Available Online : https://proceeding.researchsynergypress.com/index.php/cset/index
RSF Conference Series: Engineering and Technology
ISSN 2809-6843 (Online) | 2809-6878 (Print)
Volume 2 Number 2 (2022): 69-78

Robotic-Based Bottom Vehicle Inspection in Indonesian

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Abstract

In Motor Vehicle Testing, Bottom Vehicle Inspection is still done manually by means of the inspector entering the test box to see the Bottom Vehicle to ensure that the Bottom Vehicle is in good condition. Weaknesses of Manual Bottom Vehicle Inspection, making vehicle owners unable to see the condition of the Bottom Vehicle directly; if there is a problem at the Bottom of the vehicle, the vehicle inspector instructs the vehicle owner to go down under the test so that it takes up much time and there is a long queue. However, with current technological developments, it is possible for vehicle owners and vehicle inspectors to directly see the condition under the vehicle so as to create transparent public services by means of a robotic-based Bottom vehicle. This research aims to create a transparent public service between the vehicle inspector and the vehicle owner. This research method makes designs and builds Robot Bottom vehicles controlled by Arduino Nano and Raspberry. Arduino Nano is equipped with a stick to control the movement of the robot's wheel and robot arm; Raspberry is equipped with a camera to display the condition of the Bottom vehicle components and communication between systems using local area networks. The results showed that the Bottom vehicle could be seen directly and clearly so that if there is damage to the Bottom vehicle component, the vehicle owner can know firsthand the condition of the Bottom of the vehicle.

Keywords: *Vehicle Inspector, Bottom Vehicle Inspection, Robotic*

INTRODUCTION

Along with the rapid development of information technology, various fields such as education, security, industry, transportation, and others have used computerized technology devices. This technology makes all human work easier, faster, transparent, accountable, and can provide better customer service. Public services are a series of activities in the context of fulfilling service needs in accordance with the laws and regulations for every citizen for goods, services, and administrative services provided by public service providers or government agencies. One of the public service providers in each region is Motor Vehicle Testing which has activities to test and inspect parts or components of motorized vehicles. The scope of the motor vehicle testing service has 2 (two) processes, namely the administrative process and technical inspection vehicle.

One of the processes of technical inspection in motor vehicle testing is a bottom vehicle inspection. Bottom vehicle inspection is part of vehicle testing activities above the test aisle. This inspection serves to determine the condition, function, and installation of a component on the vehicle, especially those in the Bottom vehicle. When there is a problem with a component that is one of the reasons for rejection, the examiner is obliged to notify the vehicle owner of all

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deficiencies to be able to repair it, then the vehicle owner is also asked to go down to the test aisle to see the vehicle components that must be repaired. This takes a long time, so it can result in long queues of vehicles while in the test aisle or test building. In the inspection of the vehicle, it is still not detailed due to the less ergonomic position where an examiner has to look at the Bottom vehicle with the head bent and to look up so that an examiner quickly feels tired, which results in a sub-optimal inspection of the vehicle and some components are not checked (Yoga, 2020).

The era of reform and autonomy brings many changes to the system of bureaucracy in Indonesia, both in the government's central, regional, and business entities' state property. Bureaucracy in the era of reform and autonomy must truly emphasize efficiency, effectiveness, professionalism, and public service. (Kusuma et al., 2022). In good governance, transparency is essential and a challenge facing the government. Transparency is a concept related to governance activities, namely efforts to build a sense of mutual trust between the government and the public who need it. Transparency is a principle that guarantees access or freedom for everyone to obtain information about the administration of government, namely information about policies, the process of making and implementing them, and the results achieved. (Darpin et al., 2022).

Research related to robotic system sensors is currently developing because, with a robotic-based system, the work becomes easier. A robotic system can minimize the error rate (Vitalli et al., 2022). Given the problems in the under-vehicle inspection, this research provides an innovation in robotic-based under-vehicle inspection, with this robotic-based inspection aiming to solve problems in the Bottom vehicle inspection, where a motorized vehicle inspector and vehicle owner can see firsthand the condition of the Bottom vehicle. The process of checking the Bottom vehicle components is examined in detail so that no inspection is missed. With the robotic-based Bottom vehicle inspection, it is hoped that public services can be created, especially in the transparent and accountable inspection of the under test.

