Underground Root Imaging System
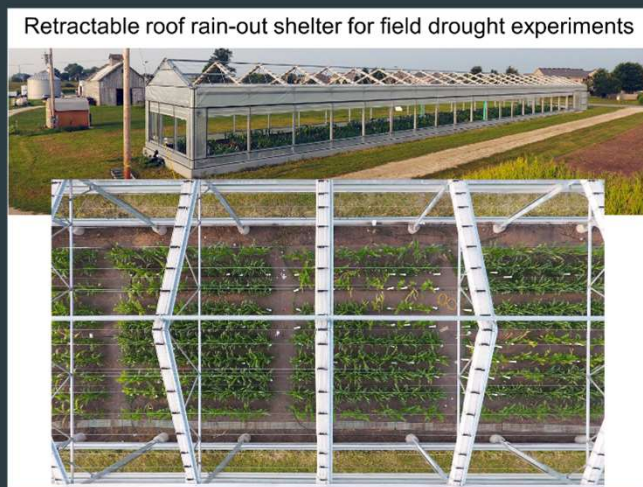
Sr Design Project

Main Focus of Agriculture Research

▶ Create New Breeds of Food Crops Resistant to Climate Change

▶ Grow Test Plots and Collect Phenotype Data to Evaluate

▶ Continue Process Until Water Efficient Breed is Established

Retractable roof rain-out shelter for field drought experiments

Data Collection in the Field

- Collect Phenotype Data of Roots
- Clear Acrylic Tubes Placed in Ground Under Plants
- Camera Inserted to Capture Root Growth
- Tedious and Time-Consuming Method
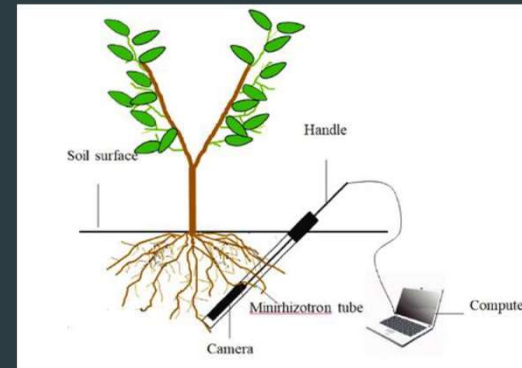
Difficulties of Current Approach

▶ Scanner Components are Not Durable Enough for Extended Field Use

▶ Solution is Not Portable

▶ Multiple Axis of Travel (Rotational and Depth)

▶ Image Collection Prone to Errors
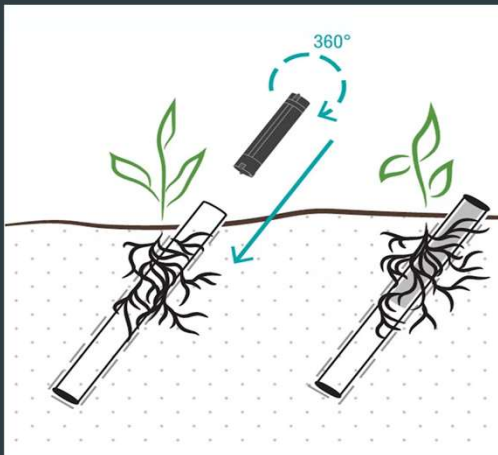
Goals for Capstone Project

▶ Devise a System Based on the Following Novel Design for Efficient Image Capture of Roots that Utilizes a Hemispherical Camera

- ▶ Develop Camera System and Triggering to Capture Underground Images

- ▶ Obtain Suitable Camera Imaging of Roots at Desired Depths

- ▶ Record Location of Individual Root Tubes in the Field

- ▶ Transfer Image Data From Device to Remote Storage

- ▶ Process Hemispherical Image into Separate Planar Images for Analysis

- ▶ Test System in the Field and Adjust Design If Necessary

Innovative Approach Desired

▶ Meet with Agriculture/Engineering Group

▶ See Demo of Existing System

▶ Use Automation and State of the Art Equipment

▶ Design for Ruggedization

    ▶ High Moisture

    ▶ Heavy Usage (100K+ images a season)

    ▶ Transported All Over Midwest

    ▶ Drop and Vibration Resistant
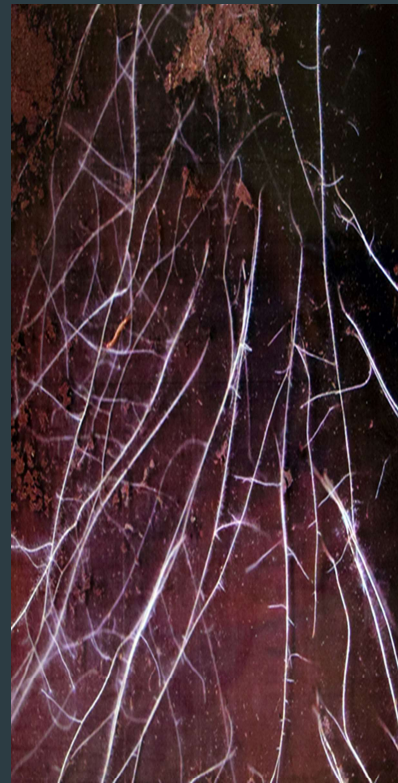
Project Support Group

- Professor Andrew Leakey
  - *Michael Aiken Chair* Professor of Plant Biology (IGB)
- Jeremy Ruhter
  - Farm Field Technician
- John M. Hart
  - Principal Research Engineer (CSL) and
  - Manager and Coordinator of the CfA Robotics Labs
  - jmhart3@