

Automatic Plant Watering With Moisture Sensing System

(UDP)

A PROJECT REPORT

Submitted by

Harshil Shah	130090107042
Harshil Joshi	130090107012
Harsh Patel	130090107028
Viral Patel	130090107053

Guided by

Prof. Bhumika H. Patel

In partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING

In

Department of Computer Engineering



C. K. Pithawalla College of Engineering and Technology, Surat

Gujarat Technological University, Ahmadabad

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Acknowledgements

It give us the great pleasure in submitting this project report in title “Automatic Plant Watering and Moisture Sensing System” carried out to study in Computer Engineering at “C.K.Pithawala College of Engineering And Technology, Surat”.

We avail this Opportunity to express our gratitude to number of the people without whom this project would not been success. We heartily express our gratitude to our collages for their help and co-operation.

We are thankful to our principle prof. “Dr.Anish Gandhi”. We are also thank our H.O.D. “Mrs. Neelam Surti” in valuable guidance at every stage of our project and our curriculum activities.

We must express our thanks to “Mrs. Bhumika H. Patel” who has endeared us from the learning and processing the knowledge during the project work and her positive attitude has encourage us to look forward well in all spheres and add.

Submitted by:

Harshil Shah (130090107042)

Harshil Joshi (130090107012)

Harsh Patel (130090107028)

Viral Patel (130090107053)

Certificate



C. K. Pithawalla College of Engineering and Technology, Surat

Department of Computer Engineering

Year – 2016

Date: DD/10/2016

This is to certify that the project entitled “Automatic Plant Watering and Moisture Sensing System” has been carried out by following students under my guidance in partial fulfillment of the degree of Bachelor of Engineering in Department of Computer Engineering (7th Semester) of Gujarat Technological University, Ahmadabad during the academic year 2016-17. The work done by them is found satisfactory.

Harshil Shah	130090107042
Harshil Joshi	130090107012
Harsh Patel	130090107028
Viral Patel	130090107053

Prof. Bhumika H. Patel
Guide

Prof. Neelam A Surti
Head of Department

Abstract

The motivation for this project came from the countries where economy is based on agriculture and the climatic conditions lead to lack of rains & scarcity of water. The farmers working in the farm lands are solely dependent on the rains and bore wells for irrigation of the land. Even if the farm land has a water-pump, manual intervention by farmers is required to turn the pump on/off whenever needed. The aim of our project is to minimize this manual intervention by the farmer.

Automated Irrigation system will serve the following purposes:

- 1) As there is no un-planned usage of water, a lot of water is saved from being wasted.*
- 2) The irrigation is the only when there is not enough moisture in the soil and the sensors decides when the pump should be turned on/off, saves a lot time for the farmers. This also gives much needed rest to the farmers, as they don't have to go and turn the pump on/off manually.*

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1 Introduction

Design thinking is a formal method for practical, creative resolution of problems and creation of solutions, with the intent of an improved future result. In this regard it is a form of solution-based, or solution-focused thinking – starting with a goal (a better future situation) instead of solving a specific problem. By considering both present and future conditions and parameters of the problem, alternative solutions may be explored simultaneously. It includes layout, components and features which are needed to implement our goal.

We are going to make a product which will be useful in day to day life and which will make peoples life easy and it will mainly help farmers to produce more crop and also to universities and nursery.

Moisturizing sensor is a device which senses moisture and works accordingly. We will build a model which will sense the moisture. A moisture sensor is often integrated as a component of a system that automatically performs a task or alerts a user of moisture in plants by sensing we can help make the life of people easy in day to day life and they will have to do less work.

1.1 Overview

A moisturizing sensor contains an optical, microwave or acoustic sensor. It can be built with the help of micro-controllers. Moisturizing sensor has found wide using in domestic and commercial applications.

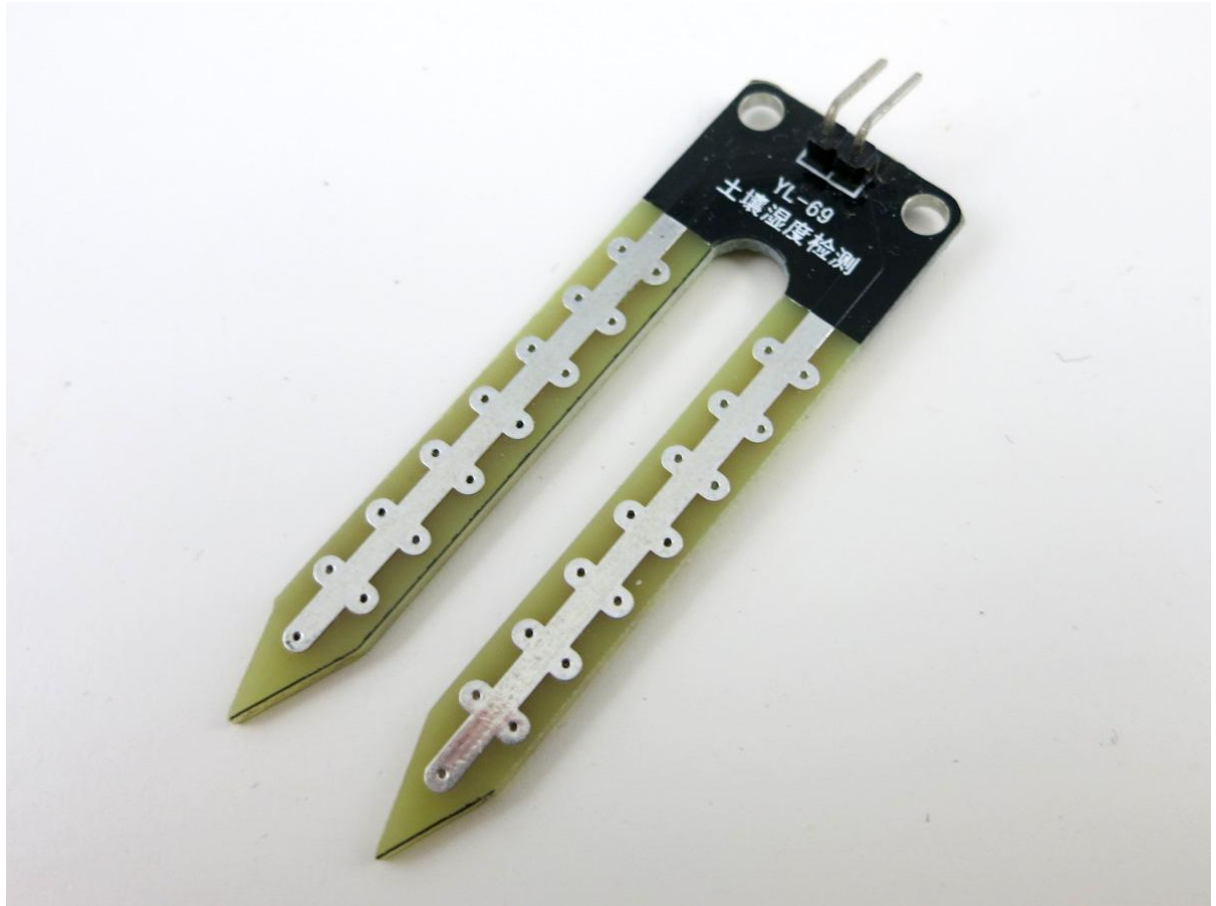


Figure 1. Moisture Sensor

1.2 Problem Definition

We are going to make a product which will be useful in day to day life and which will make peoples life easy and it will mainly help farmers to produce more crop and also to universities and nursery.