LITERATURE REVIEW

A. Innovation Service Public

The services provided by the government to the people continue to experience renewal, both in terms of paradigms and service formats along with the increasing demands of the community and changes within the government itself. Public services are all activities in the context of fulfilling basic needs in accordance with the fundamental rights of every citizen and resident of an item, service, and/or administrative service provided by service providers related to the public interest. Needs Public will service public Keep going increase with fast, effective, efficient service as well as transparent, so need existence innovation service. Innovation service must have 5 (five) aspects, namely (1) Relative advantage, where innovation must have scored more from maintenance service before. There is an inherent score novelty in innovation that becomes a distinguishing feature of the previous model. Product from innovations made is a change or fix the old system, thing this could be conducted by sustainability so that the organization is capable competitive and satisfying customers. (2) Compatibility, so that old innovations are not as well discarded, and old innovations must become part of the transition process to new innovation. This thing is intended so that the community is not startled by a new service model and necessary adjustments. Innovation service public by no means changes something in an instant. However, it is a form of the change process that has been before, so the innovation service public is not impressed becomes cumbersome and wasteful budget cost. Efficiency from innovation must also notice so that destination from service quality public can also be seen from user service. (3) Complexity, because of something the usual innovation level more complexity tall from before. So new innovation must offer more things good from the previous one. (4) Trialability, innovation only could be received if has conducted a public test and has declared to have more advantages than before, which is also essential that neither the provider nor user service could receive. (5) Observability, innovation must give convenience, could observe, good from side method proven work and results better. Output from innovation can be adopted and replicated from one place to another. So, innovation performance bureaucracy in the public sector could be used in instituting another thing. This important remember from the results could be seen that innovation has reliability—one innovation service public in testing a lower vehicle that is with application testing lower vehicle-based robotics (Nurdin, 2019).

B. Wheeled Robot

Wheeled robot is included in the category of the Mobile robot, which is a robot that can move freely because it has a movement tool to change positions. Generally, a mobile robot is fundamentally distinguished by a locomotion system or a propulsion system. Locomotion is a movement across a flat surface. All of this is adjusted to the terrain to be traversed and the tasks assigned to the robot (Hendra, 2016).

Robots that are often encountered are robots that move using wheels. Wheels are the oldest, easiest, and most efficient technique for moving a robot across a flat surface. Wheels are often chosen because they provide good traction, are easy to obtain and use, and are also easy to attach to the robot. Traction is a variable of the wheel material and the surface traversed by the wheel. Softer wheel material has a large traction coefficient, and this large traction coefficient provides greater friction and increases the power required to drive the motor. The number of wheels used in the robot varies and is chosen according to the tastes of the robot maker. Robots can be built using various kinds of wheels, for example, two-wheeled, four-wheeled, six-wheeled, or caterpillar wheels (tank-treaded), which can be seen in Figure 1 (Anggoro et al., 2013).

(a) (b)

Figure 1. Two-wheeled robot (a) and caterpillar wheeled robot (b)

C. System Control

System control on inspection robot lower vehicle using 2 (two) controllers, namely Arduino Nano and Raspberry Pi. Arduino Nano is used with a microcontroller based atmega 328; Arduino Nano is used because it is relatively small and does not take up much place during the assembly process. Arduino Nano is used for motor control for navigation and robotic arm control.

Figure 2. Arduino Nano

Arduino Nano has 14 digital pins, eight analog pins, 6 PWM pins, and Serial Peripheral Interface (SPI) communication pins. Features possessed by Arduino Nano, then accessible in the make system to control the robot's movement. The following control system (i.e., raspberry pi), Raspberry Pi used Raspberry Pi 3 type B because having a 1.2 GHz Arm Cortex-A53 processor and is equipped with convenient wireless features in connection to the local area network.

Figure 3. Raspberry Pi 3 Type B

Raspberry Pi is used to control the picture component; lower, the following vehicle will be equipped with a compatible camera with raspberry pi.

