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

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##### Abstract:

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+. In this research, with the KNN algorithm, the robot can classify soil moisture accurately and adequately, where it obtained 83.3% accuracy, 90% recall, 81.8% precision, and 85.7% F1 score. The watering node also performed well with a 94.4% success rate. In addition, soybeans in a field with the robot have better growth than soybeans in a field without robot. That is evidenced by the average plant height and the number of leaves in the field with the robot is better than those in the field without robot, that is 17.28 cm and 9 leaves compared to 15.72 cm and 8 leaves. However, plants without robot have a better stem diameter than those in a field with the robot, which is 2.8 mm compared to 2.74 mm.

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**I. Introduction**

Agriculture is a strategic sector in driving the national economy, namely in realizing food security, increasing competitiveness, expanding employment, and reducing poverty. The agricultural sector recognizes the term "strategic commodity," one of which is soybean commodity. The problem that occurs in soybean commodities is the production rate which has declined every year until 2019. Soybean production only reached 424 thousand tons, or the lowest in 5 years [1]. There are many factors behind low soybean production, but in general natural factors play a significant role in soybean growth and production. The condition of soil moisture, air temperature and humidity affect the growth of soybeans and soybean production [2].

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Eridani, Dania ; Rochim, Adian Fatchur ; Imago Dei Gloriawan, Jonathan

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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

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