1.3 Feasibility study

The components such as micro-controllers, sensors are required to build the product which are easily available and it can be made easily thus by making the product we can bring a nice change in peoples day to day life.

2 Design

2.1 Design for Performance safety and Reliability

The performance of the ram and rom and how much RAM and ROM will be needed the time required to give the necessary reading and again upload it to the main terminal will be included thus the performance should be as fast as possible and there should not be any considerable delay between the sending and receiving of information.

If someone else deploys the nodes in our farm then also the base station cannot accept the reading of that node .because all nodes have unique ids on the nodes that we have deployed

2.2 Design for Ergonomics and Aesthetics

The user will get precise reading of the Ram consumption. And will also get a status of nodes that are deployed in the field. And the user will get all information of the amount of moisture in the soil in different parts of the land all on his terminal.

2.3 Design of Ideation Canvas

People:

Women, farmers, scientists, professors, students, gardeners.

Activities:

The activities included in this are the following

1. Maintenance

It compares the speed of vehicles and sees if they are going above the speed limit

2. Detection

3. Water-Level

4. Irrigation.

Locations:

1. Farms
2. Plant Nursery
3. Laboratory
4. Universities
5. Fields.

Props:

1. Plant-Watering
2. Soil moisture sensing

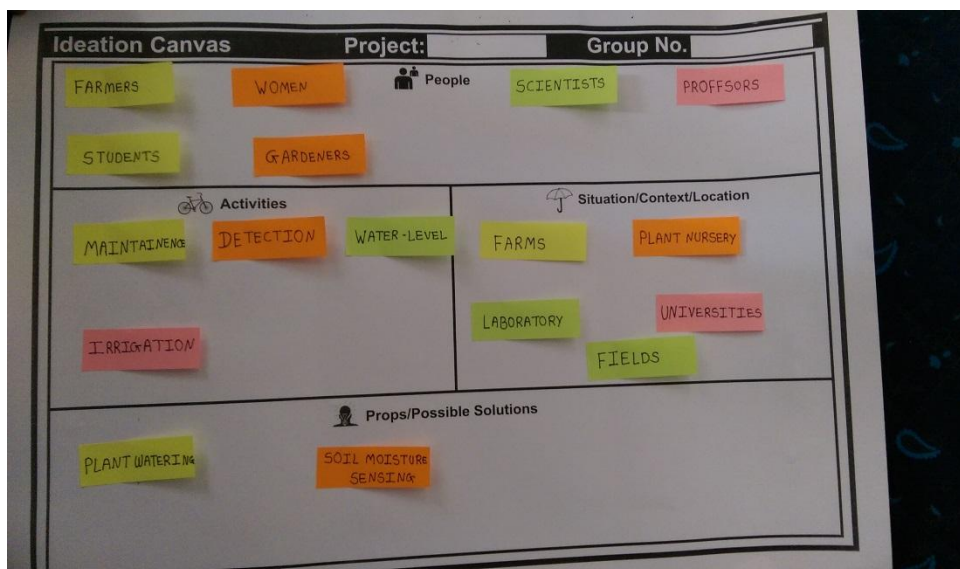


Figure 2. The Design of Ideation Canvas

2.4 Product Development Canvas

Purpose:

1. To reduce labor.
2. Water-conservation is facilitate.
3. It enhances productivity.

People:

Women, teenagers, consumers, scientists, professor, farmers.

Components:

Micro controllers, sensor, wires, transistors, Drip irrigation kit.

Functions:

1. Checking ground water level.
2. Detect availability of water.
3. To watering the plants.

Features:

1. Moisture Sensing
2. Fertility
3. Water - Conservation
4. Time preservation

Experience:

1. Peace of mind
2. Comfort

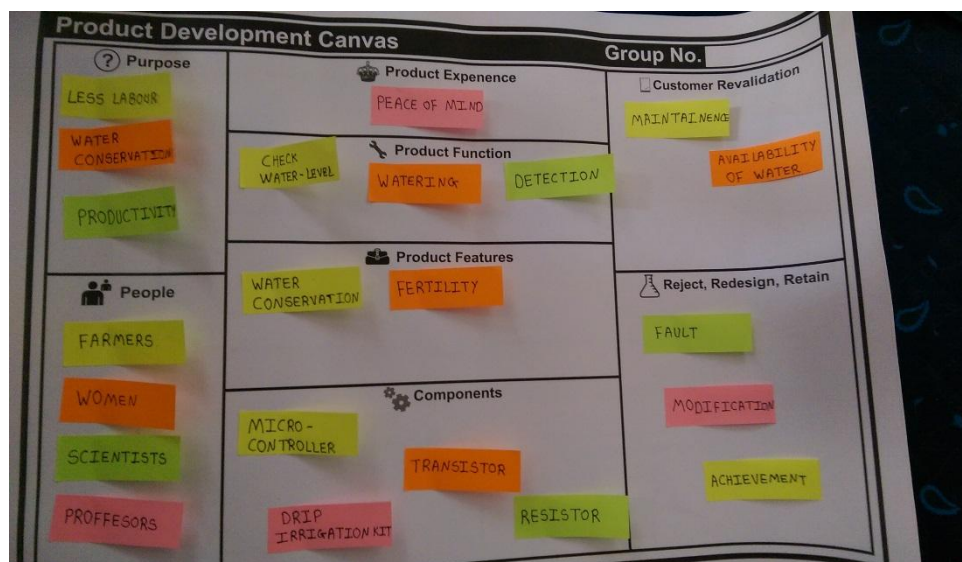


Figure 3. Design of Product Development Canvas

2.5 Design Calculation

Step 1: To deploy individual nodes in the farm.

Step 2: Individual data of the nodes will be sent to the base station.

Step 3: The base station will perform some calculation do some processing and will tell the nodes what amount of water to add in the crops.

Step 4: The amount of water that is to be added in the farm will be given by the base station and the water will be added.

