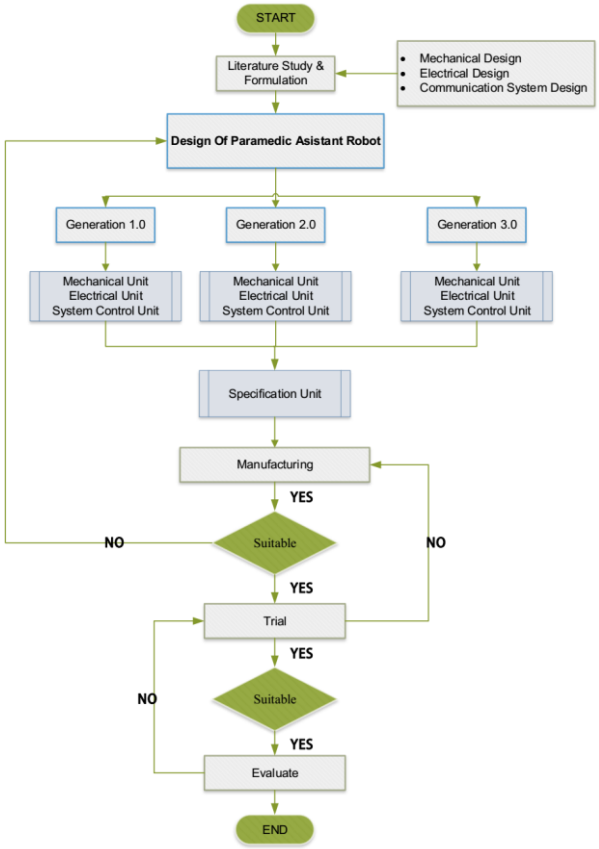


Figure 1. block diagram methods

There are several stages used for developing these robot from design to trial stage. Each stage consist of activities to build the part until assembly.

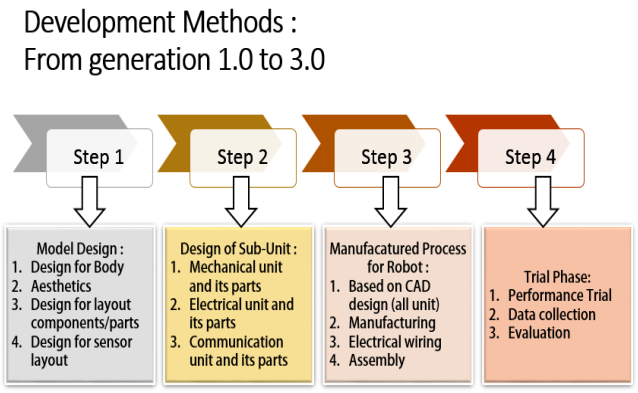


Figure 2. Stages used for developing robot

III. RESULT AND DISCUSSION

Based on the study of several design models that have been carried out, the results of the design of a paramedic assistant robot that are ready to be manufactured are as follows.

