Design Of Monitoring Robot Based On Bogie Rocker System

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Abstract. The system using CCTV cameras (Closed Circuit Television) that are currently in use still has many shortcomings. This is what underlies the making of a monitoring robot using a rocker bogie system and a camera that can be adjusted as desired and can display the situation in the room through a smartphone connected to a WiFi network. The transfer process uses IP cameras, nodeMCU, relays, DC motors and servo motors so that the monitoring process can run well. IP camera is used as a camera that will take pictures of the state of the room being monitored, this camera uses a wifi network connection to connect with other devices, nodeMCU is used as a controller while connecting the system with a wifi network. Control and navigation using smartphone applications connected to the same WiFi network. With the robot, the remote monitor becomes wider because of the movement process that can walk and climb stairs easily.

Keywords : Monitoring Robot, Control and Navigation, CCTV

1. Introduction
Technology has an important role in several aspects of life. Human needs for communication and information is one aspect that is influenced by technological progress. Applications of current technological advances generally lead to electronic monitoring systems that enable one to carry out various monitoring or monitoring activities wirelessly, effectively and safely [1]. One form of electronic monitoring system that is currently being developed is a monitoring system using CCTV (Closed Circuit Television) cameras.

The monitoring system uses CCTV cameras that are placed at certain angles in a room. Then the captured image of the CCTV camera is displayed on the monitor screen in another room [2]. This system monitoring distance is limited because the system still uses cable as power and the image sender on the monitor. In addition, webcam or CCTV positions that are static or in a fixed position lead to more limited shooting angles.

In this study, researchers wanted to develop a "Prototype Monitoring Robot Using Bogie Rocker Systems and Cameras". The system functions to monitor a room that is controlled via a smartphone with the android operating system connected to the same wifi (wireless-fidelity) network. The camera can be controlled in accordance with the instructions to find out all the circumstances that exist in the room by using an application.

This system uses an IP camera as a monitoring camera and nodeMCU as a microcontroller that controls the running of the monitoring robot. 6 DC motors are each connected to the wheels and controlled via a relay module. To move the camera to the right and left to clarify the results of monitoring using the MG996R servo motor. This monitoring robot can climb stairs easily because it uses a rocker bogie suspension system so that the robot can monitor the state of the entire room.
application of monitoring robots is used for monitoring multilevel homes and corporate offices. Besides monitoring robots can also be used when it will conduct raids on homes suspected of terrorists.

2. Methods
The working system of the monitoring robot uses a rocker bogie system and the camera is made to resemble a wheeled robot that has 6 wheels. The work system in general is the same as wheeled robots in general. It's just that this system uses wifi as communication between the smartphone application and the nodeMCU microcontroller. To be able to run the first robot that must be considered is to have an application that is used to control the robot. Then the smartphone must be on the same wifi as nodeMCU. Make sure nodeMCU is connected to wifi to be able to control it. After that, enter the IP address of nodeMCU on the Android application. When the IP address is entered correctly then the smartphone can control the way the robot starts forward, backward, right, left and stops. In addition to being able to control the course of the robot, smartphones can also move the servo facing forward, right and left in order to further clarify the results of taking pictures from an IP camera. This robot work system is described as flowchart in Figure 1.

System on the first robot turn on the monitoring robot by pressing the ON button and then enter the input in the form of an IP address on the smartphone application. Then the user presses a button on the smartphone application to run the monitoring robot. If the Up Arrow is pressed then M1 (Right Motor) and M2 (Left Motor) will process Forward or the robot will advance forward. If not then pressing the Down Arrow then the system processes M1 and M2 Backward or the robot will walk backwards. If not, then press the Right Arrow which then processes M1 Forward and M2 Backward so that the robot can turn right. If not then pressing the Left Arrow then the system will process M1 Backward and M2 Forward so the robot can turn right. Then the system will process the robot moving position. If SKiri is pressed, the system will process 0o moving servo. If not, then press SDepan then the system processes the servo to move 90o. If not, then press SKanan then the system processes the 180o moving servo. Then the system will process the position of the moving servo and the position of the IP camera moving towards monitoring to expand the monitoring process.

