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Paramedic Assistant Robot: Feature Review from Generation 1.0 to 3.0

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***Abstract*—The East Java region is a red zone area for COVID-19 cases. The number of patients being treated has an impact on the performance of medical personnel. Medical personnel gets tired easily and many of them die. To overcome this problem, a Paramedic Assistant Robot was designed. The methods used in designing this paramedical assistant robot are as follows: 1) Model design stage, 2) Determine electrical unit, 3) Determine communication unit and robot network, 4) Determine robot mechanical unit, 5) overall manufacturing process unit, 5) assembly process, 6) Robot function test. The result of each generation of feature development from 1.0 to 3.0 improved significantly. For maneuvering, from remote control and joystick to an autonomous system. This means that artificial intelligence is also increasing. The 3.0 generation robot is divided into two robots, namely robots for service and robots for monitoring. The 1.0 generation robots do not have to measure instruments, while the 2.0 and 3.0 generation robots have both integrated and separate measuring instruments.**

Keywords—paramedic, robot, assistant, covid-19

I. INTRODUCTION

Medical personnel in addition to needing personal protective equipment, also need tools that can help treat patients in terms of logistics, social distancing, and treatment. A paramedic assistant robot is a smart solution in dealing with this case. According to [1] regarding Patient Drug Management Robot, assisting medical personnel in managing the drug management system needed by patients. According to [2] about the MERC food delivery robot. MERC is designed to assist medical personnel when delivering food to hospitalized patients. This robot is programmed to provide advice to the paramedic team in determining the food of the patients being treated. According to [3], [4], [7] regarding patient surgery robots, it is very helpful for the paramedical team to handle patient operations by minimizing the time the team does surgery. According to [5] regarding Transcar and Helpmate, it eases the work of the paramedic team when programming food needs for COVID-19 patients. This robot can intelligently deliver food as determined by the paramedic team. According to [6], [9] Humanoid Robot helps the paramedic team when treating patients with very old age. This robot communicates with them to relieve the patient's boredom and stress. According to [8] about the Markov Robot Program, that robots can be programmed to do general activities carried out by humans. They will do whatever activity commands are inputted according to the tasks humans are doing. According to [10] that surgical technology robot are widely used to assist patient operations. Surgical technology robots are designed with a high degree of precision, helping the team of doctors in operations that require a long time. The purpose of this research is to build a paramedic assistant robot that functions as one of the additional troops of the paramedic team in treating COVID-19 patients. The robot is equipped with a communication camera and monitor so that the patient and the paramedic team can communicate for the treatment process, without having to meet each other.

II. RESEARCH METHODS

The methods used in designing this paramedical assistant robot are as follows: 1) Model design stage, 2) Determine electrical unit, 3) Determine communication unit and robot network, 4) Determine robot mechanical unit, 5) overall manufacturing process unit, 5) assembly process, 6) Robot function test. There are several stages used for developing these robots from the design to the trial stage. Each stage consists of activities to build the part until assembly.

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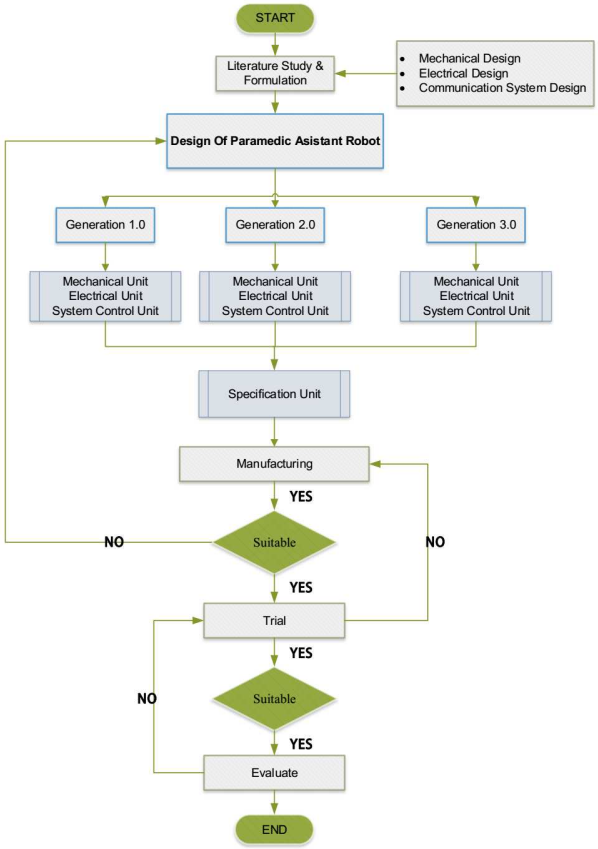


