Sensor Stick; a gardening tool for all gardening enthusiasts.

Fanny Ericsson
fanny.ericsson@hotmail.com

Lorand Fekete
lorand@fekete.se

Salle Dhali
salle.dhali@gmail.com

Tulasi Surapaneni
slakshmitulasi@gmail.com

Abstract
As a gardener it can be difficult to know exactly when you have to water your plants, because plants need different amounts of water. Obtaining knowledge about the moisture in the soil is a complicated process and for new gardeners it can therefore be hard to know if the soil is too wet or dry. In this paper we present the sensor stick which is a tool combined with an android application targeting new gardeners and assisting them in measuring the moisture level in the soil on three different depths. Our results show that the sensor stick successfully can measure the moisture levels up to 10cm depth in the soil.

Keywords
design; urban gardening; moisture level; arduino; bluetooth; android; moisture sensor;

Introduction
Sensor devices are useful to measure the moisture level of the soil where the plant is being sowed. This devices plays a vital role as they can indicate the proper time for plants that needs immediate water [1]. However the results from our literature review show that the right amount of water level will help the plant to grow at a higher rate[1][3]. However many people new to gardening tend to overwater their plants which can lead to improper and defect growth or death of the plants [2].
We propose the sensor stick which is a moisture measurement tool that allows gardeners to measure the moisture level in the soil at a depth of 2cm, 5cm or 10cm. We also developed an android based application[6] that works together with the sensor stick in order to assist new gardeners and help them to keep track on the moisture level for their plants.

Goals
The main goal of this project is to develop a device that works together with an android based application to make urban gardeners life easier and help the gardener to know when s/he have to water their plants.

Figure 1. The Sensor Stick prototype.

Figure 2. A prototype of the android application.

Additionally the Moisture Sensor can be used to detect the moisture of soil or determine if there is water around the sensor. When the moisture level is too high a light on the device will start blinking indicating the gardeners to stop providing water for their plants. The device is intended to have two areas of use, one is to insert the stick into the soil and then read sensors values. The other option will be to collect data in our mobile devices storing the moisture values and sharing them with other gardeners, or as a moisture history.

Background

Our project aims to evaluate how sensor devices can be used in planting both inside plants and outdoor as well and how useful they are for retrieving information about moisture content in soil that might assist plants for proper growing. The study reveals that using sensor devices increase the rate of surviving for many plants and also suggested that without using of this sort of tools we are overwatering the soil systems or in oppose less watering the plants which might causes the premature death of many plants. Sensor devices are useful to measure the moisture level of the soil where the plant is being sowed. According to [1] this devices plays a vital role as they can indicate the proper time for plants that needs immediate water. The devices might prevent over watering the plants that can cause improper and defect growth [2]. This criteria affects heavily for in house plants in compare with the outdoor plants as the root cannot absorb the excessive water which would otherwise be occupied with oxygen taking in the soil. The over watering makes soil soggy and suffocate the roots and transform roots to rot [3]. The right amount of water level helps plants grow at a higher rate [1] [3]. It also provides plants the resistance. Soil that contains higher level of moisture the amount of resistance power of certain plants will decrease radically.

While the modern techniques utilize soil resistivity sensor, tensiometers , infrared moisture balance and dielectric techniques such as 'Time Domain Reflectometry (TDR), Frequency Domain Reflectometry (FDR) and capacitance technique' and heat flux soil moisture sensors [7],'micro-electro mechanical systems and optical techniques' [7] [8]. However, both classical and modern techniques shows the uncertainty in relation with the accuracy and volumetric precision measurements [9].

Methods

During the project we evaluated several prototypes together with our stakeholders. In order to achieve this we did a couple of rapid prototypes in the beginning mainly made of wood and cardboard. The prototypes were presented and explained to the stakeholders followed by a discussion about several aspects such as design and functionality. During the end of the discussion a survey was handed out to the participants. However the final prototype was made based on a combination between the different design ideas that we received from the past prototyping sessions and was evaluated using the same methods as before.

Results

The result of this projects was a prototype of the moisture measurement tool for helping gardeners in their gardening process. The final prototype of the sensor stick device is able to sense if the soil is moist or not and uses a red Led light to indicate the moisture level in the soil by blinking, the faster it blinks the more moist there is in the soil. The prototype was built by using a groove moisture sensor[4] and a micro

controller called the light blue bean[5] which is a bluetooth arduino. In addition to the sensor stick the second achievement was a proof of concept of the android application. Currently the application is able to read the sensor data from the device, converting it to a percentage value which is displayed on the screen.

Discussion

During this project most of the user testings and prototyping sessions with the stakeholder were overall good. Even if we could not achieve the desired form and design for the sensor stick the feedback and design ideas gained from the stakeholders still allowed us to produce a usable product with a satisfactory design.

Future Work

In terms of future work we will consider improving the current design of the device, and make it thinner and more compact. A set of 3D models has already been made to illustrate potential future designs of the device. For the application we consider adding additional functionality for saving the moisture data that is recorded, as the current version of the app does not support this yet. Another addition to the application is to make use of open data to fetch information about different plants in order to adjust the recommended moisture level in the application for a particular plant selected by the user, as different plants need different amounts of water.

Acknowledgements

We would like to thank all of our stakeholders for their involvement, contributions and valuable feedback to our project. We would also like to thank our teachers Daniel Spikol & Patrik Berander for their supervision and support. Finally we would like to thank Mattias Nordberg for helping us building the sensor stick prototype.

References

1. Plant Moisture Meters, Available at: http://www.teachtechno.com/ plant-moisture-meters/, Accessed on 01 November. 2014
2. Sense farm, Soil moisture measurement, Available at: http://www.sensefarm.com/, Accessed on: 01 November.2014
3. Watering House Plants, http://www.guide-to-houseplants.com/wa- tering-house-plants.html,Accessed on: 03 November. 2014
4. Grove Moisture sensor, Available at: http://www.seeedstudio. com/wiki/Grove_-_Moisture_Sensor, Accessed on 15 November. 2014.
5. Light Blue Bean, Available at: https://punchthrough.com/bean/, Accessed on: 20 January. 2015.
6. Android the world's most popular mobile platform, Available at: http://developer.android.com/about/index.html, Accessed at 20 January. 2015.
7. Ridley, A. and Burland, J. (1993), `A new instrument for the measurement of soil moisture suction', Geotechnique 43(2).moisture measurement', Measurement 54, 92{105.
8. dKaleita, A. L., Tian, L. F. and Hirschi, M. C. (2005), Relationship between soil moisture content and soil surface re ectance', Transactions of the ASAE 48(5), 1979.
9. dSU, S. L., Singh, D. and Shojaei Baghini, M, (2014), `A critical review of soil moisture measurement', Measurement 54, 92{105.