RESEARCH METHOD

The method for this study is using research and development; at this study stage, we will make design a wake-up inspection robot lower vehicle. Data collection will be carried out at the UPTD PKB Bandung Regency with test Robot performance Stages in the study as follows:

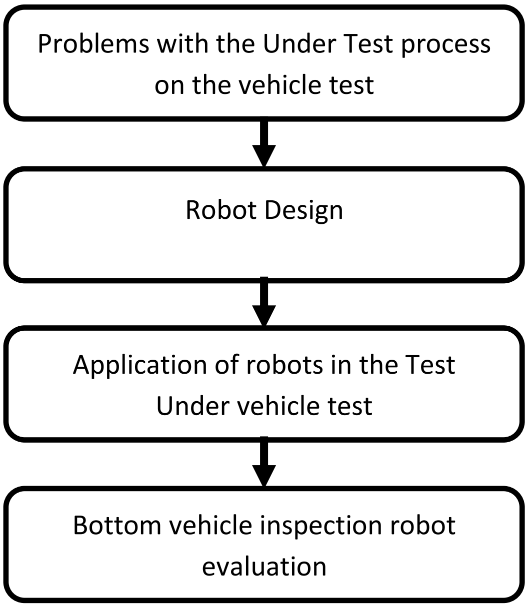

Figure 4. Stages design build inspection robot lower vehicle

The design-build inspection robot lower vehicle started with the problem factor technical testing process lower vehicle as well as transparency in inspection component lower vehicle, next made design robot design for inspection lower vehicle as in Figure 5.

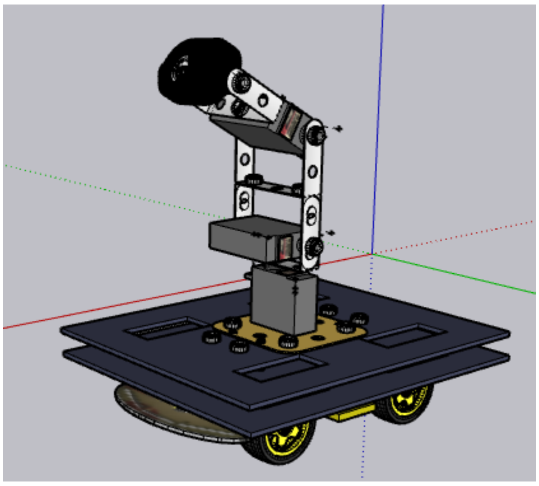

Figure 5. Design of examining robot lower vehicle

Design made using google Sketchup free version. Robots are designed using 4 (four) wheels equipped with arms for seeing the close component lower vehicle; dimensions are 30 cm long, 20

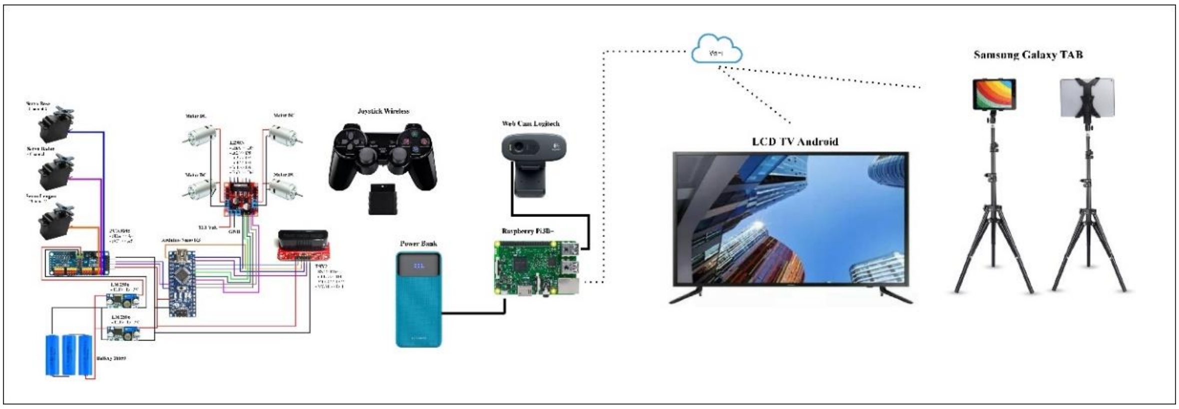

Figure 6. Inspection robot system lower vehicle

cm wide, and high, and they can customize start from 28 cm to 44 cm—robot system is created with a schematic diagram in Figure 6.