Figure 1. block diagram methods

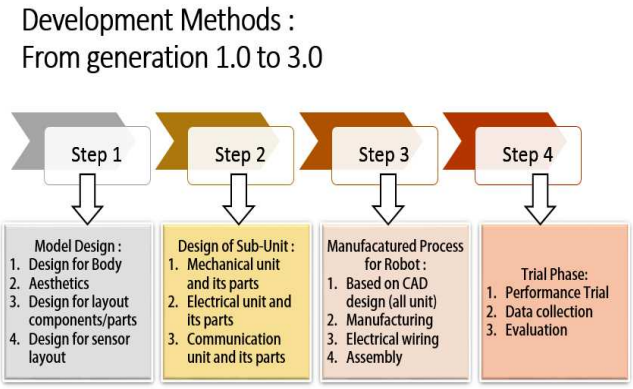


Figure 2. Stages used for developing the robot

III. RESULT AND DISCUSSION

In this result and discussion, we will present the features of paramedical assistant robots from generation 1.0 to 3.0. Where each generation has a continuous ability improvement. Especially in generation 3.0, this robot is designed to have an autonomous system for maneuvering or navigation Based on Figure 3, the design of generation 1.0 consists of two designs, namely the blue one and the purple one. The trays are three units of medium size. The blue one designed can lift only one operator above it or pull the trolley. Meanwhile, the purple one can not lift the operator because it was not equipped with room for lifting.

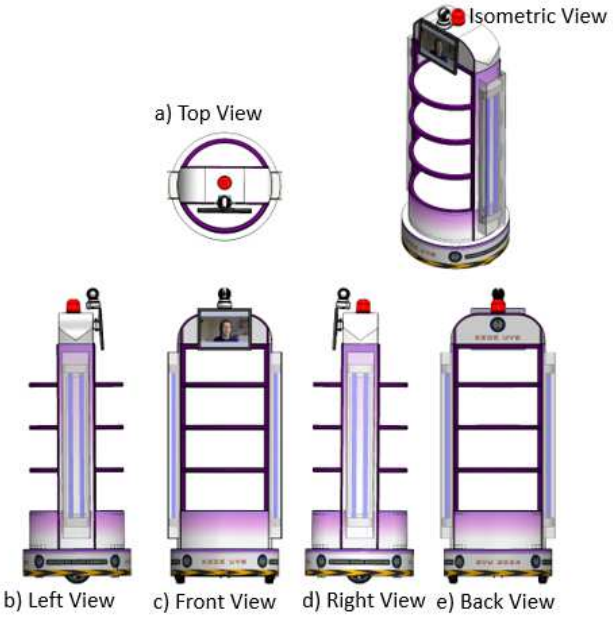


Figure 3. design of paramedic assistant robot 1.0

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

Based on table 1 above, the weakness of 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 models: 1) The blue one was built to deliver used and lift the paramedic with a maximum load of 150 – 200kg. 2) The purple one was built to sterilize the room with UV sterilization. It is also able to deliver the logistics but it can not be used for lifting the paramedic. There are some aspects when this generation 1.0 was tested after wiring, assembling, and manufacturing completed.

Table 2 showed that maneuver generation 1.0 uses the remote control to control it. The control range is about 50 meters. The next generation is the paramedic assistant robot 2.0 with additional features. Its design is also different from 1.0.

The added value of paramedic assistant 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,

TABLE 2. ELIGIBILITY OF GENERATION 1.0

NO	ELIGIBILITY GEN 1.0	DESCRIPTION
1	Communication	Operators can view patients through a 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

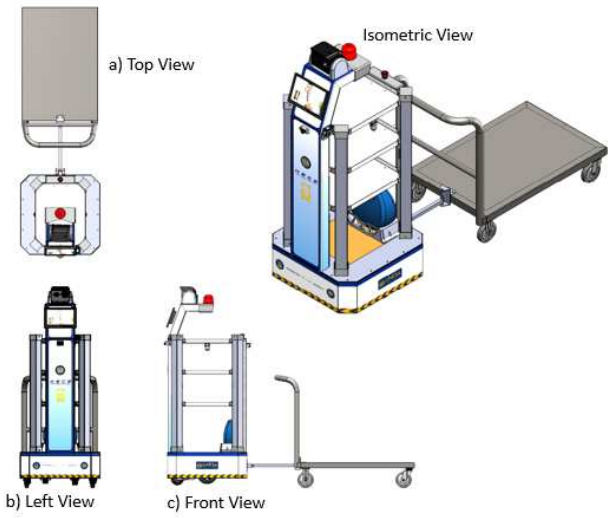


Figure 4. design of paramedic assistant robot 2.0

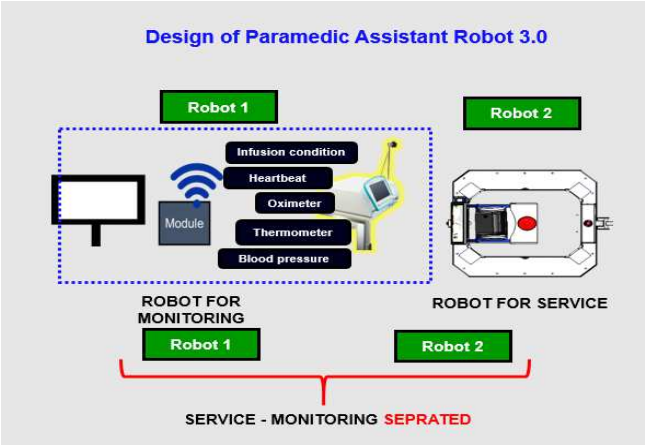
and rooms. From Figure 4 above, the design of the generation 2.0 is more aesthetics than the previous one. The chassis is also different. Table 3 showed that maneuver generation 2.0 uses a PC and joystick (manual). It means that the technology upgraded. Camera 360 exists in this generation with an impact safety sensor too.

