JURTEKSI (Jurnal Teknologi dan Sistem Informasi) ISSN 2407-1811 (Print)
Vol. VIII No 2, April 2022, hlm. 219-224 ISSN 2550-0201 (Online)
DOI: https://doi.org/10.33330/jurteksi.v8i2.1306
Available online at http://jurnal.stmikroyal.ac.id/index.php/jurteksi

PROTOTYPE DESIGN ROBOT MONITORING REMOTE CONTROL BASED ON FIRST-PERSON VIEW

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Abstract: Technological advances are not only used for the industrial world but have led to all fields both education, military, and household. One of the technological advances in the application of robots that are used to reduce the use of human power. Therefore, the design of a remote control monitoring robot prototype that is used to replace the human role in monitoring or monitoring certain objects or environments that are difficult to reach by humans to go directly to the intended object. This robot is designed by applying the FPV (First-Person View) system which is controlled remotely using the nRF24L01 and MPU6050 and uses a servo to move the camera. Based on the results of testing the Robot Prototype in this study as a whole, the prototype robot is obtained well and the Robot Prototype can replace the role of humans in monitoring objects remotely.

Keywords: Arduino; FPV; Monitoring; nRF24L01; MPU6050; Robot.

Abstrak: Kemajuan teknologi tidak hanya digunakan untuk dunia industri saja melainkan sudah mengarah ke segala bidang baik dunia pendidikan, militer dan dalam rumah tangga. Salah satu kemajuan teknologi adalah penerapan robot yang digunakan untuk mengurangi penggunaan tenaga manusia. Maka dari itu dilakukan perancangan prototype robot pemantau kendali jarak jauh yang digunakan untuk menggantikan peran manusia dalam pengawasan atau pemantauan objek ataupun lingkungan tertentu yang sulit dijangkau oleh manusia untuk terjun langsung ke objek yang dituju. Robot ini dirancang dengan menerapkan sistem FPV (*Fisrt-Person View*) yang dikendalikan dari jarak jauh menggunakan nRF24L01 dan MPU6050, serta menggunakan servo untuk menggerakan kamera. Berdasarkan hasil pengujian *prototype* robot pada penelitian ini secara keseluruhan didapatkan prototype robot dengan baik dan *prototype* robot dapat menggantikan peran manusia dalam pemantauan objek dari jarak jauh.

Kata kunci: Arduino; FPV; Monitoring; nRF24L01; MPU6050; Robot.

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INTRODUCTION

In the modern era, the role of humans in several areas of life has changed a lot, replaced by the role of robots. Among other things, making observations that do not allow the user to directly engage in field observations or make remote observations that are a little dangerous. In other words, a device in the form of a robot is needed for monitoring that can be controlled remotely, both wired and wireless to observe areas that are inaccessible or dangerous if done by humans. This research is motivated by the existence of work that cannot be done by humans so assistance from robots is needed to facilitate completion. Until now, research related to mobile robots continues to be developed, this can be seen from the control system and function of the robot itself [1],[2]. The robot used is a type of mobile robot that has wheels as a rob propulsion and functions as a mote monitoring.

The robot is defined as an electromechanical device, biomechanics, or a combination of devices of various types of structures that produce automatic movements controlled directly or indirectly. [3]-[5].

First Person View (FPV), also known as pilot view, is a system used to control a vehicle via remote control from the driver's or pilot's perspective. This system is most commonly used to control drones or other types of unmanned aerial vehicles (UAV). Drones can be controlled with a Third Person View (TPV) system or a First-Person View (FPV) system [6]. It is recommended to use a drone with a stereoscopic camera to help control the drone [7] and reconstruct the outside view [8]. FPV systems have become increasingly common from the 2000s to early 2010. The use of Head Tracking for direct control systems is also increasingly being developed to control drones [9].

In this research, the robot was designed to move using a controller originating from a remote controller with a wireless joystick device based on a microcontroller with the connection of the nRF24L01 wireless module with RX model as a data packet receiver and TX as a data packet sender with a frequency of 2.4 GHz. [10]–[12]. L298N motor driver to control the direction of rotation and speed of the DC motor [13]. The MPU6050 module as an accelerometer and gyroscope sensor can detect 3 axes of angle and 3 axes of angular velocity, for the 3 axes of angles are angles x, y, and z [14]–[16]. This MPU6050 module is mounted on FPV goggles.

The advantages of this monitoring robot are that its small dimensions make it easy to make observations have a camera that can record and observe events around it, and its control system is carried out remotely using wireless.

METHOD

The method used has two designs, namely a robot control system and a camera control system. In the robot control system, the robot is controlled using a joystick as a direction and speed controller, which is transmitted using the nRF24l01 wireless module. In the camera control system, the camera is controlled using the MPU6050 gyroscope module mounted on the FPV Goggles, so that the direction and position of the camera will follow the direction and position of the FPV Goggles which are transmitted using the nRF24L01 wireless module. In hardware design, this robot prototype requires Arduino on the robot, robot control system, and camera control system. FPV +

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Tx camera as well as FPV goggles, as a First-Person View system. Servo motor, as camera drive. DC motor, as a robot mover. nRF24L01 module, as a remote communication system, and MPU6050 module, as a Gyroscope sensor.

Figure 1. Robot Design Design

RESULT AND DISCUSSION

The first test was carried out in the Aerospace Field area of the Politeknik Penerbangan Medan.

Figure 2. Aerospace Field of the Politeknik Penerbangan Medan as seen from Google Maps

Figure 3. Field Testing

In testing the distance on the control system, both robot control and camera control on the robot, the test results are shown in Table 1, and graphs 4 and 5.