Robots designed to use Arduino Nano and Raspberry Pi controllers. Arduino Nano is equipped with a stick for robot movement and a moving robot arm, for Raspberry Pi equipped camera as well as for results catch camera will be connected using the local area network, which will connect to 10 - inch and 32- inch monitor layers, 10- inch monitor screens used for a 32-inch tester and monitor for owner vehicle. Robots will be applied to testing vehicles motorized with the illustration test in Figure 7.

Figure 7. Illustration testing inspection lower vehicle-based robotics

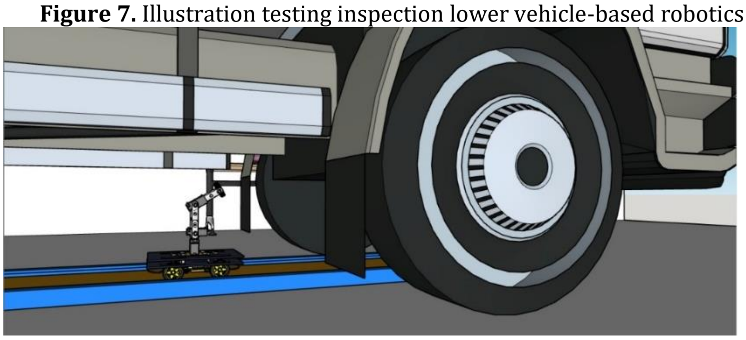

Figure 8. Illustration of a robot in check component lower vehicle

Test conducted with test try robot performance with see 2 (two) aspects is robot movement start of moving robots to deep robot arm control see the component lower vehicle, then aspect second that is test try appearance picture inspection lower vehicle. At the final stage, evaluate results from future robot performance for repair and refinement robot performance.

FINDINGS AND DISCUSSION

A. System and dimension robot

The result of the design of the examining robot lower vehicle is as follows:

Figure 9. Under Vehicle Inspection Robot

Robots equipped with a stick for control movement robot wheel and movement robotic arm. Robots have dimensions of a Length of 30 cm, a width of 20 cm, and adjustable height customized starting from 28 cm to 44 cm. Connected Robots with a local area network that will connect to the 10 - inch and 32- inch monitor layers.

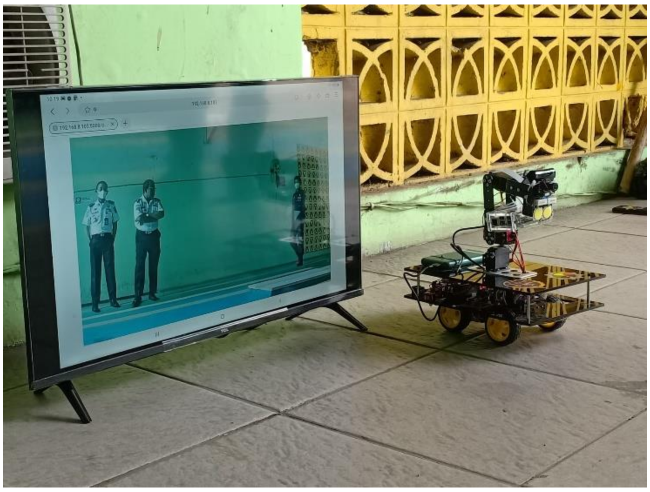

Figure 10. Robot and display monitor screen

The robot is placed in the test column with a given board for robot trajectory in the process of inspection lower the vehicle is shown in Figure 11.

