

DESIGN AND PERFORMANCE EVALUATION OF SOIL  
NITROGEN TESTER

Design Project

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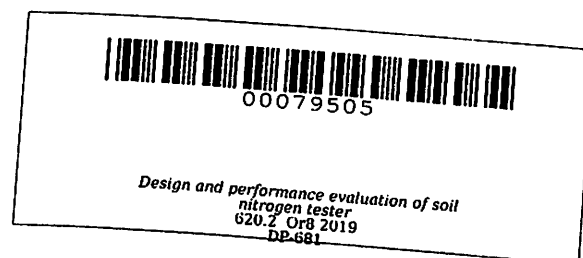
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# DESIGN AND PERFORMANCE EVALUATION OF SOIL NITROGEN TESTER

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## ABSTRACT

**ORTIZ, JC JOSEPH R. and SALLEGUE, KAZELLE ANNE A. Design and performance evaluation of Soil Nitrogen Tester.** Undergraduate Design Project. Bachelor of Science in Electronics and Communications Engineering. Cavite State University, Indang, Cavite. June 2019. Adviser: Engr. Nemilyn A. Fadchar

The general objective of the study was to design and evaluate the performance of a soil nitrogen tester. Specifically, it aimed to design and assemble a portable soil nitrogen tester. It also targeted to test and evaluate the precision and sensitivity of the system. Moreover, it intended to conduct a cost analysis of the device.

The design project was composed of Arduino Uno R3 which served as the microcontroller unit. Its ports were used to interface input and output devices such as the photodiode, infrared proximity sensor, infrared light emitting diodes (IR LEDs), LED indicators, stepper motor, motor driver, and piezo buzzer. The application software was programmed and developed using the matrix laboratory (MATLAB) App Designer. Artificial neural network and support vector machine were the learning algorithms used to determine which model was appropriate for soil nitrogen level prediction.

The project was tested by the researchers at Bancod, Indang, Cavite. The evaluation was conducted at the Engineering Science Building, Cavite State University, Indang, Cavite and at the Department of Agricultural and Food Engineering, Cavite State University, Indang, Cavite. The performance of the soil nitrogen tester was evaluated by scanning distinct soil samples with low, medium, and high levels of nitrogen. Throughout the three phases of evaluation, the artificial neural network model had precision percentages of 33.33 percent, 66.67 percent, and 77.78 percent. On the other hand, the

support vector machine had performance percentages of 55.56 percent, 100 percent, and 100 percent. Hence, support vector machine had the better prediction and was implemented as the final predictive model for the application software.

Based on the results of the evaluation, the design project met the given objectives. The system was able to operate in accordance to its intended function. The overall performance of the system is satisfactory. The total cost of the system amounted to P20,216.39 and the break-even point was calculated to be 213 samples.

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# **DESIGN AND PERFORMANCE EVALUATION OF SOIL NITROGEN TESTER**

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An undergraduate design project submitted to the faculty of the Department of Computer and Electronics Engineering, College of Engineering and Information Technology, Cavite State University, Indang, Cavite in partial fulfillment of the requirements for the degree of Bachelor of Science in Electronics and Communications Engineering with Contribution No. CEIT 2018-19-2-023. Prepared under the supervision of Engr. Nemilyn A. Fadchar.

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## **INTRODUCTION**

Plants play a vital role in the ecosystem. It gives life to animals and people by being the source of food and nutrients for the body. Without plants, we may not be able to breathe because there will be no means of carbon dioxide absorption. Consequently, it is important for us to prioritize the primary needs of a plant since well-fed plants result into a healthier, more fruitful, and more good-looking state. According to (LaLiberte, 2018), the basic needs of a plant are carbon, hydrogen and oxygen. Other essential nutrient elements, which can be found from soil, are grouped into macronutrients and micronutrients. Loch (n.d.) stated that nitrogen (N), phosphorus (P), and potassium (K) are the basic macronutrients. Among this nutrients, N is a great indicator of soil fertility. N is one of the essential elements measured in agricultural soils in order to regulate the amount of fertilizer to be applied in regard to the requirement of the crops. This is to avoid the excessive application of N which can result to the percolating of nitrate in groundwater reservoirs. When a plant