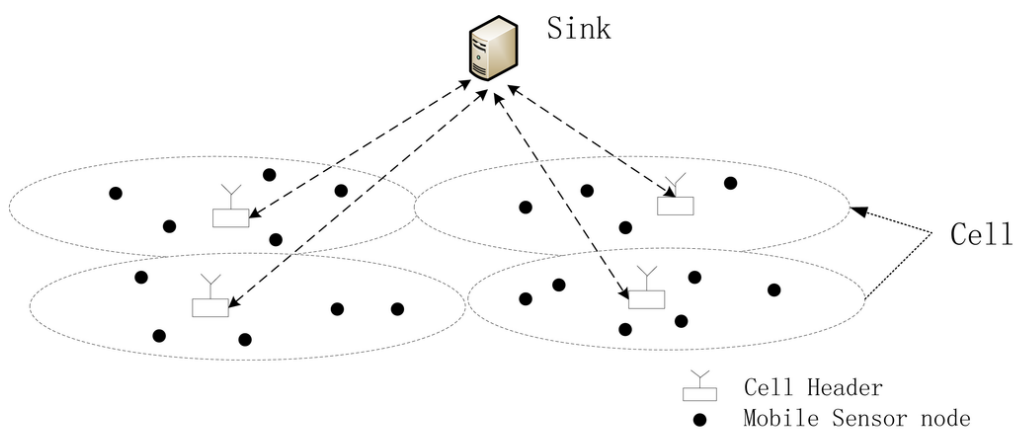


Figure 4. The Cell Distributions in farms

3 Implementation

The project was implemented in 4 models first the canvases and the AEIOU framework was made then the prototyping was done and then the results and test were carried out the 4 models of the project are given as below

3.1 Prototype-1

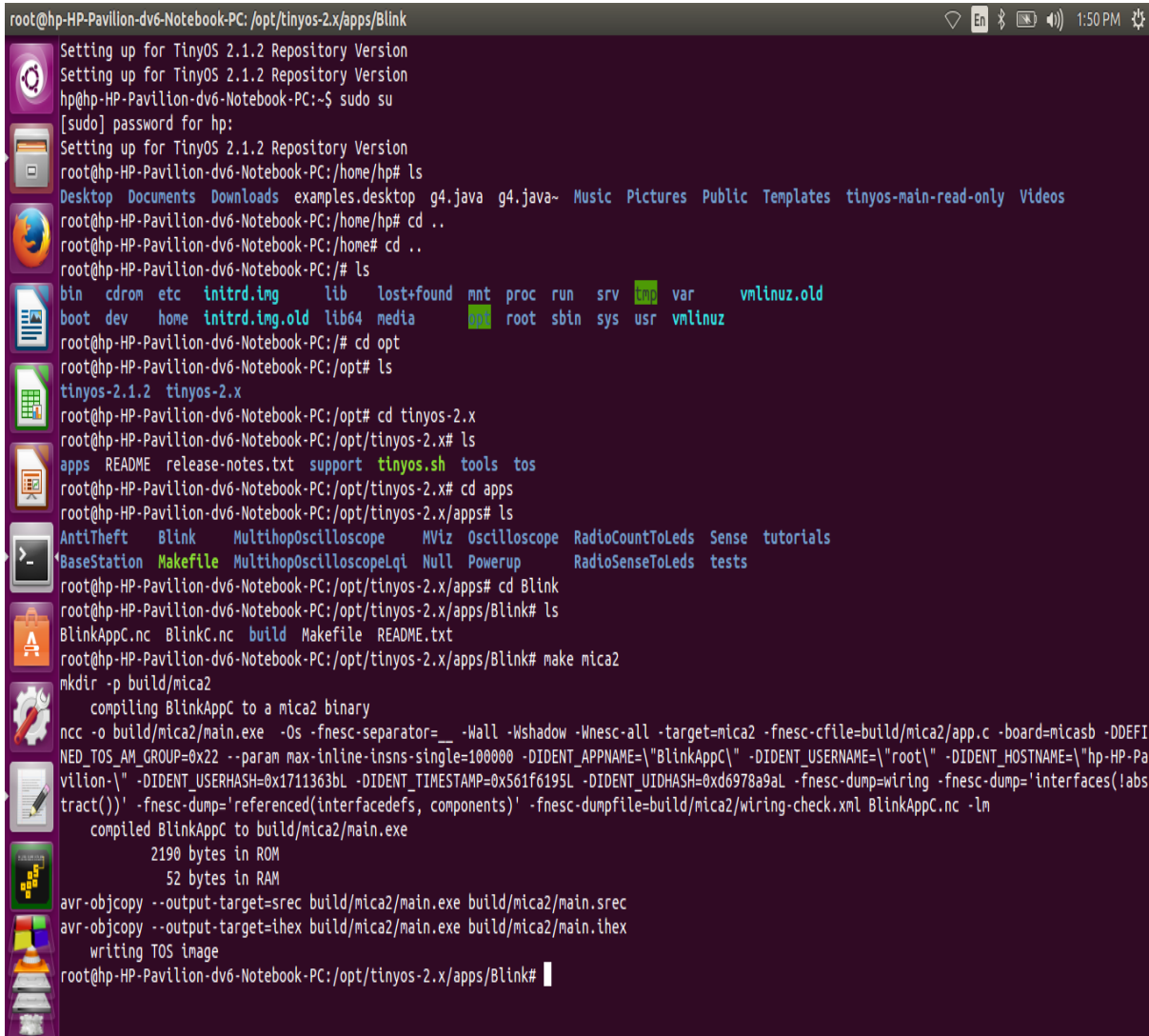
Initially the prototype will be shown to the user and the necessary changes that he/she feels should be made will be made by the developers.



Figure 5. Prototype 1

3.2 Prototype-2

The latest version of tinyos should be learned and installed on the computer to learn the language for application wireless networking.



```
root@hp-HP-Pavilion-dv6-Notebook-PC: /opt/tinyos-2.x/apps/Blink
Setting up for TinyOS 2.1.2 Repository Version
Setting up for TinyOS 2.1.2 Repository Version
hp@hp-HP-Pavilion-dv6-Notebook-PC:~$ sudo su
[sudo] password for hp:
Setting up for TinyOS 2.1.2 Repository Version
root@hp-HP-Pavilion-dv6-Notebook-PC:/home/hp# ls
Desktop Documents Downloads examples.desktop g4.java g4.java~ Music Pictures Public Templates tinyos-main-read-only Videos
root@hp-HP-Pavilion-dv6-Notebook-PC:/home/hp# cd ..
root@hp-HP-Pavilion-dv6-Notebook-PC:/home# cd ..
root@hp-HP-Pavilion-dv6-Notebook-PC:/# ls
bin cdrom etc initrd.img lib lost+found mnt proc run srv tmp var vmlinuz.old
boot dev home initrd.img.old lib64 media opt root sbin sys usr vmlinuz
root@hp-HP-Pavilion-dv6-Notebook-PC:/# cd opt
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt# ls
tinyos-2.1.2 tinyos-2.x
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt# cd tinyos-2.x
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x# ls
apps README release-notes.txt support tinyos.sh tools tos
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x# cd apps
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x/apps# ls
AntiTheft Blink MultihopOscilloscope MViz Oscilloscope RadioCountToLeds Sense tutorials
BaseStation Makefile MultihopOscilloscopeLqi Null Powerup RadioSenseToLeds tests
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x/apps# cd Blink
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x/apps/Blink# ls
BlinkAppC.nc BlinkC.nc build Makefile README.txt
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x/apps/Blink# make mica2
mkdir -p build/mica2
compiling BlinkAppC to a mica2 binary
ncc -o build/mica2/main.exe -Os -fnesc-separator=__ -Wall -Wshadow -Wnesc-all -target=mica2 -fnesc-cfile=build/mica2/app.c -board=micasb -DDEFI
NED_TOS_AM_GROUP=0x22 --param max-inline-insns-single=100000 -DIDENT_APPNAME=\"BlinkAppC\" -DIDENT_USERNAME=\"root\" -DIDENT_HOSTNAME=\"hp-HP-Pa
vilion-\" -DIDENT_USERHASH=0x1711363bL -DIDENT_TIMESTAMP=0x561f6195L -DIDENT_UIDHASH=0xd6978a9aL -fnesc-dump=wiring -fnesc-dump='interfaces(lab
s tract())' -fnesc-dump='referenced(interfacedefs, components)' -fnesc-dumpfile=build/mica2/wiring-check.xml BlinkAppC.nc -ln
compiled BlinkAppC to build/mica2/main.exe
2190 bytes in ROM
52 bytes in RAM
avr-objcopy --output-target=srec build/mica2/main.exe build/mica2/main.srec
avr-objcopy --output-target=ihex build/mica2/main.exe build/mica2/main.ihex
writing TOS image
root@hp-HP-Pavilion-dv6-Notebook-PC:/opt/tinyos-2.x/apps/Blink#
```

Figure 6. Prototype-2

3.3 Prototype-3

The program that is learned in the tinyos should be implemented in the arduino and should be compiled successfully.

