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研鑽タイトル Research Title

Realisation of high-speed odour source tracking with biological sensor mounted on flying robot

研修概要 Research outline

People gave robots a lot of abilities to make it act more like creatures, or even like human beings. However, there are still some functions are not well-developed and odour navigation is one of them. With a smell function, robots can be more powerful when rescuing people underground, searching explosions, etc. To realise this, the studies about mechanics and biology are important. In the odour tracking study, biology-inspired methods such as biosensors and insect tracking algorithms are used. However, the system of mechanical and electrical should be discussed more.

研修先について About the laboratory visited

In this generation, interdisciplinary studies are important for researching, especially for robotics studies. In Massachusetts, there are famous universities such as Massachusetts Institute of Technology (MIT) and Tufts University that good at robotics related studies. In this programme, I visited the Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT. The laboratory is located at Stata Center on the campus of MIT. In the laboratory, there are about 25 groups which are focusing on various research areas and different projects. Another lab that I visited is Microscale Sensors and Systems Laboratory at Tufts University. Since they are doing studies of microelectromechanical systems (MEMS) based sensors, they could provide me with relevant expertise.

研修内容 What you learned

In MIT, there are a lot of student-centred research associations and one of the research

team is focusing on UAV research. They have cooperation with several large companies and attend international contests very often. Unfortunately, because of the final exam, people are busy with studying and do not have time for giving a demonstration. However, Professor Daniela Rus's group has designed a special drone which is able to not only fly in the air but also drive on the ground. Because the movement is more flexible, traditional planning algorithms might not work properly. A special planning algorithm was built for this new type of vehicle. Though this invention is still too early for practical usage, it passed a brand new idea which might change the way how we design algorithms in the future. This new type of vehicle can break the limitation of terrains and can reach the destination with a more efficient route. Moreover, the case of multiple flying-and-driving robots was also being considered as part of the algorithm. How to make the robots move smoothly without interrupting one another is a big issue. As a result, Safe Interval Path Planning (SIPP) was implemented into the multimodal locomotion system to realise the goal.

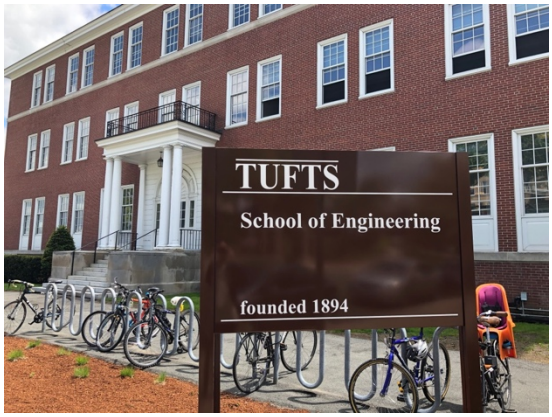
In Tufts University, Dr Robert White's group is focusing on MEMS such as electronics packaging problems, system packaging problems and aerodynamic applications. Furthermore, there is a previous project related to biomimetic acoustic sensor study. To build acoustic MEMS sensors, mimicking the mechanics of the cochlea, modelling and designing the sensor are important factors. In this way, the sensor can be used as low-power acoustic transduction and signal analysis mechanism.

研修先で特に印象に残ったこと The most impressive thing

At MIT, they have a lot of interesting cultures, such as 'hacking'. Hacking is a long-standing tradition at MIT. It can be determined as either the curious exploration of MIT's campus or the design and carrying out of harmless tricks and full of creative inventions. These hacker artefacts were featured in different buildings. In the Stata Center, a selection of larger relics from past hacks and plaques semi-permanently displayed inside and can be viewed by visitors. Furthermore, a great deal of students thinks they are not smart enough for MIT. As a result, they work harder than any other people and become experts in their spheres eventually. This may be the thing that everyone should learn in

a lifetime if one desires to be successful.

MIT Campus



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