Department	School of Engineering and the Built Environment
Supervisors	Yuyang, Zhou; Goh, Keng
Project Title	Stochastic randomized control on bicycle balance

PROJECT DESCRIPTION

Bicycles are widely used for transportation, exercise, and recreation and play an important role in urban mobility. Individuals benefit from the fact that cycling is a healthy and cheap form of transport. Moreover, in urban areas, cycling can sometimes prove to be faster than other transport modes and also allows cyclists to avoid traffic jams. For society, the advantages of cycling include environmental sustainability, cheap infrastructure requirements, and improvements in public health. However, there are some challenges for the existing bicycles in the market including:

1. Bicycle is statically unstable, especially for old and less flexible people.
2. Bicycles commonly are subjected to various sources of disturbances, making bicycle control more challenging.

This project is to develop a randomized control algorithm to address the aforementioned issues. The randomised controller will be designed firstly in theory and then be implemented on a real bicycle to test. This control method will be based on fully probablitic design where the control goal is to keep the bicycle stay balance while subjecting various sorce of randomness. Then, the developed controller will be implemented on a bike provided in the lab, while different sensors will be used to collect the signals and a motor to provide the torque. This project is suitable for people who have basic control theory knowledge and electrical electronic knowledge. The applicants should have good experienmental skill, mathematical skills and programming skills. The c programming skill is desirable but not essential.

Academic qualifications

A first degree (at least a 2.1) ideally in Electrical Electronic Engineering/ Mechanical Engineering/control automation with a good fundamental knowledge of basic mechanical/electrical engineering and mathematics, control theory/ probability thoery.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:
- Experience of fundamental of Electrical Electronics, microcontroller, sensor implementations
- Competent in BEng, MSC, MEng
- Knowledge of control theory, basic Engineering mathematics
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:
probability theory,
mathematical modelling,
advanced control methods,
c programming
matlab programing

Indicative Bibliography	[1] Herzallah R, Zhou Y. A tracking error–based fully probabilistic control for stochastic discrete-time systems with multiplicative noise[J]. Journal of Vibration and Control, 2020, 26(23-24): 2329-2339.
Enquiries	For informal enquiries about this PhD project, please contact Dr.Yuyang Zhou, Y.Zhou@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process