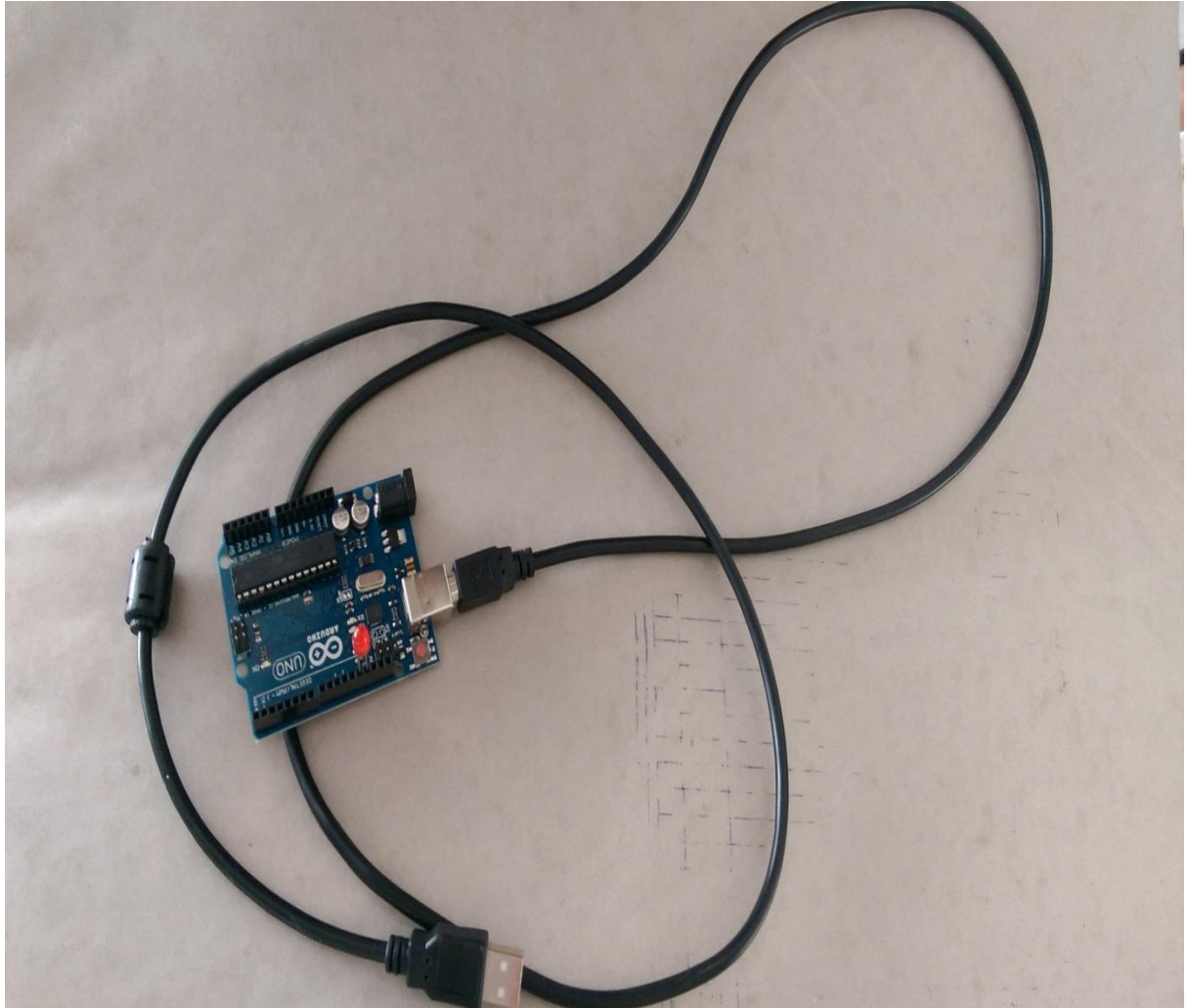


Figure 7. Prototype-3

3.4 Prototpe-4

The compiled arduino program should now be ready to run with the moisture sensor and will successfully tell the moisture in the soil.

