Abstract

Right amount of nutrients in soil plays an important role in maintaining the health of the plant as well as the soil. In this regard, developing novel ways of soil macronutrient detection has become a must in the present day scenario. Studies based on diffused reflectance for detecting soil nutrients and attributes have taken great strides towards building up more effective systems. These trends have been contributing significantly to precision farming. Reflectance measurements in the near-infrared region have proved to be reliable in terms of measuring various soil attributes like pH, organic matter and soil nutrients. In the current work, a system was designed using an NIR source of 850nm to detect the amount of nitrogen present in soil. It was used to collect the reflectivity of the sample when variable amount of chemical was added which was then correlated to the output voltage. Based on the raw data collected, a mathematical model was developed through statistical analysis. The exponential based model was found to have the best fit with the characteristic data obtained from the sensor when analyzed statistically. The model performance estimated for the optimized combination were $R^2$ of 0.99 and RMSE of 0.5. Moreover, an algorithm based on this model was tested and validated
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with a success rate of 90%. Based on the thresholds obtained from experimentation, an Arduino was programmed in order to detect the presence of nitrogen in soil as low, medium and high. The system so designed can be employed as a cost-effective optical sensor for detection of soil nitrogen and can make a significant impact on precision farming.

References

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