

Pre-Requisite Modules code(s)	Co-Requisite Modules code(s)	ECTS Credits	Module Code	Module Title
None	None	5	CMPU1030	Team Computing

8.1.11. Team Computing

Module authors: John Kelleher

Module Description:

This module introduces the student to the application of computer technology to mobile robotics from a software perspective.

Module aim:

The module will introduce core computer development concepts such as real-time hardware based design constraints, and team based software design and development. The module will use the case-study of developing software for a mobile robot platform to introduce these concepts. As part of the case study the module provides a broad introduction to the field of robotics and covers the basics of mobile robot control and surveys some common application areas. Students will work in teams that compete against one another in response to a challenge that that will test and develop their engineering design skills. The practical components of the course will give students experience in both individual and team based research and problem-solving.

Learning Outcomes:

- Define what a robot system is and discuss the applications of robot technology
- Explain and compare the operations, characteristics and applications of robot sensors and actuators
- Explain and compare different approaches to robot control.
- List the difficulties facing the development of hardware-based real-time software systems.
- Demonstrate the ability to implement software to run on a specific hardware base, for example a robot.
- Demonstrate an ability to work productively in a team.

Learning and Teaching Methods:

The module will be delivered through and mixture of lecture and lab sessions.

Module content:

- *Introduction:* Overview of robot history, classification, advantages and disadvantages and applications of robot technology.
- Introduction to the components of a robot system: power system, actuators, sensors, control system.
- *Actuators:* Review types such as electric, hydraulic, pneumatics, shape memory alloys and electric motors.
- Describe and compare the advantages and disadvantages of each type of actuator.

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- *Sensors*: Contact Sensors, Internal Sensors, Sonar, Radar, Laser Range-Finding, Satellite Based Positioning, Data Fusion, Biological Sensing, Visual Sensors and Algorithms
- *Locomotion systems*: Compare and contrast the advantages and disadvantages of different types of locomotion system: legged versus wheeled system.
- *Robot Control System Architectures*: General Control Structure for Mobile Robots, Perception Action Models, Subsumption Hierarchies, Layered Models, Deliberative Agents

Module Assessment:

This module is assessed using both individual and competitive team-based continuous assessment. The continuous assessment element will be assessed either by means of an individual credit system where individuals gain credits for each laboratory session based on the level of quality and completion of the assigned practical work or via group projects or via a mixture of group projects and laboratory work. Additionally mini-theory tests may be carried out during the laboratory element of the module. The continuous assessment will carry a total mark of 100% for the module.

Essential Reading: (author, date, title, publisher)

Roland Siegwart and Illah R. Nourbakhsh, 2004, "Introduction to Autonomous Mobile Robots", Bradford Books. ISBN 0-262-19502-X.

Supplemental Reading: (author, date, title, publisher)

- Saeed B. Niku, 2001, Introduction to Robotics, Analysis, Systems, Applications, Prentice Hall
- Newton C. Braga, 2002, Robotics, Mechatronics, and Artificial Intelligence, Newnes
- Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki, and Sebastian Thrun, 2005, "Principles of Robot Motion : Theory, Algorithms, and Implementations", The MIT Press. ISBN 0-262-03327-5
- Gregory Dudek and Michael Jenkin, 2000, "Computational Principles of Mobile Robotics", Cambridge University Press. ISBN 0-521-56876-5
- John Iovine, 1998, Robots, Androids and Animatrons, McGraw- Hill

Web references, journals and other:

<http://www.allaboutcircuits.com/> (last accessed December 2010)

<http://people.howstuffworks.com/robot.htm> (last accessed December 2010)

Further Details

Duration: 1 semester Contact Hours: 1 lecture hour and 3 lab hours per week

Date of Academic Council approval