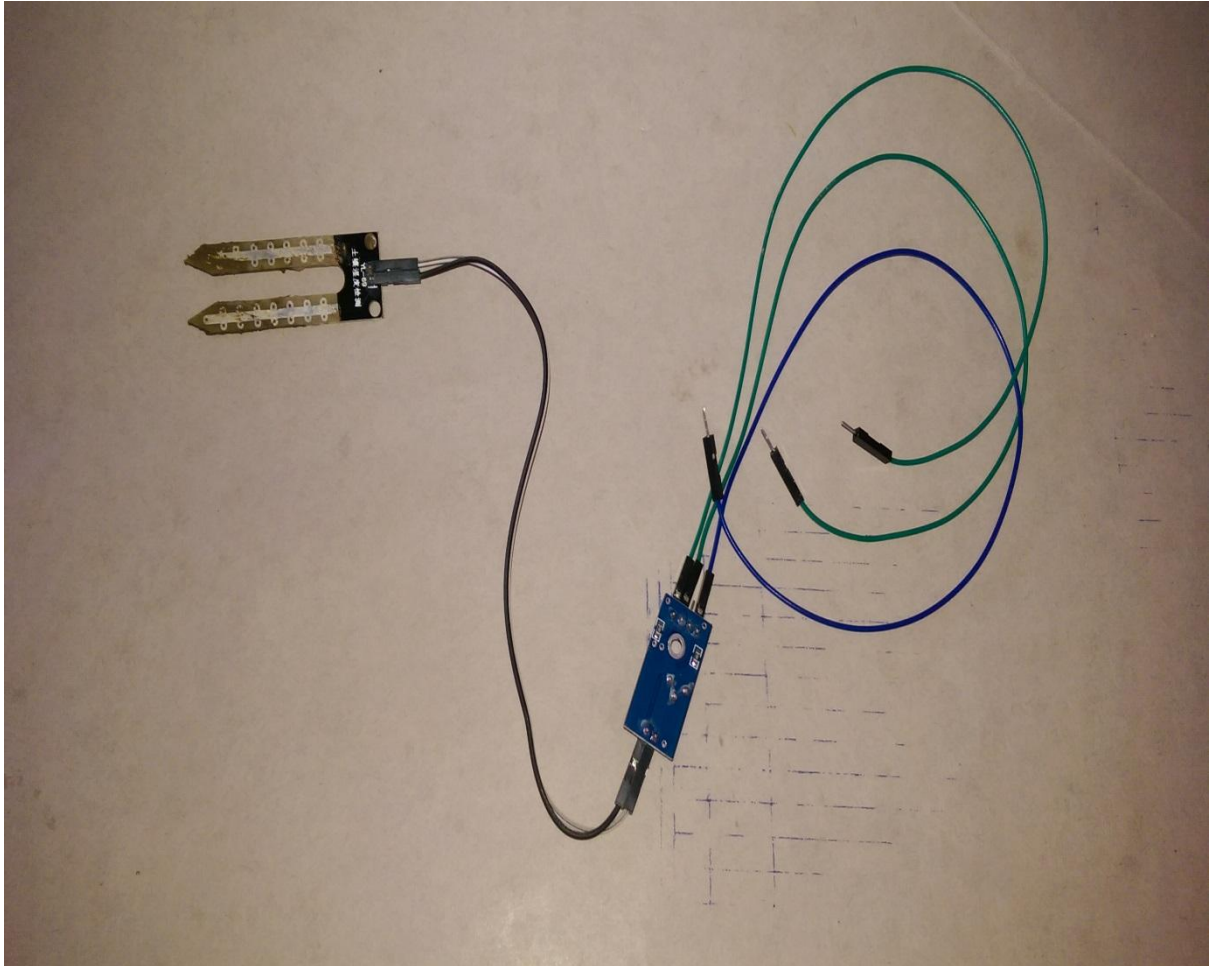


Figure 8. Prototype-8

4 Conclusion

We have started studying our platform tiny so, and the different functionalities that it provides and also the use of arduino and sensors and how will it play a very important role in our project i.e. Automatic plant watering and moisture sensing system. Our project will help farmers, universities, and nursery. It will make physical work less.

And also the various characteristics of different sensor nodes and its specification and also the different nodes that we can be used for different crops and different farms according to their characteristics.

Nowadays, the scarcity of water is increasing. In such scenario our product will make use of the sufficient water only; which in turn increase conservation of water. It is also adaptable in different environments. Moreover its cost is economical and will provide user interface in such a way that a non-technical person can easily use and understand it.

References

- [1]. www.wikipedia.com/moisture-sensor .
- [2]. www.instructables.com .

Appendix

Periodic Progress Report : First PPR

Project : Automatic Plant Watering And Moisture Sensing System

Status : Reviewed (Freeze)

1. What Progress you have made in the Project?

I have visited the farms to gain the insight of current irrigation systems. I have interacted with farmers about the benefits they will get in our system after the completion. After the conversation and necessary observations the AEIOU summary is filled.

2. What challenge you have faced?

The challenges overcome was of deciding the platform for our project such as which languages we should use or which interfacing.

3. What support you need?

The support from the internal guide was needed to pursue this project.

4. Which literature you have referred?

I refereed the patents related to the irrigation system. We also studied some of the websites related to irrigation and moisture sensor.

Comment by Internal Guide :

You can add preparation of various canvases or other activities in first query.

Periodic Progress Report : Second PPR

Project : Automatic Plant Watering And Moisture Sensing System

Status : Reviewed (Freeze)

1. What Progress you have made in the Project?

I have learned tinyos and its basic and some of its advanced commands for the application of wireless networking and have done simulation of the network nodes in it which shows us that how much memory the system will consume.

2. What challenge you have faced?

The challenge faced was to learn the new language's codes and commands and to implement it in the system.

3. What support you need?

The support needed is to read its commands and tutorial links given on its official website which will give you in depth analysis on how to operate on tinyos.

4. Which literature you have referred?

I have refereed many articles regarding the languages advantages and disadvantages and have then decided to use tinyos as it is far more advantageous. I have also refereed articles about the help you need when you start learning tinyos.

Periodic Progress Report : Third PPR

Project : Automatic Plant Watering And Moisture Sensing System

Status : Reviewed (Freeze)

1. What Progress you have made in the Project?

The commands which I learned in the tinys were useful and a program was created with that commands and it is successfully compiled and was transferred in the arduino.

2. What challenge you have faced?

The main difficulty faced was to make a code with different threshold value which the user can set and according to which the system can determine whether the soil needs water or not.

3. What support you need?

The support needed was the arduino software with its help a direct interfacing between the arduino and code is done.

4. Which literature you have referred?

I refereed various nesC articles to write the code for the system.

Periodic Progress Report : Forth PPR

Project : Automatic Plant Watering And Moisture Sensing System

Status : Reviewed (Freeze)

1. What Progress you have made in the Project?

The compiled arduino program that was made now is successfully transferred to the arduino and the moisture sensor is also attached with the arduino so it is now able to detect the moisture of the soil.

2. What challenge you have faced?

The challenge faced was to attach the moisture sensor to the arduino.

3. What support you need?

The pin diagram was arduino was needed to know where the sensor should be attached.

4. Which literature you have referred?

Referred the literature which explains the pin and the circuit diagram of arduino.

Patent Search & Analysis Report (PSAR)-1

Date of Submission:24/09/2016

Dear Shah Harshil,

Studied Patent Number for generation of PSAR:16BE7_130090107042_1

PART 1: PATENT SEARCH DATABASE USED

1. Patent Search Database used:Google Patents

Web link of database:<https://patents.google.com/>

2. Keywords Used for Search:soil, moisture, sensing

3. Search String Used:google scholar

4. Number of Results/Hits getting:100

PART 2: BASIC DATA OF PATENTED INVENTION /BIBLIOGRAPHIC DATA

5. Category/ Field of Invention:Electronics and Communication Engineering

6. Invention is Related to/Class of Invention:measurement of soil moisture

6 (a): IPC class of the studied patent:HUMAN NECESSITIES

7. Title of Invention:Soil moisture sensor

8. Patent No. : US 5445178 A

9. Application Number:US 08/198,433

9 (a): Web link of the studied patent:<https://www.google.com/patents/US5445178>

10. Date of Filing/Application (DD/MM/YYYY):18/02/1994

11. Priority Date (DD/MM/YYYY):18/02/1994

12. Publication/Journal Number:

13. Publication Date (DD/MM/YYYY):29/08/1995

14. First Filled Country:Albania:

15. Also Published as

Sr.No Country Where Filled Application No./Patent No.

1

16. Inventor/s Details.

Sr.No Name of Inventor Address/City/Country of Inventor

1 Lenny Feuer United States

17. Applicant/Assignee Details.

Sr.No Name of Applicant/Assignee Address/City/Country of Applicant

1 Feuer Lenny United States

18. Applicant for Patent is : Individual

PART 3: TECHNICAL PART OF PATENTED INVENTION

19. Limitation of Prior Technology / Art

Previous to this Technology/Art the measure of the soil moisture with the help of a sensor was really hard to measure

20. Specific Problem Solved / Objective of Invention

The present invention relates generally to moisture sensor devices, systems and methods of making and using the same and, in particular embodiments, to a moisture sensor device, system and method for sensing the moisture content of soil or other suitable medium.

