

Harvesting the fruits of

IMAGINE the scene. A sunny summer afternoon, out with the family doing some strawberry-picking (aching back, tell-tale strawberry smears around the mouth and all) and with just the twitter of birds to disturb the peace.

Then you look to the next row and you see a robot gliding smoothly along, effortlessly picking the delicate fruit with an efficiency you can only dream of – and not a hint of red around its mouth.

A scene from a futuristic novel? The result of eating the wrong type of berry maybe? A hangover from that weekend to Amsterdam perhaps? Well, none of these actually. It's a foretaste of what could be, in just a couple of years, a scene in Essex fruit fields.

Fruit-picking robots is just one of the incredible-sounding projects being worked on by a team at the School of Computer Science and Electronic Engineering at the University of Essex. The team has a strong research base in robotics and was ranked seventh in the UK in the Witty Review.

The robotics group at Essex conducts research in several areas including perception-action, reasoning, learning, decision making, control and human-robot interaction including brain-robot interfacing. The group is working with Wilkin & Sons in Tiptree on developing



A glimpse into the future, maybe!

the fruit-picking robot in response to an increasingly problematic labour shortage in the sector due to people being less inclined to work on repetitive tasks, a situation compounded by the future likely decrease in east European labour.

The care industry is also the fore when it comes to increasing involvement of robotic and artificial intelligence and Southend-on-Sea Borough Council is already trialing a robot, designed by the Essex team, which is working in the council's social care department.

Vishwanathan Mohan is part of the University of Essex team and a leading international expert in robotics research. He originally trained in the field of Microelectronics and VLSI (very large scale integration) design at IIT Madras and gained a PhD in the field of cognitive robotics at the Italian Institute of Technology. He has been a reviewer for the prestigious European Research Council starting grant (2014) and presently serves as reviewer, guest editor in several major journals in the field of robotics, neural networks and neurosciences.

Nuclear industry funding

THE University of Essex is part of a consortium of eight universities which has secured £42million of new investment to fund the National Centre for Nuclear Robotics (NCNR).

NCNR is developing state-of-the-art robotics, sensing and artificial intelligence (AI) technologies to address the major challenges posed by nuclear environments and materials. Cleaning up the UK's 4.9 million

tonnes of nuclear waste is the largest and most complex environmental remediation task in the whole of Europe. Much of this work must be done by robots, because the materials are too hazardous for humans. However, many of the necessary robotic solutions have not yet been developed.

Essex's role in the NCNR is to research the effects of radiation on the electronics of robotic systems and develop new methods for increasing the resilience of the electronics systems hardware and software, to

provide resilience and robustness against radiation damage. This work will be an active collaboration between Essex, partners and Essex's long-term collaborators at Caltech's NASA Jet Propulsion Laboratory.

The programme aims to develop robotic solutions to make a safer working environment in industries such as off-shore energy, nuclear energy, space and deep mining, increase productivity and open up new cross disciplinary opportunities, not currently available.

f future robotic labour

He said: "Our emphasis here is on cobotics - creating cognitive robots to be deployed in environments coexisting with humans like domestic assistance, healthcare robots, manufacturing, agro tech, search and rescue operations. These robotic systems are mobile, autonomous, interactive and intelligent, and will be useful assistants or companions for people of different ages, situations, activities and environments in order to improve the quality of life.

"Robotic involvement in production

lines has been relatively common-place for a number of years now and many Essex companies will have embraced such technology but we now live in an era of unprecedented change - to our businesses, our economies and our societies - and robotics is going to play an increasingly key part in the way business is carried out."

The Essex Robotics Laboratory offers dedicated space for autonomous robots, including a ground level robot workshop and a robot arena which is more than one hundred square meters

in area with a six-meter high ceiling to accommodate flying robots. It has one of the world's largest powered lab floors for long-duration experiments with both mobile and flying robots.

With more than £3 million investment, this state-of-the-art facility includes 30 wheeled mobile robots, eight flying robots, three robotic fish, three intelligent wheelchairs, two humanoid robots - Pepper and Nao - one Baxter robot with two 7 DOFs

continued on page 12

Meet Pepper – the caring face of a robotic future

WHILST many trials and academic studies have taken place into robotics and social care and how they can help services, Southend-on-Sea Borough Council is leading the way as it is the first local authority to buy and use 'Pepper' under an academic license.

Pepper is a small humanoid robot with the ability to communicate as well as perceive emotions. Pepper is kind, endearing and is currently the first robot with the ability to recognise principal human emotions as well as being able to adapt his own behaviour and make independent decisions. Pepper is also able to play videos, music, and sensory games that will be used to help dementia sufferers and children with complex disabilities.

Pepper has been programmed by the council's equipment services team and 'socialised' with some members of staff. For the past couple of months, he has been meeting members of the public and carrying out visits.

Cllr Lesley Salter, Executive Councillor for Health and Adult Social Care, says: "Pepper is an amazing addition to our equipment team and I really think he will be both popular and successful with staff and our local community, both young and old. We are all so excited to see what Pepper and this technology in general can do for our

services and help us meet the well-known challenges that the social care sector faces.

