Report for experiment GAROTICS

D 3.2: Field experiment report (second season)

Green asparagus harvesting robotic system

STRAUSS
UNIHB
CWS

Version 1
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General remarks

Please write the texts in the sections and keep everything short and concise. In case of charts, tables, pictures or other graphical material with higher resolution, please provide the original files as email-attachments or download links

1 Location / Date

C. Wright & Son (Gedney) Ltd
Main Street, Gedney Dyke, Spalding, Lincolnshire, PE12 0AJ, United Kingdom
By the ECHORD E++ project team GARotics
From 27th to 30th June 2016

2 Atendees

Adam Cunnington	CWS
Adrian Leu	UNIHB
Lasse Langstädtler	UNIHB

3 Agenda

Monday, 27th of June 2016

Unpacking of the harvesting machine and preparations for the first field tests (calibration, parameter tuning).Three hours of field tests while recording data (limitation imposed by the battery for the driving motor). Evaluation of initial results and preparations for the next day, including parameters adjustments and bug fixing.

Tuesday, 28th of June 2016

Three hours of field tests with improved parameters. The tests were successful, particularly with the first harvesting tool. However, the second tool still had large positioning errors due to the fact that the camera could not follow the asparagus until the second tool would harvest it. Improvement of tracking algorithm and preparations for the next day.

Wednesday, 29th of June 2016

Three hours of field tests with improved tracking algorithm. The preliminary implementation of drifting compensation for the second tool showed promising results, yet it showed that a more elaborated algorithm should be implemented.

4 Discussions and results

Following the suggestions given by the RIF experts in October 2015, following improvements have been implemented on the harvesting machine

- active gripping for increase of reliability
- use of container (to reduce time for depositioning)

As a consequence, the harvesting machine was able to successfully harvest asparagus stalks of various diameters and lengths and to deposit them in on-board containers. Asparagus stalks that were close to each other could be reliably detected by the vision module if they were at least 2 cm away from each other. However, they needed to be at least 6 cm away from each other in the y-direction and at least 10 cm in the x-direction in order to successfully perform

selective harvesting without damaging neighboring stalks. An estimate in performed experiments was that 90 % of the stalks fulfilled these criteria.

In order to compensate for lateral drifting of the machine, updated asparagus positions were sent to the harvesting tools. However, the camera could only track the asparagus until the first tool, as afterwards the view was partially blocked. Therefore a preliminary algorithm based on the position of visible stalks was implemented in order to test the concept of drift compensation for the second tool for asparagus stalks that are no longer visible.

The average velocity of the asparagus harvesting machine was 0.2m/s. An average mechanical harvesting cycle took about two seconds, which means that once a harvesting process started, the tool was blocked for about 0.4m. This means that having two tools, an average of 5 asparagus plants / meter could be harvested. In terms of reliability, our field tests have shown that in about 90% of the cases, the harvesting process was successful, meaning that the gripper successfully grasped an asparagus and deposited it in the storage box placed on the side.

a)

b)

Fig. 1. The robotic harvester driving over an asparagus dam (a). The asparagus process as seen by the on-board camera. The storage box on the side of the machine (b).

Fig. 2: Illustration of a part of the harvesting process, asparagus stalk approaching and grabbing by one of the harvesting tools