Botany Buggy Application

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***Abstract*—The agriculture sector in Indonesia faces a critical shortage of human resources due to a declining interest in farming as a vocation. This project aims to develop an autonomous robot, monitored via a mobile application, to assist farmers in managing crops efficiently with minimal manual labor. Our study evaluates the robot's performance and the application's usability, showing that this innovation can significantly mitigate labor shortages and enhance agricultural productivity.**

I. INTRODUCTION

1. BACKGROUND.

Indonesia's agriculture sector, crucial for the nation's food supply, faces significant challenges due to the rapidly growing population and a declining interest in farming among younger generations vocation [1]. These issues strain farmers to increase crop production, compounded by the need for specific land locations and adequate agricultural knowledge [2].

Despite technological advancements that could address these problems, research from the University of Muhammadiyah Malang indicates that the adoption of technology in Indonesia's agriculture is medium to low, leading to inefficiency and declining production. In contrast, countries with higher technological adoption in agriculture have seen increased productivity and improved system security, suggesting that similar advancements could benefit Indonesia's agricultural sustainability and economic viability [3].

In response to these challenges and technological advancements, integrating solutions like agricultural robots is promising. The Botany Buggy exemplifies this by monitoring and maintaining essential plant growth parameters such as humidity and soil moisture. Using simple sensors, it gathers real-time data and takes actions accordingly.

2. PROJECT PURPOSE.

The Botany Buggy application is designed to enhance the functionality of the Botany Buggy device by enabling users to monitor its performance. It provides real-time sensor readings, allowing users to verify that the Botany Buggy is operating correctly. This integration not only ensures optimal device functionality but also contributes to more efficient and precise

monitoring of environmental conditions essential for plant growth.

3. PROJECT BENEFITS

1. Increases the efficiency of agricultural productions
2. Enhanced Crop Management

II. LITERATURE REVIEW

Prior to designing this project, there has been some other projects on creating an application to assist farmers.

The application “Padi2U” is designed to assist rice farmers in managing their crops by providing guidance on various aspects such as determining planting schedules and offering a top-down view of their land to show its contour. Additionally, the application helps farmers assess the health of their crops through a map-based interface. However, a notable limitation of Padi2U is its inability to provide real-time data, preventing it from showing the current condition of the plants [4].

In contrast, the Botany Buggy application offers real-time data collection, enabling users to monitor essential parameters such as soil moisture, humidity, and temperature. This feature allows users to immediately detect and respond to suboptimal plant conditions, ensuring more effective and timely plant care.

III. MATERIALS & PROJECT STAGES

A. Firebase

Firebase, a Google cloud computing service, offers database hosting, services, authentication, and app integration [5]. For the "Botany Buggy" application, Firebase hosts the database, storing soil moisture, humidity, and temperature data from the robot. This integration enables real-time data retrieval and monitoring, enhancing the app's ability to provide accurate and timely environmental assessments.

B. Circular progress

The application features a circular progress bar displaying real-time soil moisture, humidity, and temperature readings. This intuitive design helps farmers quickly monitor and assess crucial environmental conditions, aiding in efficient crop management and informed decision-making to optimize plant health and productivity.

C. Graph

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D. Kotlin

Kotlin is a versatile programming language widely integrated into Android Studio, extensively utilized by Android developers. It supports various development paradigms, including server-side, client-side web, Android, and multiplatform libraries [6]. Similarly, the "Botany Buggy" application is built using Kotlin, showcasing its flexibility and efficiency in diverse development scenarios.

E. Jetpack Compose

Jetpack Compose is a contemporary toolkit designed for constructing native Android user interfaces. It streamlines and accelerates UI development on the Android platform by reducing the amount of code required and providing robust tools and intuitive Kotlin APIs [7].

