

## ABSTRACT

NPK elements are macro nutrients that play an important role in plant development. Measurement of NPK elements should ideally be done every period to determine the right dose of fertilization, but measurement through laboratory tests takes a relatively long time. With information on NPK content in the soil, farmers can apply the right fertilizer according to the needs of the plants. This helps increase agricultural productivity, optimize fertilizer use, and reduce the negative environmental impact of over-fertilization.

In previous research, a system has been made that can monitor the NPK content of the soil at the plant site. However, the reading results of the system cannot be monitored remotely and the battery life can only last 2 hours. This research aims to develop an IoT communication system so that the readings can be monitored remotely. From several proposals available, one solution for data transmission has been selected. The proposed solution chosen is to send data via an internet network connection. The system can be connected using the internet network, a microcontroller that can connect to a wifi network is used, namely ESP32 and mifi to connect to the internet via a 4G cellular network and spread it via wifi. The communication protocol chosen is the MQTT protocol based on the pub-sub model. The system sends NPK, soil moisture and pH data in 75 bytes to 84 bytes per data value. To increase battery life, 18650 lithium ion batteries are used and solar panels are used to recharge the battery.

The results of data transmission are obtained efficiently and quickly. In this study, monitoring NPK nutrient levels and soil moisture that can be monitored remotely via a web browser. The results of the trial of the tool built from the NPK element value monitor system, pH and soil moisture data sent from the microcontroller to the server until it can appear in the web browser for the first time plugged in there is a delay of 2 minutes to 3 minutes, and for the second and subsequent data transmission there is a delay of 0.9 seconds to 1.2 seconds. The results obtained from using solar panels when the sun is hot which sends 18 volts to 20 volts of power to the 18650 lithium ion battery can last up to 8 hours.

Keyword: battery, development, IoT, monitoring, MQTT, NPK.