School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Application instructions:
Detailed instructions are available at :
https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Dr Brian Davison (Email: b.davison@napier.ac.uk)
- 2ND SUPERVISOR: tbc

Subject Group: Computer Science

Research Areas: Artificial Intelligence, Computer Vision, Software Engineering

Project Title: Colebots

Project description:
Nature has been the inspiration for many technical developments in both software and hardware because natural solutions have evolved to be very efficient at certain types of task. The aim of this project is the design and development of a mobile robot whose physical design is based on beetles (coleoptera). The purpose of the robot is to operate autonomously in natural environments such as forests where it would collect data on the environment, flora and fauna.

The main goal of this project is the creation of a miniaturised hexapod robot capable of surviving in a hazardous environment. For this, it would rely on its beetle-based morphology and on pre-programmed survival behaviours that parallel those of real beetles.

The secondary goal of the project is to investigate the feasibility of the value-adding features of such a platform which include a capacity for data collection, energy harvesting and communication. The physical capability of the robot could also be extended beyond basic locomotion and survival to include flight and object manipulation.

References:

Leung, B., Billeschou, P. and Manoonpong, P. (2024) Integrated Modular Neural Control for Versatile Locomotion and Object Transportation of a Dung Beetle-Like Robot. IEEE Transactions on Cybernetics, vol. 54, no. 4, pp. 2062-2075, https://doi.org/10.1109/TCYB.2023.3249467

Brandmayr, P., Bonacci, T., Giglio, A., Talarico, F.F. and Brandmayr, T.Z., 2009. The evolution of defence mechanisms in carabid beetles: a review. Life and time: the evolution of life and its history. Cleup, Padova, pp.25-43. https://www.academia.edu/download/75611214/The_evolution_of_defence_mechanisms_in_c20211202-21403-6r5ev7.pdf

Goczal, J. and Beutel R. G. (2023) Beetle elytra: evolution, modifications and biological functions Biol. Lett.1920220559.
http://doi.org/10.1098/rsbl.2022.0559

Candidate characteristics

Education:
A first degree (a minimum 2:1) in Computer Science or Mechanical Engineering

Subject knowledge:
Software development, Robotics (i.e. robot hardware and/or microprocessor systems)

Essential attributes:
- Competent in software development
- Knowledge of basic biology
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
- Previous experience working with artificial intelligence techniques will be a major benefit