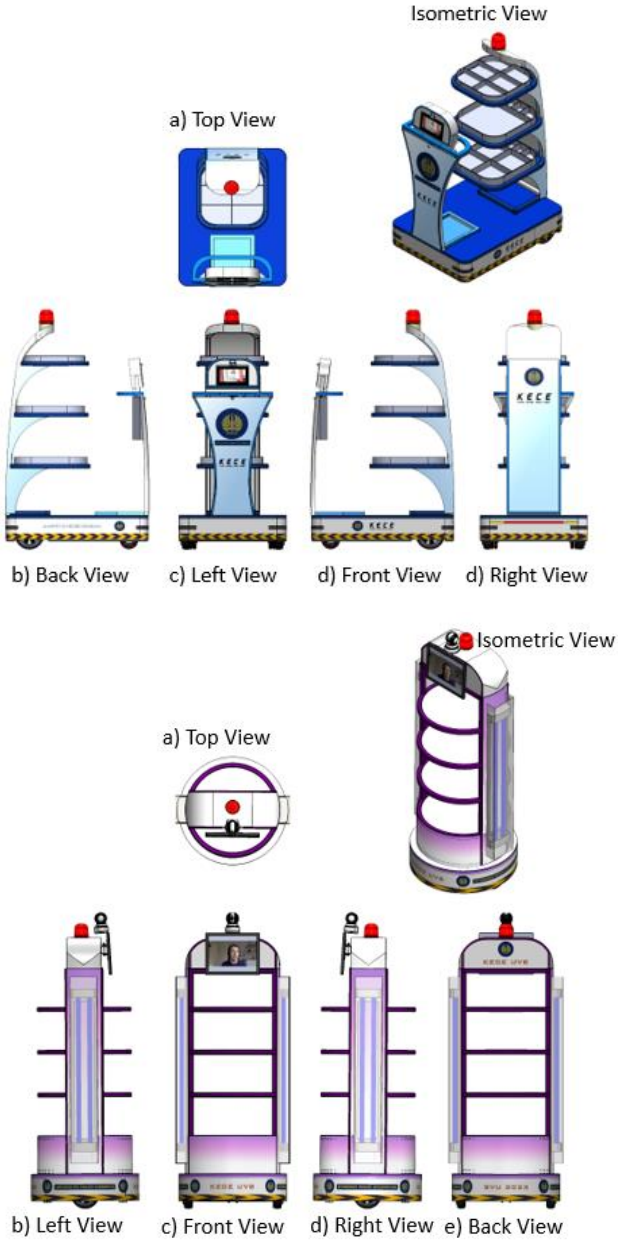


Figure 3. design of paramedic assitant robot 1.0

TABLE 1. Feature of Paramedic Assistant Robot 1.0

No	Feature	Description
1	Communication	Radio
2	Maneuver	Remote control (manual)
3	Driver	2 Motor 2 Follower Wheel
4	Main function	Delivery
		Communication by whatsapp
		UV sterilization
5	Streaming	Not Available

The frame model that is applied uses a hollow 2 cm x 2 cm and for the table using a 1 cm x 1 cm hollow. In each stack, it is designed into 3 levels of tray table frames, namely the top, middle and bottom tables. The robot's electrical unit regulates the process of robot movement and maneuvering. At this stage the electric unit manufacturing process is the installation of the BLDC electric motor and its BLDC Motor Driver. Robot communication unit includes: 1) Mini camera, 2) LCD monitor, 3) Remote control transmitter, 4) IR sensor, 5) 5.8 Ghz frequency antenna, 6) 2.4 Ghz antenna frequency. All of these units have been installed on the robot in order to communicate with the robot operator later.

The weakness of the generation 1.0 is no streaming available for monitoring the condition of the covid-19 patient. Then, the monitor screen for communication is too small. In this generation there are two model : 1) The blue one was built to delivery used and lift the paramedic with maximum load 150 – 200kg. 2) The purple one was build to sterilize room with UV sterilization. It is also be able to deliver the logistics but it can not be used for lifting the paramedic. There are some aspects when this generation 1.0 tested after wiring, assembling and manudacturing completed.

TABLE 2. Eligibility of generation 1.0

No	Eligibility gen 1.0	Description
1	Communication	Operators can view patients through mobile phone attached to the remote controller
		Patients can see the operator through the screen on the Robot
2	Maneuver	Robot can perform Maneuver according to operator control
		Robot operates well when controlled by remote control
4	Frame	Frame material is corrosion resistance
		The frame can support the maximum allowable load (150-200kg)
5	Battery	The battery used can provide a power source enough for robot operation
6	Communication range	Robot Monitor Screen Range is about 50 meters
5	Control range	Robot Control Range is about 50 meters
6	Motor	The electric motor used can generate power enough to move the robot

The next generation is paramedic assistant robot 2.0 with additional features. Its design also different from 1.0.

