

INTISARI

Pertanian di Indonesia masih banyak menggunakan metode konvensional, termasuk dalam proses penyiraman tanaman yang membutuhkan tenaga dan waktu cukup besar. Seiring perkembangan teknologi, dibutuhkan sistem penyiraman otomatis yang lebih efisien. Penelitian ini bertujuan merancang dan mengimplementasikan robot kartesian sebagai alat penyiram tanaman otomatis yang terintegrasi dengan sensor kelembaban tanah dan teknologi *Internet of Things* (IoT) untuk memantau kondisi tanaman secara *real-time*.

Metodologi penelitian meliputi studi literatur, perancangan perangkat keras dan perangkat lunak, perakitan sistem, serta pengujian alat. Sistem menggunakan Arduino Mega 2560, Arduino Nano berbasis GRBL, NodeMCU ESP8266, sensor *soil moisture*, motor *stepper* sebagai aktuator robot kartesian, pompa air, dan platform Arduino IoT Cloud. Robot dirancang untuk bergerak menuju 9 titik tanaman dan melakukan penyiraman berdasarkan ambang batas kelembaban yang telah ditentukan. Data kelembaban, status sistem, dan aktivitas penyiraman dikirim ke platform IoT sebagai monitoring jarak jauh.

Hasil penelitian menunjukkan bahwa sistem robot kartesian sebagai penyiram tanaman berhasil diimplementasikan dan dapat berfungsi sesuai dengan perancangan. Berdasarkan hasil pengujian, sistem memiliki tingkat keberhasilan sebesar 88,89%, dengan kegagalan teridentifikasi pada satu titik tanam akibat ketidakakuratan sensor kelembaban tanah. Secara keseluruhan, sistem mampu melakukan penyiraman secara otomatis dan terkontrol, serta dapat dipantau melalui platform IoT.

Kata kunci: robot kartesian, penyiram otomatis, sensor kelembaban tanah, Arduino, IoT.

ABSTRACT

Agriculture in Indonesia still relies heavily on conventional methods, including plant watering processes that require considerable labor and time. With the development of technology, there is a need for a more efficient automatic watering system. This study aims to design and implement a Cartesian robot as an automatic plant watering tool integrated with soil moisture sensors and Internet of Things (IoT) technology to monitor plant conditions in real time.

The research methodology includes literature study, hardware and software design, system assembly, and tool testing. The system uses Arduino Mega 2560, GRBL-based Arduino Nano, NodeMCU ESP8266, soil moisture sensors, stepper motors as Cartesian robot actuators, water pumps, and the Arduino IoT Cloud platform. The robot is designed to move to 9 plant points and perform watering based on predetermined moisture thresholds. Moisture data, system status, and watering activity are sent to the IoT platform for remote monitoring.

The results of the study show that the Cartesian robot system as a plant watering system has been successfully implemented and can function according to the design. Based on the test results, the system has a success rate of 88.89%, with failure identified at one planting point due to the inaccuracy of the soil moisture sensor. Overall, the system is capable of automatic and controlled watering and can be monitored through an IoT platform.

Keywords: Cartesian robot, automatic irrigation, soil moisture sensor, Arduino, IoT.