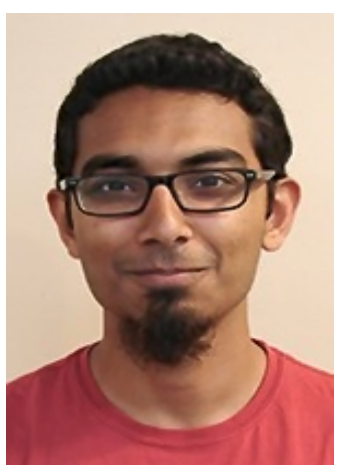
The Field Robotics Center

Seminar Series

Fri, Dec 13 **NSH 3002** **11AM – 12PM**



Food and Drinks will be served

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An Autonomous Robot for Manipulation and Mapping of NFT Installations

Abstract: At the rate at which the population of the world is currently growing, it is estimated to reach 10 billion by the year 2083. On the other hand, about 36% of the land suitable for crop production in the world is already being used, leaving only 2.7 billion hectares. The potential of a future shortage has let to rapid acquisitions of vast tracts of foreign land by food-insecure nations to protect the food security of their burgeoning population. We can curb the shortage by intensifying our agricultural techniques and innovating new practices.

Robotics and Hydroponics are two technologies that have shown promising capabilities in the recent years. By automating hydroponic installations we can overcome some of the shortfalls of the system such as the requirement of periodic labor and meticulous monitoring. In addition, the structured environment of greenhouses and systematic arrangement of plants in a hydroponic system make the domain convenient for robots to work in. To compete with the traditional methods, the system has to both produce a high yield with better quality and be inexpensive at the same time.

In this research, we describe our efforts on developing an autonomous robot known as the NFT Bot that automates several tasks that a grower would perform on a hydroponic Nutrient Film Technique (NFT) system. To keep the costs low, the robot was designed to be reconfigurable so that it could be easily deployed on top of any existing NFT infrastructure in a greenhouse. The robot is capable of planting the seedlings in the NFT gullies, manipulating the plants onto to the nursery gullies and harvesting the fully grown plants. The NFT Bot is also equipped with an interchangeable end-effector: one for gripping and manipulating the plants, and another with a Microsoft Kinect for mapping and building colorized 3D models of the plants throughout their grow cycles. Colorized 3D models of the plant structure can be used to estimate different plant properties such as canopy height, leaf area index, ecophysiological responses, plant stress and, etc. In addition, we also use the CMU Sensorweb system on the robot to remotely monitor other plant parameters including temperature, specific conductivity, dielectric constant and water reservoir depth. We present our results from the experiments performed on growing 288 heads of lettuce over two grow cycles using the NFT Bot and the AmHydro 612HL NFT system.

Speaker Bio: Abhinav Valada is a Masters student at the Robotics Institute, advised by George Kantor and Paul Scerri. He is also an Engineer at the National Robotics Engineering Center and a co-founder of the CMU spin-off Platypus, LLC. Prior to working at NREC, he was a Systems/Software Engineer at the Field Robotics Center. He received his Bachelors in Electronics and Instrumentation Engineering from VIT University.




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