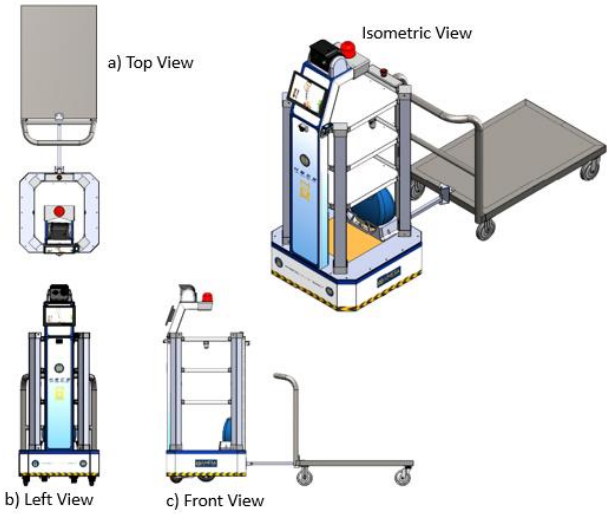


Figure 4. design of paramedic assitant robot 2.0

The added value of paramedic assitant robot 2.0 is the logistics delivery feature and UV Sterilization became one package. So that, it not only helps the delivery of logistics, but also can be used for sterilization of paramedics, patients and rooms.

TABLE 3. Feature of Paramedic Assistant Robot 2.0

No	Feature	Description
1	Communication	Wifi
2	Maneuver	PC and Joystick (Manual)
3	Driver	2 Motor
		4 Follower Wheel
4	Main function	Delivery
		Communication by streaming
		UV sterilization
		Camera 360
		Impact safety sensor
		Music therapy
5	Streaming	Available
6	Measuring instrument	Oximeter
		Thermometer

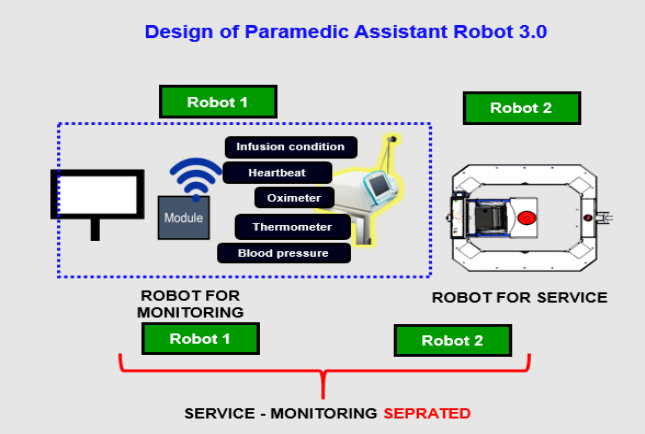
In the development of the paramedic assistant robot 2.0, the sterilization and logistics features are integrated with the robot. To maneuver the 2.0 generation robot using a PC and a joystick (manual). Equipped with impact safety sensor and 360 camera (4 sides).

TABLE 4. Eligibility of generation 2.0

No	Eligibility gen 2.0	Description
1	Communication	Operators can view patients through monitor

		screen
		Patients can see the operator through the monitor screen on the robot
2	Maneuver	Robot can perform Maneuver according to operator control with joystick (manual) Robot operates well when controlled by joystick (manual)
4	Frame	Frame material is corrosion resistance The frame can support the maximum allowable load (150 – 200kg)
5	Battery	The battery used can provide a power source enough for robot operation
6	Communication range	Robot Monitor Screen Range is about 50 meters or more (it depends on wifi routers attached in hospital)
5	Control range	Robot Control Range is about 50 meters or more (it depends on wifi routers attached in hospital)
6	Motor	The electric motor used can generate power enough to move the robot

Furthermore, the team developed the robot to the next generation, namely generation 3.0. In this 3rd generation robots are divided into: 1) Monitoring Robots; has the feature of being able to find out the condition of the infusion of Covid-19 patients, the condition of the heart rate, oximeter, temperature measurement and blood pressure conditions. 2) Service Robots; features a) delivery, b) communication by streaming, c) music therapy, d) camera 360. The sensors used are: a) impact safety sensor, b) LIDAR sensor, c) IMU sensor, d) Gyroscope.



