Acquiring Soil-Humidity by LabVIEW

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Abstract— The key objective of this paper is determining the humidity content present in the soil sample. The process is accompanied by means of NI-ELVIS, which is an efficient technology being introduced for the first time in the field of agriculture as well as in humidity analysis. The sensor in specific is the soil moisture hygrometer. Humidity in the basis represents the water vapour content present in the sample atmosphere.

Key words: Soil humidity, NI-ELVIS, LabVIEW, soil moisture hygrometer

I. INTRODUCTION

The humidity content sensed from soil can be made use for feasibility analysis & production efficiency in the field of agriculture, which helps in prediction of seasonal changes during late monsoons &high degrees of temperature. It also prevents drying of crops & abundant irrigation at times of no necessity. This promotes consistency in soil characteristics & such factors help environmentalists in their research & development. Architectural engineers also need the study of soil humidity in planning based on soil's strength, binding capacity & basement constructions. Apart from these, soil humidity is utilized in the fields of hydrology, mining, industries such as dairy farms, soft drinks & beverages cement industry & water treatment processes. Determining the soil humidity thus serves wide scope from setting up an industry to product selection& from fertility prediction to selection of right seasonal crops etc. Humidity is the amount of water vapor in the air. Water vapor is the gaseous state of water and is invisible. Humidity indicates the likelihood of precipitation, dew, or fog.

II. BLOCK DIAGRAM

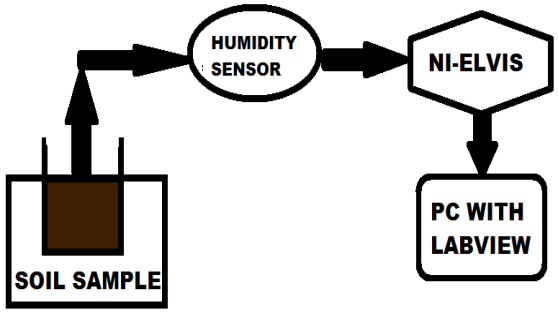

Fig. 1: Block Diagram

A. Soil Moisture Hygrometer:

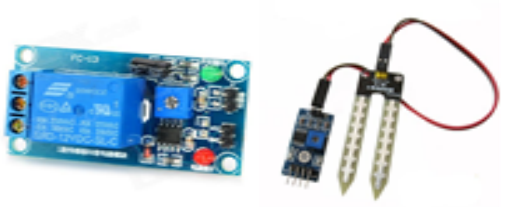

Fig. 2: Soil Moisture Hygrometer

B. Sensor Description:

Soil moisture hygrometer is a humidity determination in soil sensor with a dual output mode of digital as well as analog accompanied with a red led denoting power indicator & a green led denoting switching output indicator**.** It also has a stable LM393 comparator chip.

C. Sensor Specification:

Model	FC-13-D
Color	Blue
Material	PCB panel
Specification	Power supply: 12V DC; Output voltage signal: 0~4.2V; Input current: 100Ma
Application	– Used to detect the moisture content of the soil; – Module in the soil humidity less than a set threshold value when the DO port output high. – when soil humidity exceeds the threshold value is set, the module D0 output low; – Small plates digital outputs D0 can be directly connected with the microcontroller, microcontroller to detect high and low, and thus to detect soil moisture
Dimensions	1.97 in x 1.02 in x 0.67 in
Weight	0.60 oz (17 g)
Type	Hygrometer

Table. 1: Sensor Specification

D. Sensor Circuitry:

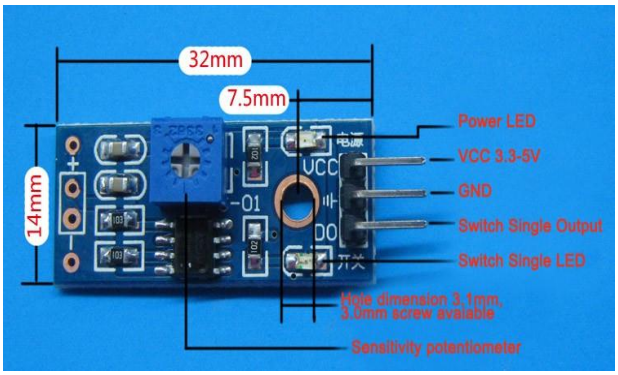

Fig. 3: Sensor Circuitry

E. Sensor Characteristics:

- Accuracy
- Interchangeability
- Linearity
- Repeatability
- Reversibility
- Temperature compensation

- Reliability
- Hysteresis
- portable

F. Components used:

The block diagram consists of the various hardware & software components under study. They are the soil sample under study, soil moisture hygrometer type of humidity measurement sensor, NI-ELVIS (stands for National Instruments Educational Laboratory Virtual Instrumentation Suite), PCI 6221 (68 pin cable), LabVIEW software (Laboratory Virtual Instrument Engineering Workbench) installed pc.

G. Software:

1) LabVIEW:

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a combination of customized software and modular measurement hardware to create user defined measurement system which is commonly used for Data acquisition and on various platforms. It usually consists of a front panel & block diagram as shown in figure below.

