Movement Controlling for Air Quality Monitoring Robot in Pediatric Cancer Patient Shelter Using Google Assistant

Yeni Irdayanti, Nurhaida Nurhaida, Faisal Damsi, Abdurrahman Abdurrahman, Nyayu Latifah Husni(✉), Ade Silvia Handayani, Deva Markinashella, Kgs. Dzikrirrahman, and Dini Yono Pitasari

Politeknik Negeri Sriwijaya, Jalan Srijaya Negara Bukit Besar Palembang, Palembang, Indonesia
nyayu_latifah@polsri.ac.id

Abstract. Cancer will cause big impact to the psychological and physical condition of patients, especially for children. Social support for pediatric cancer patients is very necessary. Various ways can be conducted to support them to move on from the adversity of their illness, including by providing a comfort shelter. This shelter can be a place of refuge and entertainment for them when they are going to and after undergoing various medical therapies. To enhance the comfort of this area, the researchers establish an air quality monitoring system using a robot that can be controlled easily from further place using google assistant. Using this system, the air can be guaranteed its quality. From the experiments, it is obtained that the robot can move from one place to another place trough the google assistant command while it is also collecting the information of the environmental information, such as: temperature, humidity, air quality level, and gas or smoke of cigarette.

Keywords: Pediatric cancer · Air quality monitoring · Robot · Google assistant · Movement controlling

1 Introduction

Cancer is a disease that requires a level of vigilance and continuous monitoring, especially if it affects children. Not only when going to and undergoing a therapist for their health, but the air quality of the place where pediatric cancer patients are is also a major factor that must be considered [1, 2]. To overcome this, a system is needed to support and facilitate parents, nurses and doctors who treat these patients, especially in terms of air quality around patients.

Many parties such as parents, nurses, doctors, and the surrounding community must give very special attention to children with cancer. To support and provide facilities for children with cancer, researchers focus on technological sophistication in key aspects, as stated above.

In shelters for children with cancer, air quality cannot be monitored properly, this will result in the health of children being disturbed. The urgency of research to overcome these problems. To participate in supporting the process of solving environmental problems

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in the shelter as a target user, namely pediatric cancer patients, researchers innovate to connect an integrated system that can monitor the environment around the shelter.

The system is sophisticated, unique and very easy to control using Google Assistant. The color and shape of the system attracts children's attention, the display of air quality control and monitoring is made in such a way and is very helpful for medical personnel, and parents to maintain health also help children rise from adversity.

There are a lot research that discusses about the air quality robots [3–8]. This study designs and analyzes the motor control system for moving goods using the Google Assistant, which is part of the module using SMD components. A similar study was also conducted by Boi Manggala Houtagao, with the title Lawn Mower Robot Control System using a Smart Phone. The robot control system that he designed, utilizes commands from android and ultrasonic. The working system of the designed robot, functions as a lawn mower and uses one command (Muhammad Amin, 2019).

2 Proposed Method

2.1 Research Stage

The flowchart of the research for air quality monitoring detection system can be seen in Fig. 1.

Based on Fig. 1, this research will be carried out for 12 months with an estimated research series as follows:

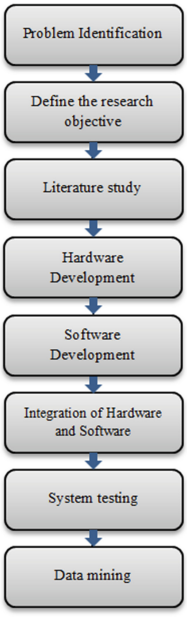


Fig. 1. Stages of the research of air quality monitoring detection system

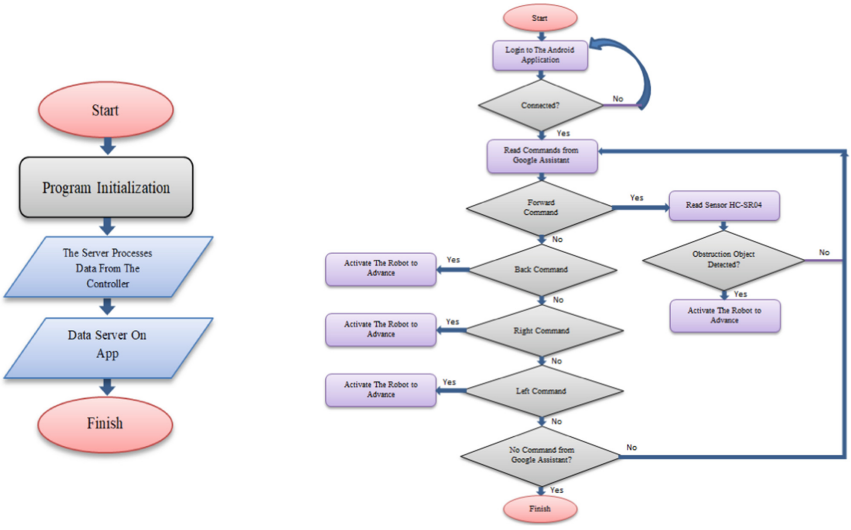
- Problem identification, determining the subject matter that occurs so that the background of making the device.
- Literature study to research the development of devices based on existing references and research that has been previously conducted.
- Design of the development hardware and software system.
- Integrate between hardware and software
- Testing robots for trials after the system has been successfully made

Data capture from test equipment based on trials that have been made.

