

# Detection of Moisture in the Soil Using Microwave

Nuthan N<sup>1</sup>, Pranav Kumar Eranti<sup>2</sup>

<sup>1</sup>. Atria Institute of Technology, ASKB Campus, Anand Nagar, Bengaluru – 560024, nuthan.sachin@gmail.com

<sup>2</sup>. Atria Institute of Technology, ASKB Campus, Anand Nagar, Bengaluru – 560024, eapranav@gmail.com

**Abstract:** *This paper explains about the determination of soil stability for farming using microwave analysis. This uses a low cost microstrip patch antenna. This works on the principle of increase in dielectric constant if there is an increase in moisture. This works because of the high dielectric constant of water. And by knowing the type of soil and its moisture content the crops can be suggested suitably.*

**Keywords:** *Microwave, Strip antenna, agriculture, moisture, soil.*

## I. INTRODUCTION

Agriculture is the most important sector and it depends on the soil, atmosphere and water. The water should be accessible to the root level of the crops and this depends on water retention of the soil than the frequency of the rainfall. This helps us to know the budget of water needed, it is also used to find the time and place to grow crops. It also helps in civil and soil engineering and various purposes. This uses a microwave sensor which is simple, durable, small and highly sensitive which is used to determine and increase the soil performance. The sensor measures effective dielectric constant of the soil and hence the moisture in the soil can be known.

## II. TECHNIQUES

There are few methods to measure the moisture in the soil. There are direct method and indirect method. The direct method is also called destructive method as it may harm the crop in that process. The direct sampling can be achieved by evaporation, leaching and the chemical process and calculated accordingly. The indirect method which is also called nondestructive method uses sensors which is kept on the soil sample and determine the moisture level of water. It requires calibration, less resources and highly accurate and can be matched with the similar soil samples.

## III. MEASUREMENT OF DIELECTRIC PROPERTIES

There are various techniques used to determine the properties of solids and semi-solids. It can be achieved by these mediums namely co-axial cables, free space, waveguides and transmission lines. Transmission line method does not need any special preparation it's easy to know the dielectric properties of soil. The ionic conductivity becomes negligible compare to dielectric losses from this procedure the water content present is measured furthermore the dielectric permittivity is higher than the soil contents. The moisture is varies and the readings are taken.

## IV. SENSOR DESIGNS

The antenna sensors are used and hence the calculations are easy to perform and the modeling of the antenna is complex as it has to interact with moisture and the soil and hence should be made rigid. The antenna is made to resonate at 2.45 GHz and simulated by HFSS. The simulated return losses are 20.2806 dB.

### A. Measurement Of Dielectric Properties

The soil samples are collected and baked in the oven for 8 hours at 100 degrees Celsius and the moist and the dry weights are measured finding out the moisture content in the soil and the moisture samples vary from 9.122-16.02.

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