

Robot Monitoring and Controlling Soybean Field Soil Condition Based on K-Nearest Neighbor Algorithm and Message Queuing Telemetry Transport

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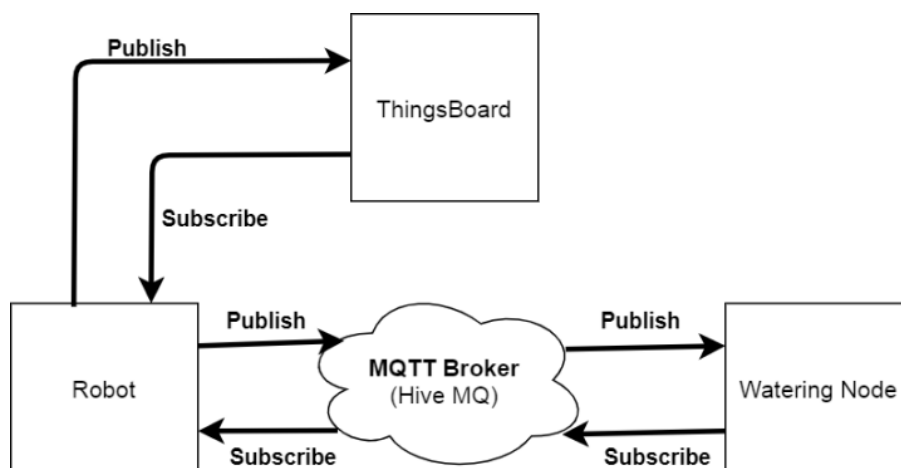
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Introduction

Soybean production is decreasing every year. The level of soybean production is strongly influenced by soil moisture. The problem is that farmers let soybeans grow without adequate maintenance, including without checking the soil moisture. Therefore, an autonomous robot is built that could replace the role of farmers in caring for soybeans. This robot is built to monitor the conditions of the soybean field and classify the image of soybean field soil using the K-Nearest Neighbor algorithm. The results of soil classification are used to control the watering node for watering plants. This robot uses the Internet of Things concept with the MQTT protocol integrated with ThingsBoard as a display of monitoring information. The robot is built based on the Raspberry Pi 3 Model B+.

System

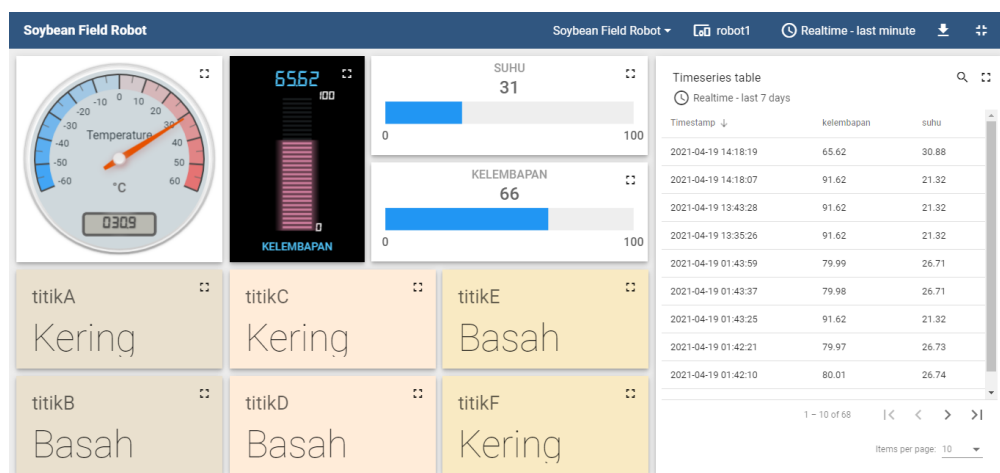


The system consists of 4 main components, that are the robot, the watering node, the ThingsBoard (as a IoT dashboard) and the broker. The working principle of the system is that the robot explores the soybean field while checking temperature and humidity and the processing and classifying soil images. If the soil image is classified as dry, the water pump will water the plants. On the other hand, if the soil image is classified as wet, then the water pump still off. Checking the condition of the land is always followed by sending data to the MQTT broker. When the entire land has been explored, the robot will stop.

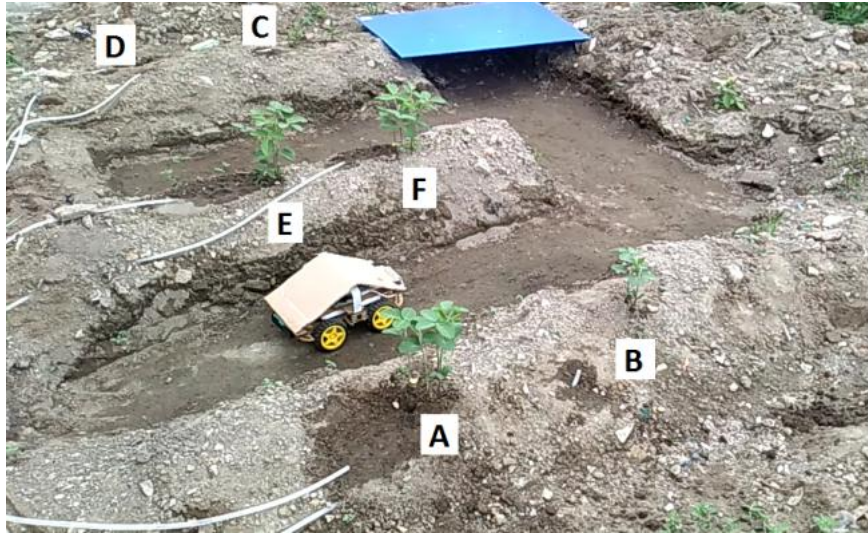


The robot is built based on the Raspberry Pi 3 Model B+, which is equipped with sensor and actuator components including 2 (two) HC-SR04 distance sensors, BME280 temperature and humidity sensor, camera module board Rev 1.3, DC motor driver L298N which controls 4 (four) DC motors as a robot wheel.

The watering node is built based on NodeMCU V3, which is embedded with the ESP8266-12E wireless communication module and is equipped with a logic level converter, a 5V 4-Channel relay module a 5V 2-Channel relay that controls 6 (six) 12V micro water pumps. This watering node is controlled by the robot remotely based on the result of soil image classification.



The ThingsBoard is a web-based IoT dashboard to display monitoring results in both textual and graphical form.



This system is applied in a soybean field with a specific shape and only has 6 planting points. You can check the demonstration of this system on this link: <https://youtu.be/7hBYImPXcvY>

Research Submission

This research has been presented at 2021 International Conference on Artificial Intelligence and Computer Science Technology (ICAICST) on June 29, 2021.