2.2 System Principle

The design of the monitoring system for the air quality in this system has several specifications including hardware design, software design that are integrated with each other. The hardware design is divided into several stages of design. The Fig. 2 is a description of each stage.

The monitoring system will connect to the server via router and internet. From the above flowchart, the controlling system is set from instructions via Google Assistant. Then, the system will monitor the temperature, humidity, and air quality in the environment around the system. This system has a set of components, such as: proximity sensor HC-SR04, Gas sensor, MQ-8, DHT-22 temperature and humidity sensor, power supply, and nodeMcu, as well as Arduino mega 2560.



(a) Monitoring (b) Controlling

Fig. 2. Flowchart of monitoring and controlling system

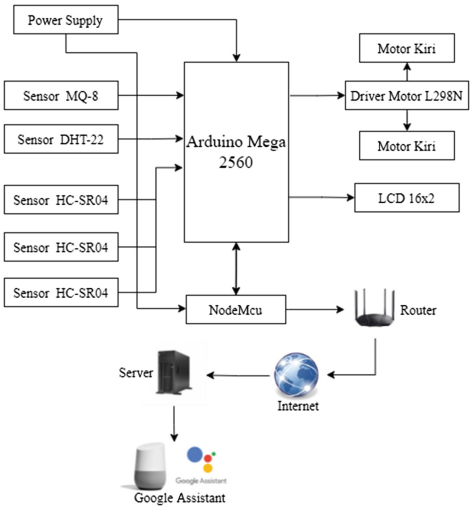


Fig. 3. Diagram block of system

2.3 Block Diagram

The block diagram of the system is shown in Fig. 3**.** Hardware design is the process of explaining the monitoring system using a Arduino Mega and NodeMcu as a data processor. Arduino is a sensor data processor that is inputted, namely from the HC-SR04, MQ7 sensor. The data that has been processed by Arduino is displayed on the LCD and sent to the L298N motor driver. The data processed by Arduino is processed and connected and then sent to the cloud server via a Wi-Fi router which can then be controlled using the Google Assistant. Users can use mobile phones, PCs, or laptops to control this system and monitor temperature, humidity and air quality. This block diagram shows how the flow of the process of monitoring the air quality works.

Based on the diagram block, this system can be controlled only with Google Assistant and can detect air quality much more easily. Thus, it is very helpful for medical personnel and parents in monitoring the health of pediatric cancer patients.

2.4 System Design

The air quality monitoring system consists of several components in its manufacture so that the system can function and run properly. In addition, the design of the system on this robot includes several parts, namely the monitoring system on Android and the control system on Android using the Google Assistant. The monitoring system is carried out to monitor temperature, humidity and Air Quality in the environment around the system (gas concentration). The body of the robot in this research is shown in Fig. 4.

This data will be sent from the monitoring system to android to be monitored and the use of phyton software as a command giver to the device. The controlling system for this environmental monitoring system is carried out using the Google Assistant through the Android application. The display for monitoring and controlling the monitoring system

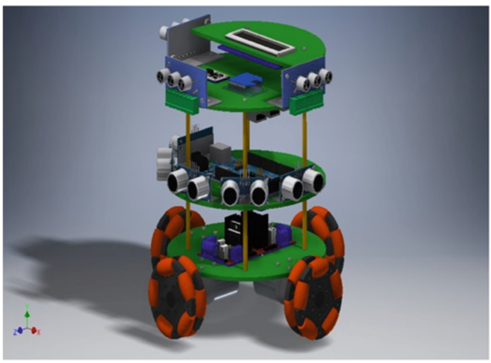


Fig. 4. Body of the robot

Fig. 5. Android interface of the system

is made as attractive as possible, so that this system is really practical and can really help medical personnel, parents, as well as everyone involved in protecting and helping pediatric cancer patients rise from adversity. Figure 5 shows the interface of the system.

3 Proposed Method

3.1 Measurements and Testing Steps

To reduce errors in measuring and testing, it is necessary to take the following steps:

– Prepare the circuit and device to be tested.
– Check the circuit first to ensure that the entire circuit is in good condition.
– Determine the number of tests to be performed.

– Take measurements repeatedly to be more thorough.
– Record the measurement data that will be used as a reference to make an analysis.

Measurement and testing is complete, then turn off all equipment.

3.2 Movement Instruction Case

Figure 6 is a test of forward movements where the user gives forward instructions via the google assistant on the android application and the system movement is obtained, namely moving forward.

Figure 7 is a test of backward movements where the user gives backward instructions via the google assistant on the android application and the system movement is obtained, namely moving backward.

Figure 8 is a test of the movement to the right, when the user gives instructions to the right via the google assistant and the experiment is carried out but the movement becomes less suitable in recognizing and executing the movement so that the system moves sideways to the right. This may be due to an unstable network connection so that the system is less suitable in recognizing the instructions given.

