

Fighting world hunger: Robotics aid in the study of corn and drought tolerance

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To develop 3-D images of corn plants in the field, DeSouza's team developed a combination approach of a mobile sensor tower (in background) and an autonomous robot vehicle equipped with three levels of sensors and an additional robotic arm. Credit: Gui DeSouza



Developing drought tolerant corn that makes efficient use of available water will be vital to sustain the estimated 9 billion global population by 2050. In March 2014, the National Science Foundation (NSF) awarded the University of Missouri a \$20 million grant as part of a multiinstitutional consortium to study how corn maintains root growth during drought conditions. Using funding from the NSF, Mizzou engineers on a multidisciplinary team have developed a robotic system that is changing the way scientists study crops and plant composition.

Gui DeSouza, an associate professor of electrical engineering and computer science, and colleagues and students in his Vision-Guided and Intelligent Robotics (ViGIR) Laboratory partnered with researchers such as Felix Fritschi, an associate professor of <u>plant sciences</u> in the College of Agriculture, Food and Natural Resources and Todd Mockler, a principal investigator with the Danforth Plant Science Center to study the effects of climate change on crops in Missouri. Using principles developed in the ViGIR lab, DeSouza is changing the way agriculturists collect data in the <u>field</u>.

"I've been working with CAFNR assisting them in experiments where we helped to create 3-D images of <u>root growth</u> in the laboratory," DeSouza said. "Now, we're creating robotics to assist in creating those images out in the field."

The engineering and plant science research team developed a combination, two-pronged approach using a mobile sensing tower as well as a robot vehicle equipped with three levels of sensors. The tower inspects a 60-foot radius of a given field to identify areas affected by environmental stresses, while the vehicle collects data on individual plants. The sensors have the ability to measure various heights of the corn plant in order to reconstruct the 3-D image.



"Measurements taken from the tower alert us if any of the plants are under stress, such as heat or drought," DeSouza said. "The tower then signals the mobile robot, which we call the Vinobot, to go to a particular area of the field and perform data collection on the individual plants. The Vinobot has three sets of sensors and a robotic arm to collect temperature, humidity and light intensity at three different heights on the corn plant. This is called plant phenotyping, which assesses growth, development, yield and items such as tolerance and resistance to environmental stressors by correlating these to physiology and shape of the plants."

While the <u>tower</u> covers only a relatively small area, it can easily be moved to cover an entire field. This cost-effective measure means it is less expensive to have more towers, stationed at various points in the field, operating simultaneously.

"The towers not only are inexpensive, they also are available throughout the day and night and can generate more data than any aerial vehicle could," DeSouza said.

The team's study, "Vinobot and Vinoculer: Two robotic platforms for high-throughput field phenotyping," recently was published in *Sensors*.

More information: Ali Shafiekhani et al. Vinobot and Vinoculer: Two Robotic Platforms for High-Throughput Field Phenotyping, *Sensors* (2017). <u>DOI: 10.3390/s17010214</u>

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