Figure 11. Robot on the track under test

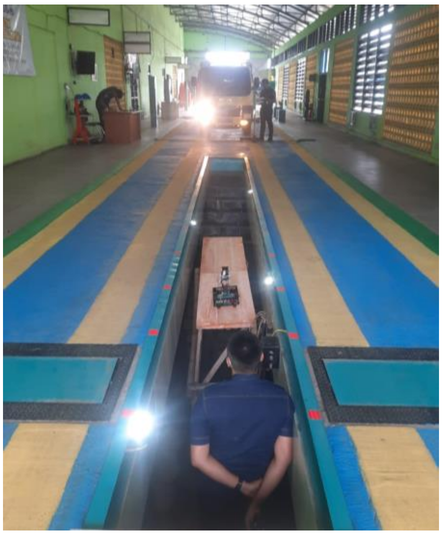

Figure 12. Inspection process lower vehicle

The lower vehicle inspection process can be seen in Figure 12, where the test vehicle will cross on top of the robot, and the robot will inspect the Bottom vehicle in detail—robots equipped with lamp chops will assist in lighting the bottom vehicle.

B. Navigation Robot

Trial robot navigation includes testing movement forward, backward, turn right, turn left, and rotate come back as well as testing. The robot arm includes the base servo, center servo, and top servo. Robots on the move using a DC motor and moving robot arm using a servo motor with 180-degree movement. Robot movement using a connected stick with a local area network works well. The robot can drive to the front and behind. Then, maneuver to the right and the left well without a hitch before the robot turns back to position early.

Table 1. Robotic performance test

No	Robotic Performance	It work	Not work
Wheel Navigation			
1	Forward control	√	-
2	Reverse control	√	-
3	Right turn control	√	-
4	Left turn control	√	-
5	Roll back control	√	-
Arm Navigation			
1	Base Servo	√	-
2	Center Servo	√	-
3	Top Servo	√	-

C. Bottom vehicle Component Inspection Results

Robots equipped with working cameras to see direct Bottom vehicle condition. The motor vehicle inspector and owner vehicle could see the direct condition of lower vehicles, as well as if occur a problem with the tester Bottom vehicle, could direct tell owner vehicle.

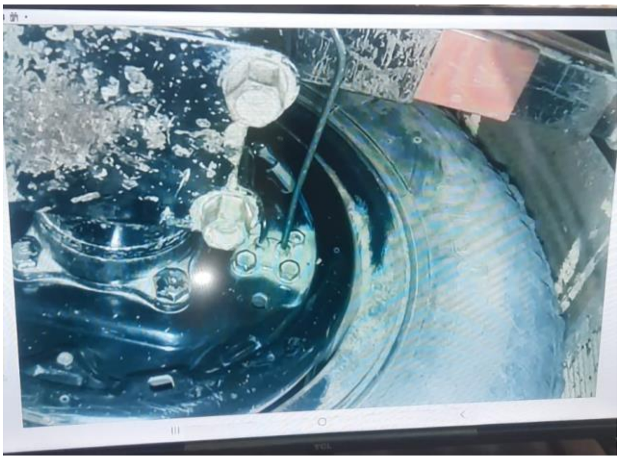

Figure 13. Section wheel right behind

Figure 13 shows part of the wheel back; the part wheel most frequently occurs damage like crack on the rim because of overload factor or broken roads. In Figure 13, it can be seen part wheel is in good condition.

Figure 14. Parts of the propeller shaft

Figure 14 shows that part of the propeller shaft connects components between the transmission and axle. This component is often damaged, and damage to components is usually bent or fractured caused by impact object hard moment across the road rocky, or Street perforated, deep picture the seen inner propeller shaft parts state well. The camera could show results clearly to see clear bottom vehicle condition.

CONCLUSION AND FURTHER RESEARCH

Robots designed and built could represent the bottom vehicle condition well, making it easier for motorized vehicle inspectors and owners to see direct Bottom vehicle condition. The limitations of the wheeled robot made still not effective enough because it needs installation on a test column vehicle with an additional table and board track for robot movement. The following research will conduct improvements to the parts of the robot wheel with replace it with a track rail so that the robot can move faster and more bottom vehicle testing process is more effective and efficient.

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