Besides the system flow diagram, the component design of the monitoring robot as in Figure 2 uses a bogie rocker system and a camera. When a robot passes through an obstacle or climbs a ladder,
the front of the robot serves to pull the robot while the back of the robot is used to push the robot to climb the stairs or pass the obstacle. At the top of the robot there is a box used to store the components that will move the robot so that the components are safer because they are in a closed place. At the component place there are electronic components, namely the MCU node, 4 channel relay, LM2596, UBEC 5V, MG996R and there is an IP camera above the component place. NodeMCU functions as a microcontroller that gets commands from smartphones that have been run by the user who then gives commands to the motor to move according to the input received. 4 channel relay is used to drive 6 motors through NC and NO contactors ordered by the microcontroller. LM2596 functions as a step down or a voltage drop that is flowed on the camera and motor so that the voltage is always stable 12V. UBEC 5V functions the same as LM2596 but UBEC has a constant output voltage of 5V, besides that UBEC also has a constant current output of 3A so that it can be used as power from nodeMCU, relay and MG996R. MG996R functions to move the position of the camera to the right and left so that the camera's vision becomes more flexible. IP cameras function as monitoring the situation in the room and can be seen through an android smartphone.

Figure 2. Monitoring Robot Design

3. Result and Discussion
Testing the distance of controlling the robot through nodeMCU is done 6 times by controlling the robot at a certain distance, whether nodeMCU can accept the command or not. The test results can be seen in Table 1.

| No | Testing | Distance | Status | Connection time | Information |
|----|---------|----------|--------|-----------------|-------------|

3
A.
The test results in Table 1 can be concluded that the control distance from the monitoring robot can only be controlled with a maximum distance of 15 meters, if the control is carried out at a distance of more than 15 meters, the monitoring robot cannot run because the connection between the android smartphone and nodeMCU has been lost.

MCU node testing is the basis for controlling robots. If the MCU Node has been successfully used, the next step is testing the IP camera on Roboto. Figure 3 shows the display when the IP camera is accessed through a web browser. The main display can display the catches from the IP camera.

![Figure 3. IP camera](image)

Overall testing of the system is carried out 10 times per instruction on Roboto to ensure the robot can function as it should. The robot is used to perform all of its functions in accordance with the commands on the web browser that is packed on Android. Table 2 shows the results of overall system testing conducted by robots and Figure 4 shows the results of system testing.

| No | Instructions        | amount | Percentage of success |
|----|---------------------|--------|-----------------------|
| 1  | Robot Connection   | 9      | 1                     | 90%        |
| 2  | Pamenatau camera   | 10     | 0                     | 100%       |
| 3  | Turn right         | 10     | 0                     | 100%       |
| 4  | Turn left          | 10     | 0                     | 100%       |
| 5  | Up                  | 10     | 0                     | 100%       |
| 6  | Mandur             | 10     | 0                     | 100%       |
| 7  | Move the camera    | 10     | 0                     | 100%       |
|    | Total Percentage   |        |                       | 98.5%      |
4. Conclusion
Based on the test results it is necessary to conclude the results of this study.

1. When the wheels of the robot get rough, the robot will find it easier to climb the stairs while it is very difficult when trying to turn, but when the wheels are slippery, the robot is very easy to turn but it is very difficult to climb the stairs.

2. The monitoring robot can only be controlled with a maximum distance of 15 meters, if the control distance is more than 15 meters, the monitoring robot cannot be controlled because the wifi connection has been lost.

3. The use of UBEC modules in DC motor circuits is very influential, because DC motors require a constant voltage of 12V and require large currents to strengthen the movement of the wheels on the monitoring robot.

4. The process of connecting nodeMCU with wifi takes quite a long time of about 5.6 minutes.

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