



## Mobile Robot Detects Pests And Diseases In Palm Oil Nurseries

**Raden Aris Sugianto**

Institut Teknologi Sawit Indonesia

**Andi Prayogi**

Institut Teknologi Sawit Indonesia

**Hasanal Fachri Satia Simbolon**

Institut Teknologi Sawit Indonesia

\*Correspondence email : [radenaris@itsi.ac.id](mailto:radenaris@itsi.ac.id)

**Abstract.** *The palm oil industry is an important economic pillar in various countries, making a significant contribution to global vegetable oil production. Despite its vital role, oil palm growth is often faced with serious challenges such as pest and disease attacks that can threaten crop yields and plant health. Oil palm seeding, as the initial stage in the plant growth cycle, is key in ensuring optimal quality and productivity in the future. The successful application of mobile robot technology in detecting pests and diseases in oil palm nurseries will not only increase production efficiency, but also support the principles of sustainability and wise resource management.*

**Keyword :** *Mobile Robot, Detects Pests And Diseases, Palm Oil Nurseries*

### BACKGROUND

The palm oil industry is an important economic pillar in various countries, making a significant contribution to global vegetable oil production. Despite its vital role, oil palm growth is often faced with serious challenges such as pest and disease attacks that can threaten crop yields and plant health. Oil palm seeding, as the initial stage in the plant growth cycle, is key in ensuring optimal quality and productivity in the future.

Pest and disease management in oil palm nurseries requires a fast, accurate and effective approach. This is where mobile robot technology can be an innovative solution that has great potential. The use of mobile robots to detect pests and diseases early in the nursery environment can help farmers take preventive action early, reduce the risk of spread, and improve the health and yields of oil palm plants.

The successful application of mobile robot technology in detecting pests and diseases in oil palm nurseries will not only increase production efficiency, but also support the principles of sustainability and wise resource management. Therefore, this practical report aims to evaluate the performance and potential of mobile robots as a tool for detecting pests and diseases, as well as providing new insights regarding the application of this technology in the context of modern agriculture.

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\* Raden Aris Sugianto, [radenaris@itsi.ac.id](mailto:radenaris@itsi.ac.id)

## **THEORETICAL REVIEW**

### 1. Technology Based Agriculture:

In recent years, agriculture has undergone significant transformation with the adoption of modern technology. The use of robotics and automation in the agricultural sector has become a major concern for increasing efficiency and productivity. Recent research shows that the integration of mobile robot technology in agriculture can provide effective solutions in overcoming challenges such as detecting pests and diseases in plants.

### 2. Palm Oil Nursery:

Oil palm nurseries play an important role in determining the quality and productivity of harvested crops. Pest and disease attacks in the early stages of growth can have a major impact on the final yield. Therefore, effective monitoring at the seedling stage is necessary. A review of the literature shows that the use of advanced technology, such as mobile robots, can increase the effectiveness of this monitoring.

### 3. Automatic Pest and Disease Detection:

The development of automatic detection systems for pests and diseases in crops has been the focus of intensive research. Optical sensors and image processing techniques have been used to detect changes in plants caused by pathogenic factors. This research provides the basis for integrating similar technology in mobile robots to detect pests and diseases in real-time.

### 4. Mobile Robots in Agriculture:

The use of mobile robots in agriculture has shown great potential in various aspects, including crop monitoring, land management, and early detection of pests and diseases. The successful implementation of mobile robots is highly dependent on appropriate hardware design and reliable software for data analysis.

### 5. Sustainability in Agriculture:

Sustainability aspects in agriculture are increasingly becoming a concern. Mobile robots that can quickly detect pests and diseases can help reduce pesticide use and have a positive impact on the environment and consumer health.