"Robots may seem like something from the distant future, but the technology is here and we strongly believe that Pepper can have a positive impact on social care. Pepper has a number of features that we believe will be of real benefit to local people we care for. We think he could run a reminiscence group for those with dementia, freeing up time for social workers and carers to carry out one-to-one activity. Academics at universities are also exploring how robotics can help stroke survivors to do physio exercises.

"We are absolutely clear that Pepper is not here to replace any of our people, but to complement and help the existing staff we have to deliver a better service by freeing up time for them to deal directly with people."

Sharon Houlden, Director of Adult Services and Housing, said: "Whilst Pepper will not be used to carry out any direct or personal one-to-one care, he will be used in a range of settings, including in residential care homes, our sheltered housing schemes and as an information and advice point in relevant buildings. Pepper will also be a champion for the advances that digital and robotic technology and programming can make in a social care setting and he will visit local schools to inspire children to consider a career in the social care, robotic and



Vishwanathan Mohan with Pepper.

programming sector.

"We also want to use him in some of our inter-generational projects - for example in one group, where older people teach younger people how to knit, he could display knitting techniques and video tutorials. He can also play videos and we plan to develop a reminiscence session that Pepper could run. We expect that whilst Pepper will not replace any services we commission, he will free up time for our social workers and carers to spend more time giving direct care and the personal touch.

"This is also about exploration and pushing the boundaries. Whilst the sector has talked about this technology for some time now, we are ambitious and confident enough in Southend-on-Sea to make the first move and become the first local authority to trial this technology. We are convinced that digital technology is where the future lies for social care and we would be delighted to explore this further with other innovative partners."

Increasing emphasis on collaborative robots

continued from page 11

arms and one robotic hand with five fingers. A VICON optic motion tracking system with nine infrared cameras is fixed on the ceiling and provides reliable location information so that the performance of the developed robots and navigation algorithms can be accurately evaluated.

As many in automation are aware, robots are becoming an increasingly popular answer to completing dangerous or repetitive tasks. The leading robot manufacturers all appear to be focused on making robots simpler to programme/configure and easier to integrate with technologies that create



incredible functionality – in other words, collaborative robots. Using various sensing technologies, the applications for collaborative robots to

work with human counterparts are infinite. Today's robots are becoming more flexible in their range of applications, with friendlier interfaces, and free to be placed anywhere on the manufacturing floor or, indeed, in an increasing number of sector environments.

Vishwanathan added: "As labour, particularly for the less skilled jobs, becomes more and more scarce, more and more businesses will become increasingly dependent on artificial intelligence to fill the gaps. Essex is right at the centre of providing these solutions."

Picking solutions to challenging issues

THE Wilkin family has been growing fruit in the fields around Tiptree since 1865 and has been making preserves since 1885. The firm's adoption of the most up-to-date farming techniques has ensured the farm is more successful than ever at growing exactly the right varieties of high quality fruit for 'the jam factory', retaining the flavour of the fresh fruit in the finished product and to meet the needs of the fresh fruit market's demands.

Now, the firm is looking to cutting-edge robotic technology as part of the solution to an increasingly worrying fruit-picking labour shortage, a problem hastened by the Brexit vote and subsequent weakening pound.

Andrey Ivanov, General Manager – Farms, came to the UK from his native Bulgaria 17 years ago and part of his early years was spent fruit-picking, including in Tiptree, so he has excellent first-hand knowledge of the issues and challenges presented by a business which requires up to 300 fruit-pickers in peak-season at a time when labour for repetitive, low-skill work is harder

and harder to come by, Andrey said: "When the referendum result was announced in June 2016, it prompted a lot of discussion among our largely eastern European workforce. However, it was last summer, 2017, when we witnessed the first visible repercussions. A significant number of our expected temporary workforce did not materialise. A major problem was the weakening of the pound against the euro. We managed by offering more hours to those who were here working but it highlighted an issue we couldn't afford to ignore.

"We've worked hard introducing initiatives onto the farm these past few years which have looked to lengthen the picking season and make picking a little more comfortable. It was only a few years ago that our peak picking season, when 300 pickers were required, lasted just four weeks. Now, that peak season is spread over the summer, from May until the end of October."

One of those initiatives has involved growing strawberry plants at a higher level in fields to make picking easier. Last summer, the farm became the first in the UK to introduce a system called the New Growing System (NGS). It involves growing plants in long troughs which can be electronically lowered and raised for an optimum



Andrey Ivanov.

picking environment, all within a large closed-in plastic coated greenhouse. The controlled growing conditions, protected from the vagaries of the English climate, lend themselves to a much longer picking season and has resulted in a greater yield than in a similar sized area out in the open fields.

"We are constantly looking at ways we can extend our growing and picking season and make the picking easier for those involved. Ultimately though, we realise it is getting harder and harder to find the labour required to pick the fruit to satisfy the increasing demand for our produce. Robots could well be part of the solution and we are now in detailed talks with the University of Essex team to look at the practicalities and costs," added Andrey.