STUDY ON USING LOW COST HOMEMADE NODE MCU SOIL MOISTURE SENSOR IN MONITORING SOIL MOISTURE CONTENT

BY

M. LASHIKA LAKMALI

DEPARTMENT OF BIOSYSTEMS TECHNOLOGY

FACULTY OF TECHNOLOGY

EASTERN UNIVERSITY, SRI LANKA

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ABSTRACT

A study was conducted to develop a soil moisture sensor interface with Node MCU ESP8266 micro-controller and to assess its efficiency in various land uses over oven dry methods. The developed soil moisture sensor had improved features, including a Wi-Fi internet module and low production cost than the other microcontroller Node MCU ESP8266 sensors. Therefore, it can be introduced to the low-scale farmers to attend the real-world problem in the field. Storing all moisture data in the SD card RIC module in real-time is another sensor advantage. Further, the sensor can measure soil moisture content at different types of vegetative land or soil conditions.

Field applications to test the efficiency of the buildup sensor was carried out in 05 different types of land uses, namely, escape land, paddy land, orchard land, natural vegetation land and water source land. The efficiency of the sensor was compared with the oven dry measurements, soil temperature and pH.

Paired t-test and paired sample correlation test were carried out to examine the significant difference between oven dry and sensor soil moisture measurements. The statistical results revealed that the oven dry and sensor methods showed significant differences in soil moisture content in paddy land and water source land. In contrast, soil moisture content showed non-significant differences in escape, orchard and natural vegetation land at 5% significant level. The correlation between paired samples showed positive significance in escape, orchard and natural vegetation land, while the other two land uses showed a non-significant correlation ($p<0.05$). Model comparisons were conducted to examine the efficiency of soil moisture sensors over the oven dry method. Among tested models, the sensor used in escape, orchard and natural vegetation lands showed a strong positive correlation with the oven dry

measurements (r^2= 0.76, 0.83 and 0.65), respectively. However, the sensor used in paddy land and water source lands did not correlate with oven dry measurements.

Pearson correlation among variables resulted in a moderate negative correlation between soil moisture content by oven dry and sensor methods and soil temperature and moderate positive correlation between soil moisture content by oven dry and sensor methods and pH at a non-significant level ($p<0.05$ & $p<0.01$). Thus, the different methods of soil moisture measurements do not influence the soil parameters such as temperature and pH.

The study revealed that the Node MCU soil moisture sensor is more effective in orchard land (83%) and escape (76%) land and moderately effective in natural vegetation land (65%) to replace the oven dry measurements. The sensor is also suitable for measuring the readily available soil water to ensure irrigation efficiency in the field.

Since the direct gravimetric measurement of free-soil moisture requires removing, drying, and weighing a sample, soil moisture sensors measure the volumetric water content indirectly by using some other soil property, such as electrical resistance and dielectric constant or interaction with neutrons as a proxy for the moisture content. Thus, developing low-cost soil moisture sensors will create room for the low-scale farm to adopt modern agricultural techniques.

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