FoodBioSystems DTP - PhD Project Advertisement Template

Project title:

FBS2021-95-Rose-rc: Responsible innovation of autonomous robots in agriculture: towards more substantive inclusion and user-centred design

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Project description:

A recent survey by a Scottish membership organisation found that 65% of farm businesses arere considering down-scaling operations due to the impact of COVID-19 (Migration Advisory Committee, 2020). The pandemic, combined with uncertainty over Brexit, is threatening the supply of migrant labour and thus the completion of vital tasks in the high-value crop sector (e.g. top fruit [apples etc.], soft fruit [strawberries etc.], and field veg [asparagus etc.]). The soft fruit sector alone is worth £1.5 billion in retail value and £450 million to farm businesses per year and vital tasks such as harvesting and packing of crops needs to be completed to ensure that businesses are productive and that food security in these healthy products is guaranteed. Farming also needs to reduce its carbon emissions, limit food waste and reduce chemical use.

Autonomous robots in the high value crop sector potentially provides a solution to the lack of labour and these other issues. Electrification of robots can help with carbon emissions, precision technology can reduce chemical use, and autonomous machines may replace the work normally done by a human and improve food security of these healthy foods. Such technology is approaching high technology readiness levels and is being demonstrated on farms across the world. However, there are a number of social and ethical considerations of autonomous robots – such as impact on farm employment, cybersecurity, data ownership, bad consumer perception, and lack of safety – that may present barriers to adoption. We know from the history of agricultural innovation, particularly GM crops, that some technologies can fail because they are not designed in consultation with end users and other stakeholders.

It has been suggested that responsible innovation principles can help. This asks technology developers to *anticipate* consequences of their technology, both good and bad, *include* a wide range of stakeholders in development, listen to these stakeholders views and changing design or course (*reflexivity)*, and work with policy-makers to set an institutional framework (e.g. policy instruments, laws) that can help *respond* to new knowledge or views.

There has been little, if any, empirical work that has investigated how to operationalize responsible innovation principles in the development of autonomous robots in agriculture. This PhD sets out to explore how stakeholders can be included in the best way, ensuring that inclusion is substantive instead of tokenistic, and then investigates

how user views can be used to optimize the design of autonomous robots. The aim is to help roboticists understand how to incorporate response innovation principles into the design of robots that work for all stakeholders. Methods may include a structured literature review, surveys, interactive workshops, observation, citizen juries with stakeholders plus a social media analysis of user perceptions of robots, plus interviews and observation of roboticists involved in development. You will be working alongside cutting-edge projects (e.g. Reading/Lincoln "Robot Highways" project) which is demonstrating the application of autonomous robots in farm environments. You will also have access to the smart farming facilities of the Agri-EPI Centre (see below) where state-of-the-art robotic technologies are being developed and trialed.

This is a cutting-edge, trans-disciplinary PhD. You will be at the forefront of developing socially acceptable solutions in the important area of autonomous robots in farming, an issue of international importance. You will be supported by world-leading experts in the ethics of technology and human-robot interaction from the Universities of Reading, Cranfield and Lincoln. A steering committee of the Institution of Agricultural Engineers, the Agri-EPI Centre (Government agri-tech centre for precision agriculture) and Agri-TechE (brokering organization working with farmers, technologists, and scientists) will provide industry support to ensure that their research is relevant and impactful. Training in social science and human-robot interaction is available through the unique partnerships offered by bringing together Reading, Cranfield, Lincoln and the Industrial partners. We encourage students from many different disciplines to apply to this trans-disciplinary PhD, which seeks to address the key challenge to the implementation of robotic solutions in farming globally. The results are likely to make a big impact on policy and industry practice and the supporting team are well-placed to help the student maximise such impact.

AUTONOMOUS ROBOTS IN FARMING

If we want to responsibly develop robots, we have to do the following:

ANTICIPATE SOCIAL AND ETHICAL CONSEQUENCES

RESPOND TO NEW IDEAS

INCLUDE PEOPLE IN THE DESIGN PROCESS

LISTEN AND CHANGE

WE DON'T REALLY KNOW HOW TO DO ANY OF THIS IN PRACTICE

EXPLORE HOW WE CAN BETTER INCLUDE STAKEHOLDERS IN THE DESIGN OF ROBOTS AND IMPROVE HUMAN-ROBOT INTERACTION DESIGN

THIS WILL IMPROVE ROBOT IMPLEMENTATION TO HELP FOOD SECURITY, FILL GAPS IN LABOUR, AND HELP THE ENVIRONMENT

Training opportunities:

Through affiliate partnership with the University of Lincoln, the student will be able to attend training through both the FoodBioSystems DTP and some events (e.g. Annual Conference) offered through the Lincoln-led Agri-FoRwArdS Centre for Doctoral Training. Industry support will give the student free membership of the Institute of Agricultural Engineers, through which events can be attended and professional networking undertaken, plus access to Agri-TechE events, which may include the student disseminating their research. Involvement of the Agri-EPI Centre will also expose the student to smart farming facilities and tours of these facilities where training may be provided.

Student profile:

This project would be suitable for students from a wide variety of disciplinary backgrounds and we encourage students from all disciplines, and those with inter-disciplinary backgrounds, to apply. Relevant subjects may include computer science, engineering, agriculture, geography, psychology or behavioural sciences, history and philosophy of science, science and technology studies, human factors, human-robot interaction, land economy, political science (collaborative governance perspective), but we are open to students who relish the chance to conduct trans-disciplinary research with a diverse supervisory team.

Funding Note

This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply

Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.

References:

Rose, D. C. 2020. Autonomous Robots in the Soft Fruit sector, https://www.youtube.com/watch?v=Y9oZT5AZUwU

Rose, D. C. and Chilvers, J. 2018. Agriculture 4.0: Broadening responsible innovation in an era of smart farming. *Frontiers in Sustainable Food Systems*, https://doi.org/10.3389/fsufs.2018.00

Sparrow, R., Howard, M. 2020. Robots in agriculture: prospects, impacts, ethics, and policy. *Precision Agriculture*. https://doi.org/10.1007/s11119-020-09757-9

Charalambous G, Fletcher S & Webb P (2016) The development of a scale to evaluate trust in industrial human-robot collaboration, *International Journal of Social Robotics*, 8 (2) 193-209.