21. Brief about Invention

Moisture sensor devices, systems and methods of making and using the same employ a pair of elongated, probe-like, conductive sensor elements, coupled as part of an LC oscillator circuit. The use of an LC oscillator circuit can minimize adverse effects of conductivity variances in the medium being monitored, because the resistance of the medium (and, thus, the medium's conductivity) has minimal or no effect on the resonant frequency of an LC oscillator circuit. An LC oscillator circuit of suitable stability for moisture sensing applications includes first and second comparators connected such that the output of the first comparator is coupled to the inverting input of the second comparator. An inductor is coupled between the outputs and inverting input of the first comparator and a capacitance C is provided between the output of the second comparator and the inverting input of the first comparator. The capacitance C is composed primarily of the capacitance value provided by the pair of probe-like sensor elements and the dielectric constant of the medium in which the probe-like sensor elements are disposed. The capacitance is averaged over the length of the probe-like sensor elements.

22. Key learning Points

It is often desirable to detect the moisture content of a granular, particulate, fine or powdery medium

23. Summary of Invention

The present invention relates generally to moisture sensor devices, systems and methods of making and using the same which obviates, for

Practical purposes, the above noted drawbacks of the prior art. Moisture sensor devices according to preferred embodiments of the present invention comprise a pair of elongated, probe-like, conductive sensor elements, coupled as part of an LC oscillator circuit.

24. Number of Claims:28

25. Patent Status:Granted Patent & In-force Patent

26. How much this invention is related with your IDP/UDP?

< 70 %

27. Do you have any idea to do anything around the said invention to improve it? (Give short note in not more than 500) words)

The main goal of our project is to measure the moisture of the soil and by the help of this patent we will be able to do it. Prior to this patent there was no fix method on how to measure the soil moisture so after the grant of this patent it became easy to find the moisture of soil

Patent Search & Analysis Report-2 (PSAR)

Date of Submission : 25/09/2016

Dear Shah Harshil,

Studied Patent Number for generation of PSAR : 16BE7_130090107042_2

PART 1: PATENT SEARCH DATABASE USED

1. Patent Search Database used : Google Patents

Web link of database : <https://patents.google.com/>

2. Keywords Used for Search : soil,moisture,sensing

3. Search String Used : soil moisture sensing

4. Number of Results/Hits getting : 100

PART 2: BASIC DATA OF PATENTED INVENTION /BIBLIOGRAPHIC DATA

5. Category/ Field of Invention : Computer/IT Engineering

6. Invention is Related to/Class of Invention : measure of moisture in soil

6 (a) : IPC class of the studied patent : PHYSICS

7. Title of Invention : Soil moisture sensor

8. Patent No. : US 5424649 A

9. Application Number : US 08/181,220

9 (a) : Web link of the studied patent : <https://www.google.com/patents/US5424649>

10. Date of Filing/Application (DD/MM/YYYY) : 13/01/1994

11. Priority Date (DD/MM/YYYY) : 29/08/1993

12. Publication/Journal Number :

13. Publication Date (DD/MM/YYYY) : 13/06/1995

14. First Filled Country : Albania :

15. Also Published as

Sr.No Country Where Filled Application No./Patent No.

1

16. Inventor/s Details.

Sr.No Name of Inventor Address/City/Country of Inventor

1 Israel Gluck United States

2 Anatoly Friedman United States

3 Naftali Feniger United States

17. Applicant/Assignee Details.

Sr.No Name of Applicant/Assignee Address/City/Country of Applicant

1 Silora Television Electronics United States

18. Applicant for Patent is : Company

PART 3: TECHNICAL PART OF PATENTED INVENTION

19. Limitation of Prior Technology / Art

Previous to this Technology the measure of the moisture that is in the soil with the help of a sensor was not accurate.

20. Specific Problem Solved / Objective of Invention

The present invention relates to soil moisture sensors, and more particularly, to a soil moisture sensor which measures the freely available moisture in the soil surrounding the sensor, to provide increased accuracy of control for irrigation systems.

21. Brief about Invention

A soil moisture sensor using sensor electrodes each designed with a larger capacitance for reduced sensitivity to soil resistance and increased sensitivity to soil moisture surrounding the electrode. The soil moisture sensor is provided as a pair of cylindrical rods each coated with a thin layer of dielectric material, which are buried in the soil or other medium and are connected to a conversion circuit in which the electrodes act as a variable capacitance. The capacitance developed by each of the sensor electrodes is related to the moisture contained in the soil particles surrounding the electrodes. An effective conducting area is developed by the soil particles in contact with the electrodes and this determines the value of the variable capacitance presented to the conversion circuit. The conversion circuit is a multivibrator in which the variable capacitance determines the output frequency, and this provides a measurement of soil moisture. Alternatively, the conversion circuit provides the measurement as a voltage output. The use of a relatively thin dielectric coating on each of the electrodes increases the capacitance and reduces the soil resistance as a factor in the soil moisture measurement. Based on the cylindrical shape of the sensor electrodes and dielectric coating, a linear relationship is developed between capacitance and the electrode length in contact with soil particles containing moisture, which increases the accuracy of soil moisture measurement at soil depths of interest. The inventive soil moisture sensor can be used to control valves in automatically-controlled irrigation systems.

22. Key learning Points

The system uses sensor electrodes each designed with a larger capacitance for reduced sensitivity to soil resistance and increased sensitivity to soil moisture surrounding the electrode

23. Summary of Invention

Accordingly, it is a principal object of the present invention to overcome the above-mentioned disadvantages of prior art soil moisture designs and provide a soil moisture sensor which uses sensor electrodes each designed with a larger capacitance for reduced sensitivity to soil resistance and increased sensitivity to soil moisture surrounding the electrode.

24. Number of Claims : 18

25. Patent Status : Granted Patent & In-force Patent

26. How much this invention is related with your IDP/UDP?

< 70 %

27. Do you have any idea to do anything around the said invention to improve it? (Give short note in not more than 500(words))

Prior to this patent there was a method on how to measure the soil moisture but it was not as accurate and the readings would vary quite widely so after the grant of this patent it became easy to find the moisture of soil.

Patent Search & Analysis Report(PSAR)-3

Date of Submission : 25/09/2016

Dear Shah Harshil,

Studied Patent Number for generation of PSAR : 16BE7_130090107042_3

PART 1: PATENT SEARCH DATABASE USED

1. Patent Search Database used : Google Patents

Web link of database : <https://patents.google.com/>

2. Keywords Used for Search : soil,moisture,sensing

3. Search String Used : soil moisture sensing

4. Number of Results/Hits getting : 100

PART 2: BASIC DATA OF PATENTED INVENTION /BIBLIOGRAPHIC DATA

5. Category/ Field of Invention : Electronics and Communication Engineering

6. Invention is Related to/Class of Invention : detection of soil moisture

6 (a) : IPC class of the studied patent : HUMAN NECESSITIES

7. Title of Invention : Soil moisture detection

8. Patent No. : US 6532803 B2

9. Application Number : US 09/384,920

9 (a) : Web link of the studied patent : <https://www.google.com/patents/US6532803>

10. Date of Filing/Application (DD/MM/YYYY) : 27/08/1999

11. Priority Date (DD/MM/YYYY) : 28/02/1997

12. Publication/Journal Number :

13. Publication Date (DD/MM/YYYY) : 18/03/2003

14. First Filled Country : Albania :

15. Also Published as

Sr.No Country Where Filled Application No./Patent No.