Figure 9 is a left movement test, when the user gives instructions to the left through the google assistant the result is the system moves according to the instructions, namely moving left.

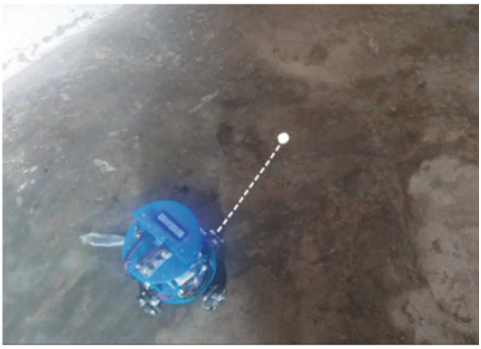
Figure 9 is another test of the stop movement. Which is when the system is executing the previous command via the google assistant and the user gives a stop instruction, the system that was moving will automatically stop according to the instructions. Testing is also carried out repeatedly to determine the efficiency of the system (Fig. 10).

(a) forward command

(b) system respon

Fig. 6. Forward movement instructions

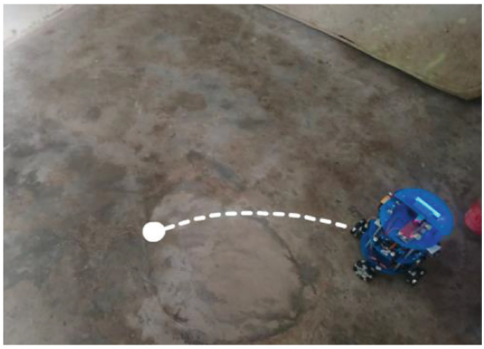
(a) backward command



(b) system respon

Fig. 7. Backward movement

(a) rightward command



(b) system respon

Fig. 8. Rightward movement

3.3 Movement of Detection Variable

How to determine the system moves according to the instructions and determine the error that occurs requires a formula. Based on the reference that has been made and determining the percentage of success with the percentage formula:

$$P = \frac{Total\ Detected\ Movement}{Total\ Test} \times 100\%$$

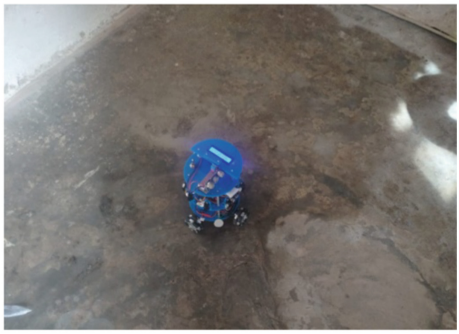
By using this formula, we can know the percentage of movement readings that were successfully performed and recognized by the system. To test the system, the first step is to see if the system has moved well, the instructions given and the system test results are shown by Table 1.

(a) leftward command

(b) system respon

Fig. 9. Leftward movement

(a) stop command



(b) system respon

Fig. 10. Stop movement

By testing these movements, it can be seen that the instructions given can be recognized and executed properly by the system. The results of the movement can be used as a benchmark for the running and functioning of the system. However, there are several factors that can affect system initiation which can be caused by internet connection or other error. By checking all the components described in the initial statement, errors can be minimized.

After testing, it is known that this system has very good accuracy, which is the data collection of the system is correct 14 times and 1 time data collection is not appropriate. This air quality monitoring system is very effective and can really help medical personnel, parents, and everyone involved in the healing process of pediatric cancer patients. This system is very efficient and suitable if applied in shelters, medical facility

Table 1. System movement test via google assistant

No.	Instructions	Response	Movement	Description
1	Forward	Okay, robot forward	Forward	In accordance
2	Backward	Okay, robot backward	Backward	In accordance
3	Right	Okay, robot right	Right	In accordance
4	Left	Okay, robot left	Left	In accordance
5	Stop	Okay, robot stop	Stop	In accordance
6	Forward	Okay, robot forward	Forward	In accordance
7	Backward	Okay, robot backward	Backward	In accordance
8	Left	Okay, robot left	Left	In accordance
9	Right	Okay, robot right	Right	In accordance
10	Stop	Okay, robot stop	Stop	In accordance
11	Right	Okay, robot right	Right angled	Less suitable
12	Left	Okay, robot left	Left	In accordance
13	Stop	Okay, robot stop	Stop	In accordance
14	Backward	Okay, robot backward	Backward	In accordance
15	Forward	Okay, robot forward	Forward	In accordance

or other hospitals. This system will be able to continue to be developed for technological advancements in the future.

4 Conclusion

Based on the results of measurements, research and discussion on the air quality monitoring system, it can be concluded:

1. In testing the system has a success rate of more than 90%.
2. Network connection can also affect the initiation process and the results received by the system on the movement of the system.
3. This system has a very good level of accuracy, and is really helpful for medical personnel, parents and everyone involved in the healing process of pediatric cancer patients.
4. The system can continue to be developed for technological progress, especially in the health sector in the South Sumatra region, Indonesia.

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