Table 1 Testing the Connectivity Distance to Robots in the Field

No	Distance (meters)	Result	Description
1	5	Connected	Well-controlled
2	10	Connected	Well-controlled
3	15	Connected	Well-controlled
4	20	Connected	Well-controlled
5	25	Connected	Well-controlled
6	30	Connected	Well-controlled
7	35	Connected	Controlled
8	40	Connected	Controlled
9	45	Connected	Controlled
10	50	Connected	Controlled
11	55	Connected	Controlled
12	60	Connected	Controlled
13	65	Connected	Controlled
14	70	Connected	Controlled
15	75	Connected	Controlled
16	80	Disturbed	Hard to control
17	85	Disturbed	Hard to control
18	90	Not connected	Uncontrollable
19	95	Not connected	Uncontrollable
20	100	Not connected	Uncontrollable

From Table 1, it can be seen that the control system using the nRF24L01 module on the Robot is difficult to control from a distance of ±80 meters in-field testing.

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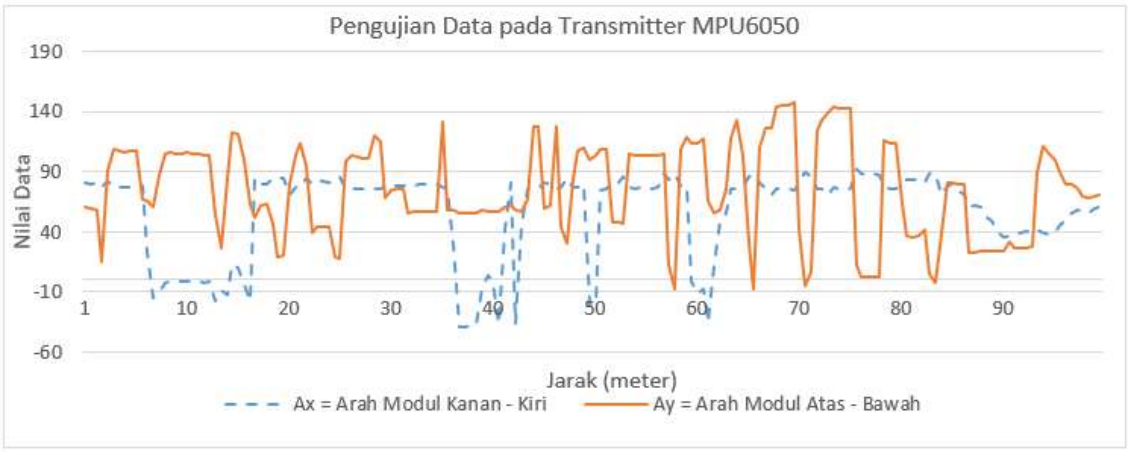

Figure 4. Graph of MPU6050 Sensor Testing on Transmitter Robot in the field

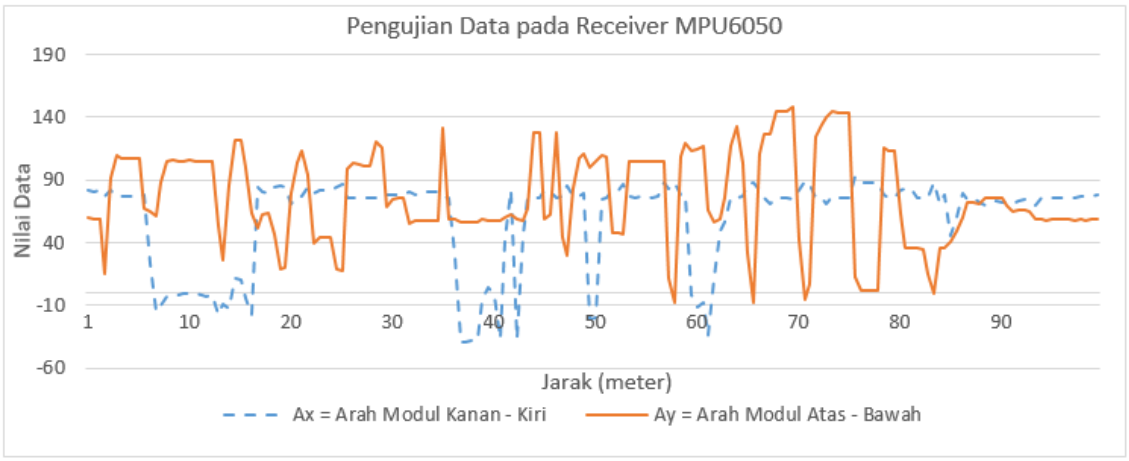

Figure 5. Graph of MPU6050 Sensor Testing on Receiver Robot in the Field

From the graphs shown in Figure 4 and Figure 5, it can be seen that the data values are shown from the test graph on the Transmitter and Receiver controlling the FPV camera experience different values at a distance of ±80 meters during testing in the Aerospace Field. This difference is because the Receiver is no longer able to receive the appropriate data value from the MPU6050 gyroscope sensor on the Transmitter side.

CONCLUSION

From the results of the research that has been done, it can be concluded that the devices used can be used as controllers in the remote control robot system. Based on data obtained from system testing, the nRF24L01 module working in outdoor testing at the Aerospace Field can communicate up to a distance of ±80 meters. As for the MPU6050 module, the module works well and provides maximum performance, and is reliable enough to be used as a reference for the movement of the camera position during the maximum performance of the nRF24L01.

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