1

16. Inventor/s Details.

Sr.No Name of Inventor Address/City/Country of Inventor

1 Paul Andrew Hutchinson United States

2 Richard Stirzaker United States

17. Applicant/Assignee Details.

Sr.No Name of Applicant/Assignee Address/City/Country of Applicant

1 Commonwealth Scientific And Industrial

Research Or

United States

18. Applicant for Patent is : Organization

PART 3: TECHNICAL PART OF PATENTED INVENTION

19. Limitation of Prior Technology / Art

Before studying this patent the technology which was used to detect soil moisture was simply outdated and not as accurate

20. Specific Problem Solved / Objective of Invention

Devices which can assist irrigators to apply water in accordance with plant requirements are known. These include sensors based on electric, thermal and matric suction measurements (gypsum blocks, thermal probes, capacitance probes and tensiometry), and dielectric or radiation absorption measurements (time domain reflectometry, neutron scattering). These sensors vary in their cost, robustness, accuracy and the complexity of operation.

21. Brief about Invention

A detection assembly for detecting moisture within an unsaturated permeable soil or soil-like medium is disclosed which includes a funnel 11 having a surface inclined in use to the vertical for distorting the flow streamlines within the medium to cause an increase in fluid content and saturation at points in the permeable medium; a cup 13 beneath the funnel for collecting free fluid from the saturated permeable medium; a sensor 14 for detecting the presence of free fluid formed upon saturation within the permeable medium, and a vent 16 for venting air from said collection means.

22. Key learning Points

The key learning point is the method in which the water content in the soil or we can say that the moisture is detected.

23. Summary of Invention

The present invention aims to provide an alternative to known methods and apparatus for moisture detection. This invention in one aspect resides broadly in a method of detecting moisture within an unsaturated permeable medium, the method including distorting the flow streamlines within the unsaturated permeable medium to increase the fluid content at points therein, and detecting the increased fluid content.

24. Number of Claims : 11**25. Patent Status : Granted Patent & In-force Patent****26. How much this invention is related with your IDP/UDP?**

< 70 %

27. Do you have any idea to do anything around the said invention to improve it? (Give short note in not more than 500(words))

The patent given here is already in use in the current system and no modification is required as the sensors available now are pretty much accurate.

Patent Search & Analysis Report(PSAR)-4

Date of Submission : 27/09/2016

Dear Shah Harshil,

Studied Patent Number for generation of PSAR : 16BE7_130090107042_4

PART 1: PATENT SEARCH DATABASE USED

1. Patent Search Database used : Google Patents

Web link of database : <https://patents.google.com/>

2. Keywords Used for Search : soil,moisture,sensing

3. Search String Used : soil moisture sensing

4. Number of Results/Hits getting : 100

PART 2: BASIC DATA OF PATENTED INVENTION /BIBLIOGRAPHIC DATA

5. Category/ Field of Invention : Electronics and Communication Engineering

6. Invention is Related to/Class of Invention : moisture sensing of soil

6 (a) : IPC class of the studied patent : PHYSICS

7. Title of Invention : Soil moisture sensor

8. Patent No. : US 4540936 A

9. Application Number : US 06/416,232

9 (a) : Web link of the studied patent : <https://www.google.com/patents/US4540936>

10. Date of Filing/Application (DD/MM/YYYY) : 07/09/1982

11. Priority Date (DD/MM/YYYY) : 07/09/1982

12. Publication/Journal Number :

13. Publication Date (DD/MM/YYYY) : 10/09/1985

14. First Filled Country : Albania :

15. Also Published as

Sr.No Country Where Filled Application No./Patent No.

1

16. Inventor/s Details.

Sr.No Name of Inventor Address/City/Country of Inventor

1 John E Walsh United States

17. Applicant/Assignee Details.

Sr.No Name of Applicant/Assignee Address/City/Country of Applicant

1 Dartmouth College United States

2 John E Walsh United States

18. Applicant for Patent is : College

PART 3: TECHNICAL PART OF PATENTED INVENTION

19. Limitation of Prior Technology / Art

prior to this a system was defined to detect moisture in the soil as it was not that proper this is an upgrade to that method.

20. Specific Problem Solved / Objective of Invention

The present invention relates to an improved sensor for producing a signal indicating the moisture content of material into which the sensor is inserted.

21. Brief about Invention

A moisture sensor including in one embodiment a probe formed with a first cylindrical tube extending outward from a base and having a plurality of axially extending slots around the periphery thereof and a second slotted cylindrical tube extending outward from the base separated and insulated from the first tube, and extending coaxially with the first tube. The tubes form an effective coaxial capacitor and are insertable into material to be sensed appear as a ground plane. In a second and third embodiment a member defining flat surfaces extends from a base forming in cross-section a volume with a square center and legs extending from each side thereof to an open peripheral end. An RC bridge circuit, preferably a Wien bridge or a capacitor divider circuit is connected to the tubes to measure the impedance of the material.

22. Key learning Points

Many applications exist in which it is necessary to accurately ascertain the moisture content of material. For example, knowing the exact moisture content of soil is important in agricultural applications, in waste treatment applications where soil is used for purifying water, for erosion studies, for monitoring earth dams, and for various military applications. Accurately determining the moisture content of grain is another important application. Maintaining accurate records as to the amount of moisture in trees is not only important in preventing forest fires, but also in monitoring the growth of those trees. Many other industrial applications such as curing concrete also require periodic and accurate information as to the moisture content of material.

23. Summary of Invention

It gives an improved and updated system to the previously defined patent.

24. Number of Claims : 14**25. Patent Status : Granted Patent & In-force Patent****26. How much this invention is related with your IDP/UDP?**

< 70 %

27. Do you have any idea to do anything around the said invention to improve it? (Give short note in not more than 500(words))

The patent is already an improved version of a previously defined patent so no further improvements can be made.

Patent Search & Analysis Report (PSAR)-5

Date of Submission:28/09/2016

Dear Shah Harshil,

Studied Patent Number for generation of PSAR: 16BE7_130090107042_5

PART 1: PATENT SEARCH DATABASE USED

1. Patent Search Database used:Google Patents

Web link of database:<https://patents.google.com/>

2. Keywords Used for Search:soil,moisture,sensing

3. Search String Used:soil moisture sensing

4. Number of Results/Hits getting:100

PART 2: BASIC DATA OF PATENTED INVENTION /BIBLIOGRAPHIC DATA

5. Category/ Field of Invention:Computer/IT Engineering

6. Invention is Related to/Class of Invention:detecting the moisture in the soil

6 (a): IPC class of the studied patent:PHYSICS

7. Title of Invention:Soil moisture sensor

8. Patent No. : US 7135871 B1

9. Application Number:US 11/304,285

9 (a): Web link of the studied patent:<https://www.google.com/patents/US7135871>

10. Date of Filing/Application (DD/MM/YYYY):15/12/2005

11. Priority Date (DD/MM/YYYY):30/12/2004

12. Publication/Journal Number:

13. Publication Date (DD/MM/YYYY):14/11/2006

14. First Filled Country:Albania:

15. Also Published as

Sr.No Country Where Filled Application No./Patent No.