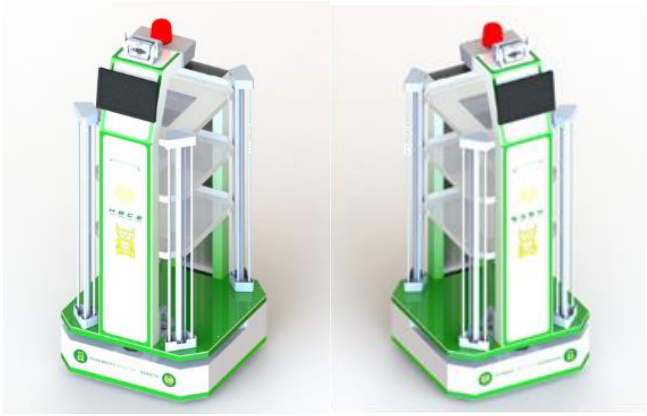


Figure 5. design of paramedic assitant robot 3.0

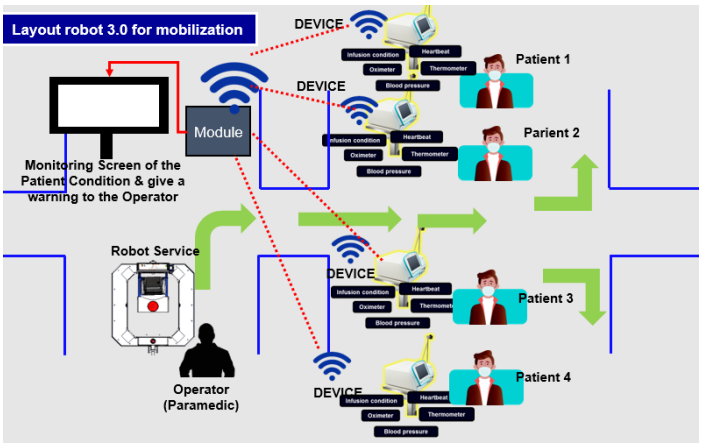


Figure 6. Layout mobilization robot generation 3.0

Paramedic Assistant Robot generation 3.0 has a Wifi communication system and can stream, Autonomous and Joystrick maneuvers.

TABLE 5. Feature of Paramedic Assistant Robot 3.0

No	Feature	Description
1	Communication	Wifi
2	Maneuver	Autonomous and Joystick (Manual)
3	Driver	4 Motor 4 Follower Wheel
4	Main function	Delivery
		Communication by streaming
		UV sterilization
		Camera 360
		Impact safety sensor
		Music therapy
5	Streaming	Available
6	Measuring instrument	Oximeter
		Thermometer
		Blood Pressure, Heartbeat

TABLE 6. Eligibility of generation 3.0

No	Eligibility gen 3.0	Description
1	Communication	Operators can view patients through monitor screen
		Patients can see the operator through the monitor screen on the robot
2	Maneuver	Robot can perform Maneuver Autonomous and according to operator control with joystick (manual)
		Robot operates well when controlled by joystick (manual)
4	Frame	Frame material is corrosion resistance
		The frame can support the maximum allowable load (150 – 200kg)
5	Battery	The battery used can provide a power source enough for robot operation
6	Communication range	Robot Monitor Screen Range is about 50 meters or more (it depends on wifi routers attached in hospital)
5	Control range	Robot Control Range is about 50 meters or more (it depends on wifi routers attached in hospital)
6	Motor	The electric motor used can generate power enough to move the robot
7	Robot for Monitoring	Monitoring screen of the patient condition & give a warning to the Operator (Paramedic)
8	Robot for Service	Executing the order from operator based on the result of robot monitoring

IV. CONCLUSION

The paramedic assistant robot has advantages :

1. Delivery the logistic
2. Sterilization the room of the patients using UV sterilization
3. Patients can receive music therapy from the robot
4. Communication by streaming become more interactive
5. From maneuver generation 1.0 to 3.0 increase significantly

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