## METHODS



The following are the tools used to make a Mobile Robot to detect pests and diseases in oil palm nurseries:

- Battery Box
- Batteries (2 pcs)
- DC motors (4 PCS)
- Motor Mounts (4 pcs)
- Spacers, Nuts and Bolts
- Wheels (4 pcs)
- Chassis
- RoboCam ESP32 mainboard
- ESP32 Cam
- Robot controller laptop/cellphone
- Pliers, screwdriver

### Making Mobile Robots

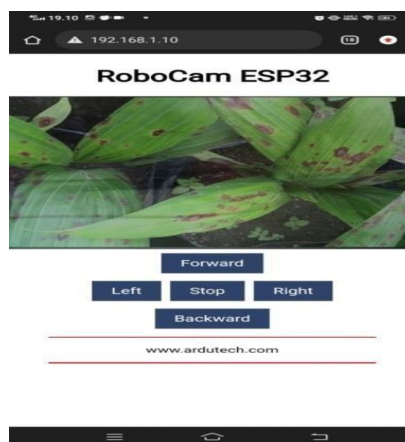
The following is the working procedure for making a Mobile Robot to detect pests and diseases in oil palm nurseries:

1. Prepare 4 chassis and MS-1 (without bolts).
2. Prepare the motor mounts, 4 MP-2s, then install the motor mounts on the chassis.
3. Prepare the battery box, MF-1 then install it on the top of the chassis. Insert the battery cable into the hole in the rear of the chassis
4. Place 8 MP-2s and the DC motor then install it in the position as shown in the picture. Pay attention to the right and left position of the motor. The cable is inside. Insert the cable from the DC motor into the center hole of the chassis.

5. Prepare the RoboCam ESP32 mainboard then install it as shown in the picture. Also attach the cables from the DC motor and battery to the connector on the back of the mainboard
6. Prepare the ESP32 Cam and MS-1 bolts then install them
7. Prepare 4 wheels then install them
8. Prepare the battery then install it. RoboCam ESP32 is complete.
9. Now we prepare the ESP32 Cam so that it can be recognized by the Arduino IDE and can be programmed with it. Prepare a micro USB cable, then connect it to the ESP32 Cam adapter USB port and computer/laptop USB port. The computer/laptop must be connected to the internet for the download process.
10. Please install the Arduino IDE software as in the How to Install Arduino IDE PDF guide. Learn and practice how to create programs on Arduino.
11. RoboCam ESP32 Test Program, In this test program we run RoboCam ESP32 back and forth, turn right and turn left.
12. RoboCam ESP32 WiFi program, this main program is to control RoboCam with an Android cellphone and also display. This main program is to control the RoboCam ESP32 with an Android cellphone and also display the images on the RoboCam camera.
13. Use image processing software to analyze data and detect diseases and pests on oil palm seedlings

## Results and Discussion

### Results of Pest and Disease Detection by Mobile Robot



The image above is a display of MobileRobot which detects diseases or pests on oil palm seeds. In implementing automatic pest and disease detection technology in oil palm

nurseries using MobileRobot, various significant results have been obtained. The following is a summary of the practicum findings.

### **Detection Accuracy**

Mobile robots have succeeded in detecting cases of pests and diseases in oil palm plants with a high level of accuracy. These results demonstrate the ability of automatic detection technology to provide a reliable solution for identifying plant health problems.

### **Response Time**

The response time of the mobile robot in detecting pests and diseases in real-time shows very good performance. The average detection time is faster compared to manual detection methods, allowing for more prompt preventive action.

### **Coverage area**

The mobile robot is able to cover oil palm nursery areas efficiently, ensuring thorough scanning and detecting potential problems throughout the field. These results prove the superiority of mobile robots in achieving wider area coverage compared to traditional methods.

### **Advantages of Mobile Robot Technology**

The application of mobile robot technology in pest and disease detection brings a number of advantages. With the ability to move autonomously, mobile robots can reach areas that are difficult to access by manual methods, minimizing the risk of plant damage and increasing work efficiency.

### **Environmental Influence on Performance**

Observations of the influence of environmental factors, such as light and weather conditions, on mobile robot performance show that this technology requires adaptability. Optimizing sensors and detection algorithms needs to be done to minimize the influence of environmental variability on detection accuracy.

### **Contribution to Sustainable Agriculture**

The implementation of mobile robots in detecting pests and diseases in oil palm nurseries makes a positive contribution to sustainable agriculture. The ability to detect early helps reduce pesticide use and supports environmentally friendly agricultural practices.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results and discussion, several recommendations and directions for further development can be identified. It is important to increase the technology's robustness to environmental variations and optimize detection algorithms to improve detection accuracy. In further development, this technology will be integrated with a monitoring system

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