1

16. Inventor/s Details.

Sr.No Name of Inventor Address/City/Country of Inventor

1 Mathew G Pelletier United States

17. Applicant/Assignee Details.

Sr.No Name of Applicant/Assignee Address/City/Country of Applicant

1 The United State Of America As

Represented

United States

2 By The Secretary Of Agriculture United States

18. Applicant for Patent is:United States Department of Agriculture (USDA),

PART 3: TECHNICAL PART OF PATENTED INVENTION

19. Limitation of Prior Technology / Art

The method used prior to this technology was TDR and its disadvantage are due to the very broad frequency band-width the system requires due to the technique's use of a very rapid rise-time ns-duration pulse. This disadvantage is best illustrated by noting that the frequency spectrum

Of a pulse is extremely wide and when taken to the extreme with an infinitely narrow pulse-width, leads to an infinitely wide frequency spectrum. Thus, this technique is, by its design, an extremely broad-band technique that cannot take advantage of the frequency-based variability that Naturally occurs in the dielectric spectrum. Thus, the response of TDR is limited to an average response of all of these frequencies that produce a combined response that becomes the TDR measurement.

20. Specific Problem Solved / Objective of Invention

Evaluation of soil water content is a fundamental operation for irrigation scheduling in crop production, management and research.

21. Brief about Invention

The moisture content of soil may be determined using a swept-frequency microwave-based process and device. The process includes the steps of producing a primary microwave signal with a varying frequency, splitting the primary signal to provide first and second microwave signals, which first signal is transmitted through an electric conductor in the soil where it will be delayed in proportion to the dielectric constant of the soil, while the second signal provides an internal reference signal, receiving a third signal which includes the first signal after it has passed through the electrical conductor, mixing the third signal together with the second signal, generating a mixed signal, filtering the mixed signal to remove upper side-band interference signals, generating a filtered-mixed signal, measuring the frequency of the filtered-mixed signal and calculating the moisture content of the soil.

22. Key learning Points

The invention relates to an improved microwave system for measuring the moisture content of soil.

23. Summary of Invention

I have now invented a novel swept-frequency microwave technique and apparatus for determining the dielectric constant, complex permittivity, and moisture content of soil. The process of the invention includes the steps of producing a primary microwave signal with a varying frequency, this signal may be a continuously varying signal or a discrete time varying signal splitting the primary signal to provide first and second microwave signals, wherein the first signal is transmitted through an electrical conductor embedded in the soil and the second signal provides an internal reference signal transmitting the first signal through the electrical conductor, wherein as this signal is transmitted, it will be delayed in proportion to the dielectric constant of the surrounding soil

24. Number of Claims:20

25. Patent Status:Granted Patent & In-force Patent

Page 2

26. How much this invention is related with your IDP/UDP?

< 70 %

27. Do you have any idea to do anything around the said invention to improve it? (Give short note in not more than 500(words))

This technology used in the patent is already used in some type of sensors in day to day life and is pretty accurate and no more advances can be made in that so no improvement can be done in this technology.

AEIOU Summary Canvas

AEIOU Summary		Group ID: Domain name:	Date:	Version:
Environment: Weather (Rainy/Fog/Sunny) Day/Night Noisy Trees/Plants High Wind	Interactions: Group Discussion Water level in Source How Much Water is Needed? Irrigation Systems How much Fertilizer is Needed? growth of Plants	Objects: Pipe Pump Wells Shade Nets Water Tanks Fertilizers/Pesticides		
Activities : Talking Reading Newspapers Harvesting Use of Mobile Walking Sprinkling Pesticides Eating Food	Users : Farmers Students Professors Male / Female Farmers growing Crops Harvesting the Plants User Checks Water levels Gardeners			

Empathy Summary Canvas

Empathy Mapping Canvas				
Design For Date		Design By Version		
USER FARMERS GARDENERS	SCIENTISTS STUDENTS	STAKEHOLDERS FARMERS GOVERNMENT UNIVERSITY NURSERY		
ACTIVITIES MAINTENANCE	DETECTION	WATER-LEVEL	IRRIGATION	
STORY BOARDING				
HAPPY	Water will be conserved and thus will be used for other purposes.			
HAPPY	He will have to do less physical work unlike watering the plants frequently.			
SAD	Wastage of water will increase			
SAD	He will have to do more physical work such as watering the plants manually			

Ideation Canvas

Ideation Canvas		Project:	Group No.
<div> <div>FARMERS</div> <div>WOMEN</div> <div>People</div> <div>SCIENTISTS</div> <div>PROFFSORS</div> </div>			
<div> <div>STUDENTS</div> <div>GARDENERS</div> </div>			
<div> <div>Activities</div> <div>MAINTAINENCE</div> <div>DETECTION</div> <div>WATER-LEVEL</div> <div>IRRIGATION</div> </div>		<div> <div>Situation/Context/Location</div> <div>FARMS</div> <div>PLANT NURSERY</div> <div>LABORATORY</div> <div>UNIVERSITIES</div> <div>FIELDS</div> </div>	
<div> <div>Props/Possible Solutions</div> <div>PLANT WATERING</div> <div>SOIL MOISTURE SENSING</div> </div>			

Product Development Canvas

Product Development Canvas		Group No.
<div> <div>Purpose</div> <div>LESS LABOUR</div> <div>WATER CONSERVATION</div> <div>PRODUCTIVITY</div> </div>	<div> <div>Product Expenence</div> <div>PEACE OF MIND</div> </div>	<div> <div>Customer Revalidation</div> <div>MAINTAINENCE</div> <div>AVAILABILITY OF WATER</div> </div>
	<div> <div>Product Function</div> <div>CHECK WATER-LEVEL</div> <div>WATERING</div> <div>DETECTION</div> </div>	
	<div> <div>Product Features</div> <div>WATER CONSERVATION</div> <div>FERTILITY</div> </div>	<div> <div>Reject, Redesign, Retain</div> <div>FAULT</div> <div>MODIFICATION</div> <div>ACHIEVEMENT</div> </div>
<div> <div>People</div> <div>FARMERS</div> <div>WOMEN</div> <div>SCIENTISTS</div> <div>PROFFESORS</div> </div>	<div> <div>Components</div> <div>MICRO-CONTROLLER</div> <div>TRANSISTOR</div> <div>DRIP IRRIGATION KIT</div> <div>RESISTOR</div> </div>	

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been success -

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Unique Pithawalla College of Engineering and Technology, Surat Gujarat Technological University, Ahmadabad Nov, 2016

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the great pleasure in submitting this project report in title "Automatic Plant Watering and Moisture -

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positive attitude has encourage us to look forward well in all spheres and -

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(DFMA) 3 2.4 Design for cost Environment 3 2.5 Design Calculation 4 3 Implementation 5 4

Conclusion 6 References 7 Appendix 8 Acknowledgements It give us the great

pleasure in submitting this project report in title "Automatic Plant Watering and Moisture Sensing System" carried out to study in Computer Engineering at "C.K.Pithawala

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from the learning and processing the knowledge during the project work and her positive attitude has encourage us to look forward well in all spheres and add. Submitted by:

Harshil Shah (130090107042) Harshil Joshi (130090107012) Harsh Patel (130090107028) Viral Patel (130090107053) Certific