RIPPA heads east to Lindenow, Victoria

Field trial and event update - May 2017

The RIPPA™ (Robot for Intelligent Perception and Precision Application) topped off a jam-packed couple of months at the recent East Gippsland Vegetable Innovation Days in Lindenow, Victoria. This was part of a week-long trial at Bulmer Farms, following similar data collection on commercial farms in Tasmania, Queensland and Clyde in Victoria over the past six months.

Created through the Horticulture Innovation Centre for Robotics and Intelligent Systems in the University of Sydney's internationally-recognised Australian Centre for Field Robotics, RIPPA aims to benefit the vegetable industry by:

- Operating autonomously 24 hours 7 days a week
- Automatically removing weeds through a wide variety of implements
- Autonomously detecting and removing foreign objects
- Determining crop health and soil status
- Conducting autonomous precision spraying on each individual plant
- Monitoring crop growth and estimating yield through intelligent data analytics.

The aim of RIPPA is to reduce farm input costs such as labour and fertiliser, as well as improve marketable yield of vegetables.

Over 500 people attended the field day and had the opportunity to talk one-on-one with the University of Sydney research team. This included providing an overview of the sensor systems, decision support tools, and how the robot interacts with crops while the robot operated autonomously nearby (Figure 1). The event also provided the chance to seek valuable feedback from vegetable growers and other industry stakeholders on how the technology could be applied on-farm (Figure 2).

Figure 1 (below left): RIPPA on display at the East Gippsland Vegetable Innovation Days

Figure 2 (below right): Dr Zhe Xu and Justin Clarke from the University of Sydney interact with vegetable growers at the East Gippsland Vegetable Innovation Days

This project has been funded by Horticulture Innovation Australia Limited using the research and development vegetable levy and funds from the Australian Government.

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The broader trial evaluated and demonstrated specific functions of the robot and intelligent systems. This included:

- Autonomous row following on a 5' (1.52m) rows in the same field trial campaign as visits to farms that operate on 6' (1.83m) and 2.0m row spacings
- Crop mapping on lettuce crops
- Mechanical weeding within lettuce crops (shown in Figure 3)
- Scans of a lettuce crop one week apart to characterise growth.

RIPPA collected a large amount of data that will support further technology development. Of particular interest to growers is what RIPPA 'sees' from on-board cameras and how this information is processed and used. Figure 4 shows four different images from left to right:

1. Visible spectrum image (Red-Green-Blue) showing what RIPPA 'sees', which is also complemented by a near-infra-red camera
2. Normalized Difference Vegetation Index (NDVI) image in which lettuce, and other plants, appear bright
3. Computer vision filters are applied to make the lettuce distinct and to remove noise such as the cracks in the soil
4. Visualisation of analytics that can be performed on this imagery, including detection of lettuce and their size (green circles) and weeds (red circle).

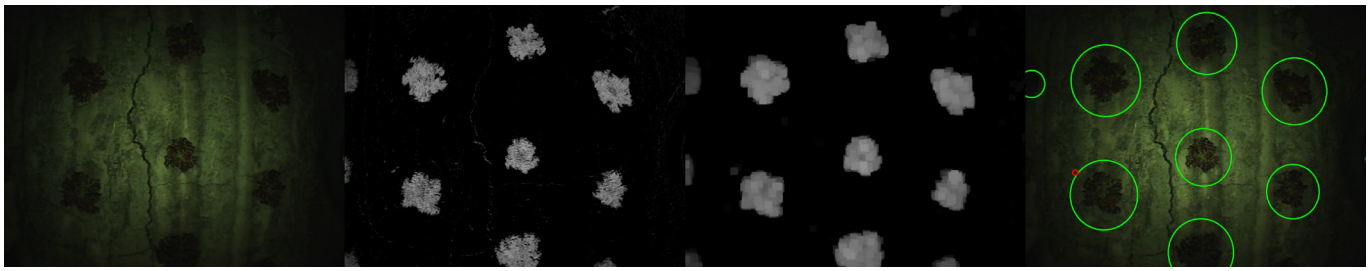
These images can be used by growers and agronomists to guide decision-making to improve the health and uniformity of a vegetable crop, as well as determine optimal harvest timing.

Figure 3: RIPPA weeding between lettuces at Bulmer Farms, Victoria while autonomously following rows

RIPPA will continue to be developed and improved based on the findings of the trial and the important feedback received from growers. This includes mechanical weeding in varying lighting conditions indicated the need for additional filtering of false positive weed detections. The research team will also use multi-target tracking techniques to reject more false positive weed detections.

There was also a live cross from the event by the ABC Victorian Country Hour. You can listen to Dr Zhe Xu talk about the robot and the field trial further from the 20:47 minute mark here: https://itunes.apple.com/au/podcast/victoria-country-hour/d362378375?mt=2#episodeGuid=http%3A%2F%2Fwww.abc.net.au%2Fnews%2Frural%2Fprograms%2Fvic-country-hour%2F2017-05-04%2Fvic-country-hour-podcast-4-may-2017%2F8496898

Figure 4: What RIPPA 'sees' from on-board cameras at Bulmer Farms, Victoria



IF YOU'D LIKE TO SEE RIPPA IN ACTION...

You can attend the following upcoming event:

- New South Wales: Wednesday 19 July 2017, 10:30am - 2:30pm, at TJM RD&E site, 86B Hawkins Road, Yoogali, NSW 2680 (near Griffith) In conjunction with: VegNET Riverina Precision Agriculture Field Day.

To find out more or to register for the above event please contact Carl Larsen (carll@rmcg.com.au) or Salah Sukkarieh (salah.sukkarieh@sydney.edu.au), or visit www.sydney.edu.au/acfr/agriculture.