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

TABLE 4. ELIGIBILITY OF GENERATION 2.0

NO	ELIGIBILITY GEN 2.0	DESCRIPTION
1	Communication	Operators can view patients through the monitor screen
		Patients can see the operator through the monitor screen on the robot
2	Maneuver	The robot can perform Maneuver according to operator control with joystick (manual)
		The 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



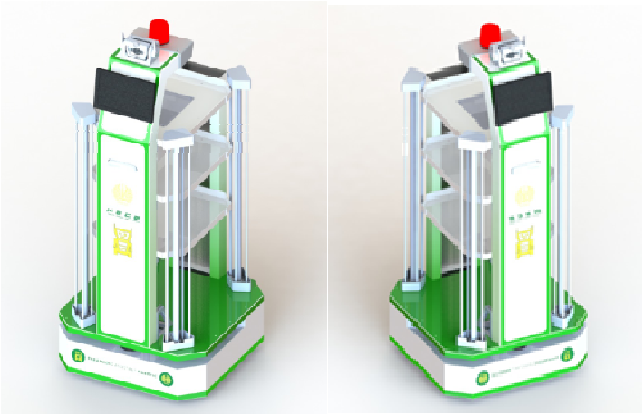


Figure 5. design of paramedic assistant robot 3.0

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

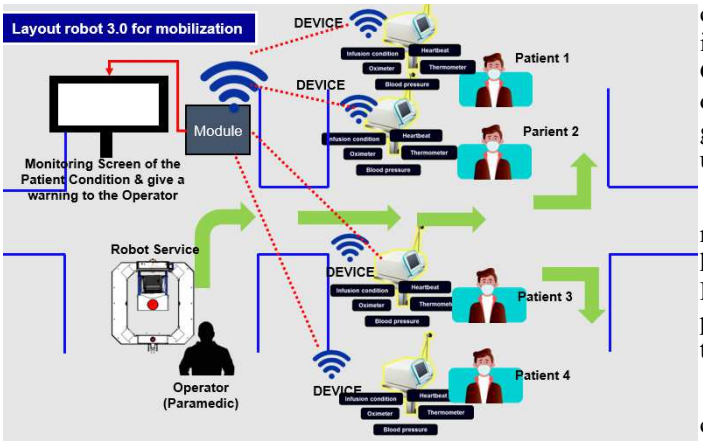


Figure 6. Layout mobilization robot generation 3.0

Based on table 4 below, 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). Robot Monitor Screen Range is about 50 meters or more (it depends on wifi routers attached in the hospital). Robot Control Range is about 50 meters or more (it depends on wifi routers attached in hospital). Furthermore, the team developed the robot for 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. Based on figure 5, the design of generation 3.0 is different from generation 2.0, where the color in this generation is green. For the camera, communication has been upgraded.

From figure 6 above, it is shown that a robot for monitoring is designed permanently in one room in the hospital that can be accessed by the paramedic team. Meanwhile, the robot for services does its job as soon as the paramedic reviews the result from the monitor screen about the patient's conditions.

Paramedic Assistant Robot generation 3.0 has a Wifi communication system and can stream, Autonomous and Joystick maneuvers. Table 5 showed more about the technical specification of generation 3.0. Generation 3.0 is a more sophisticated one. The maneuver is Autonomous equipped with a joystick (manual). Measuring instruments that integrated with robot monitoring based table 5, are Oximeter, Thermometer, Blood Pressure, and Harbert.

Based on table 6 above, showed that for maneuver, Robot can perform Maneuver Autonomous and according to operator control with joystick (manual). The robot operates well when controlled by a joystick (manual). As usual, the maximum load for lifting, designed still 150 – 200kg. Robot for monitoring used for monitoring screen of the patient condition & give a warning to the Operator (Paramedic). Robot for service used for executing the order from an operator based on the result of robot monitoring.

TABLE 6. ELIGIBILITY OF GENERATION 3.0

NO	ELIGIBILITY GEN 3.0	DESCRIPTION
1	Communication	Operators can view patients through the monitor screen
		Patients can see the operator through the monitor screen on the robot
2	Maneuver	The robot can perform Maneuver Autonomous and according to operator control with joystick (manual)
		The robot operates well when controlled by a 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 the operator based on the result of robot monitoring

IV. CONCLUSION

The paramedic assistant robot has several improvements to help the paramedic team and the covid-19 patient's better than before. The design of generation 1.0 to 3.0, showed that the technology upgraded. For the maneuver, from controlled by remote control then joystick (manual). Finally, at the final stage, it is controlled with an autonomous system. In the 3.0 generation, the robot was separated become two functions like monitoring and service.

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