F. Early Stages of Botany Buggy Application

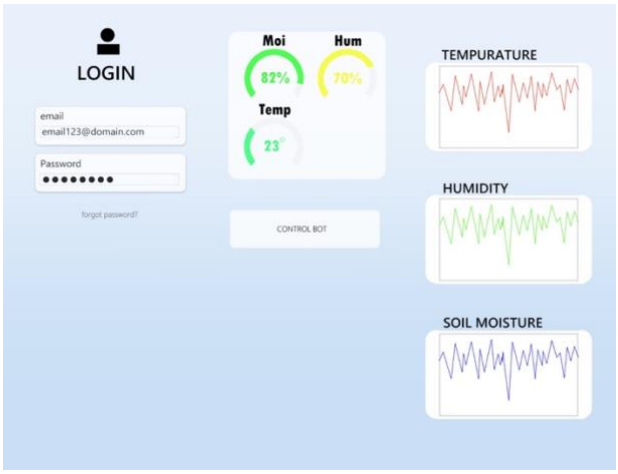

Image 3.3.1

The image above depicts the initial stages of the Botany Buggy Application. While the displayed information closely resembles the final version, the design remains quite basic and the interface lacks interactivity.

IV. PROJECT RESULT & DISCUSSION

A. Application Interface

1. Login page

Image 6.1.1

The provided image illustrates the interface of a login page where users are required to enter their username and password to access the application's homepage.

2. Home Page

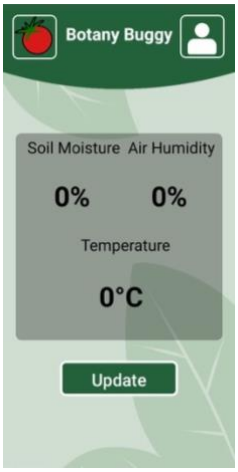

Image 6.1.2

The provided image depicts the home page of the Botany Buggy application, which displays the status of soil moisture, air humidity, and temperature using circular progress bars. When a user selects one of these circular progress bars, they are directed to another page

that presents detailed graphs and specifications for tomato plants.

3. Graph and specification for tomato plant page

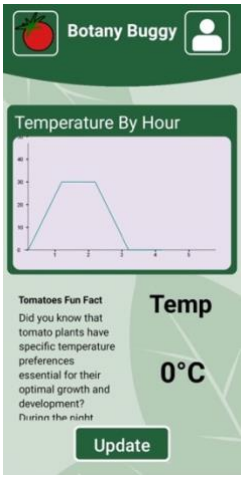

Image 6.1.3

The provided image illustrates the graph and specifications specifically for temperature. However, there are also separate graph and specification pages for the other parameters, including soil moisture and air humidity.

4. Drop Down

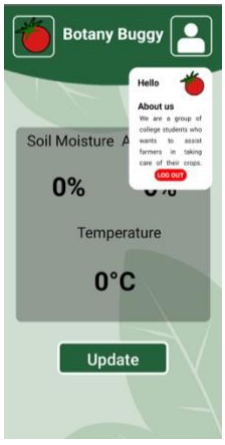

Image 6.1.4

The provided image shows a dropdown menu that appears when the icon in the top-right corner of the screen is pressed. This dropdown contains the "About Us" section for the application.

5. Disease Detection

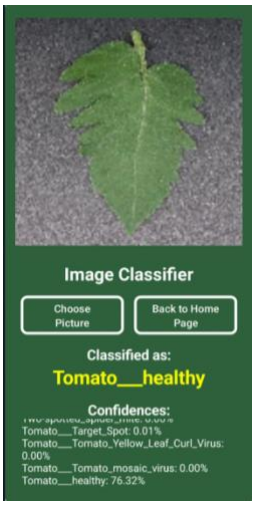

Image 6.15

This page allows you to upload an image of the leaf of a tomato plant. We deployed a form of artificial intelligence to recognize symptoms of a disease that appears on the leaf.

B. Project Disscussion

The Botany Buggy app provides real-time soil moisture, air humidity, and temperature data via Firebase, aiding quick decisions. It uses machine learning to identify plant diseases with 96% accuracy in 1-2 seconds. Its intuitive interface, with progress bars and graphs, helps optimize crop management for better productivity and sustainability.

V. CONCLUSION

Our project helps farmers care for their tomato plants by using a robot equipped with sensors to monitor soil moisture and air humidity. Data from these sensors are displayed in the app as graphs. The app also includes image recognition to identify tomato plant diseases.

VI. REFERENCES

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