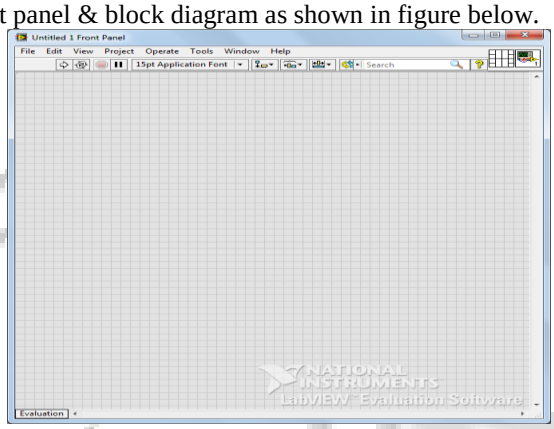

Fig. 4: Front Panel of LabVIEW

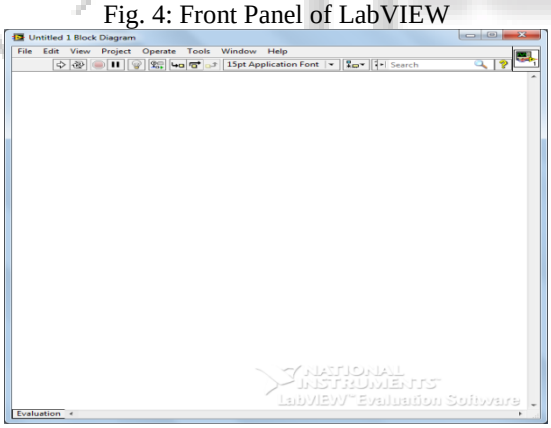

Fig. 5: Block Diagram of LabVIEW

The technique for humidity monitoring is with the help of NI ELVIS and DAQ. Data acquisition (DAQ) is the process of measuring any electrical, physical phenomenon such as voltage, current, temperature or sound with the computer. A DAQ system consists of sensors, measurement hardware and the computer with programmed software which makes it more powerful, flexible and cost-effective and is used in this process of monitoring and controlling humidity of the soil.

LabVIEW is beneficial due to the following:-

- feasible interfacing,
- code compilation,
- large libraries,
- code re-use,
- parallel programming,
- ecosystem and user community
- graphical user-interface
- data visualization
- complete functionalities
- integrated i/o capabilities
- multicore
- built for industrial standards

2) PCI 6221 Cable:

The PCI 6221 is 68 pin cables that are used for interfacing the NI ELVIS with the PC with LabVIEW. For analog input signals shielded cables and twisted pair wires for each analog input pair of differential inputs is used. The analog route lines are separated from the digital signals. A cable shield uses separate shield for analog and digital sections of the cable and thus eliminates noise coupling into the analog signals from transient digital signals**.**

Fig. 5: PCI 6221 is 68 pin cables

3) NI-ELVIS:

NI-ELVIS stands for National Instruments Educational Laboratory Virtual Instrumentation Suite, is a modular platform that delivers hands-on lab experience for engineering. It features an integrated suite of commonly used instruments in a single compact form factor based on industrial relevant technology of 12 integrated instruments in a single device.

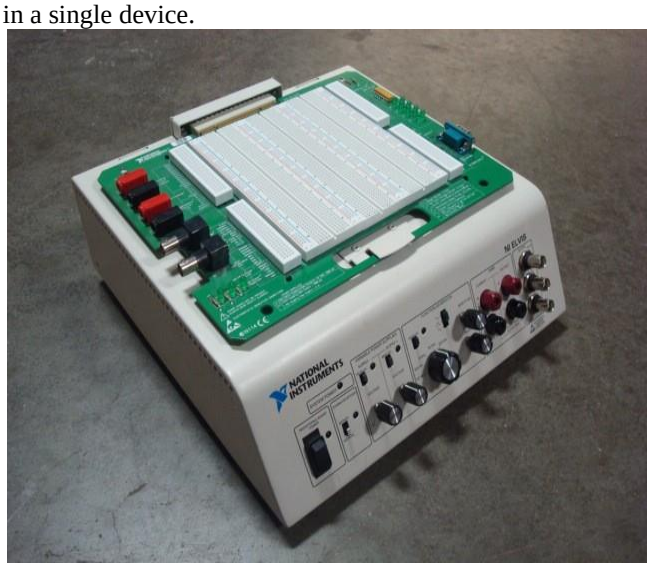

Fig. 6: NI-ELVIS

H. Acquired Sensor Outputs:

SOIL TYPE	HUMIDITY PRESENT (%)	NUMERICAL OUTPUT OBTAINED
Very dry soil	0	5.07531
Less humid soil	20	4.1582
Ordinary soil	40	2.9532
Water sprayed soil	60	2.0159
Humid soil	80	1.7320
Highly-water filled soil	100	0.91014

Table 2: Acquired Sensor Outputs

III. CONCLUSION

In our paper, we have acquired the non-identical parameter, which is the soil's humidity .The variations of soil humidity for various cases has also been taken into considerations and also experimental verifications were provided through tabulations for the same. The expected outcome of acquiring humidity irrespective of the type of soil has also been done. This project can be further enhanced by considering control implementation.

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