

Liverpool John Moores University

Title: INTRODUCTION TO ROBOTICS USING JAVA
Status: Definitive
Code: **3002BELCM** (101118)
Version Start Date: 01-08-2011

Owning School/Faculty: Arts, Professional and Social Studies
Teaching School/Faculty: Bellerby's College - Brighton

Team	Leader
Jarmila Hickman	Y

Academic Level: FHEQ3
Credit Value: 12.00
Total Delivered Hours: 68.00
Total Learning Hours: 120
Private Study: 52

Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	66.000

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Technology	AS1	2 projects where students work in pairs	75.0	
Exam	AS2	Closed book exam on Robotics RISC systems and AI.	25.0	2.00

Aims

The course aims to provide students with:
An introduction to a RISC embedded system (ARM7) and its connection with series of customised peripherals;
Experience of advantages and limitations of a visual programming language and interface (NI LabVIEW);
An ability to use the Java programming language and leJOS API to create programs that control simple and more complex robotic actions and behaviours;
Introduction to aspects of Artificial Intelligence.

Learning Outcomes

After completing the module the student should be able to:

- 1 Identify the functions and understand the interaction between main components of a RISC embedded system and its interfaces with peripherals.
- 2 Use a visual programming language (LabVIEW) to develop programmes that control the actions and simple behaviours of standard robots.
- 3 Understand and use the facilities of the the leJOS API firmware.
- 4 Use the Java programming language to write programmes that control more complex behaviours of customised robots.
- 5 Understand the basics concepts of AI in Robotics and develop robotics programs that operationalise some very simple aspects of AI.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

CW	1	2	3	4	5
EXAM	1	2	3	4	5

Outline Syllabus

1. *NXT robot construction equipment*
 - (a) *Servo motors, (with rotation sensors, and feedback)*
 - (b) *Ultrasonic distance and movement sensor*
 - (c) *Sound sensor, with sound pattern and tone recognition*
 - (d) *Light sensor, detecting different colors and light intensity*
 - (e) *Robot structural components*
2. *The NXT Hardware & resident software*
 - (a) *32-bit ARM7 main microprocessor*
 - (b) *256 KB flash memory, 64 KB RAM*
 - (c) *60x100 pixel LCD matrix display*
 - (d) *USB 2.0 port*
 - (e) *Bluetooth wireless functionality*
 - (f) *Digital Wire Interface*
 - (g) *NI LabVIEW*
 - (h) *Java revision and introduction to the leJOS API: (firmware replacement for programmable NXT controller, including Java Virtual Machine (JVM))*
3. *Construction Techniques*
4. *Bluetooth connectivity*
5. *Robot Sensing*
 - (a) *Vision, Sound, Scanning, touch*
 - (b) *Robot Behaviors*
 - (c) *Grabbing, Balance, Navigation, Mapping*
 - (d) *Introduction to AI concepts in Robotics: Robotic Vision, Subsumption Architecture, Reinforcement Learning, Neural Networks, Genetic Algorithms.*

Learning Activities

Students will progress through:

Series of practical workshop sessions examining the components and functions of a RISC embedded system.

Textbook guiding students through a progressively complex series of practical robot construction exercises demonstrating how to develop robot control programs using firstly a visual programming language and later the Java programming language using the leJOS API firmware.

Undertake 2 assessed projects working in pairs that require construction of a robot and development of a control program to a specific brief.

Undertake an assessed project working as an individual that require construction of a robot and development of a control program to a brief of the students own choosing but which meets the approval of the teaching staff in terms of scope and complexity.

References

Course Material	Book
Author	Bagnall, B
Publishing Year	2007
Title	Maximum Lego NXT
Subtitle	Building Robots with Java Brains
Edition	
Publisher	Variant Press
ISBN	9780973864915

Notes

The module will give students an introduction to a RISC embedded system, experience of a visual programming language and interface and an introduction to aspects of Artificial Intelligence.

Assessment:

2 assessed projects (in pairs) that require construction of a robot and development of a control program to a specific brief.

1 assessed project (individual) requiring construction of a robot and development of a control program to a brief of the students own choosing and meeting the approval

of the teaching staff in terms of scope and complexity.

Students will be able to ask for assistance with these assessed projects from the teacher; teachers will adjust the assessed projects marks for those students who have needed more assistance to complete the tasks than has been given to the group as a whole. This will allow all students to complete the assessed projects without inflating assessment grades. This is a standard procedure used by IGCSE and A level Examination Boards.

Students will complete a 2 hour closed book examination testing their understanding of the concepts of Robotics, RISC embedded systems and AI concepts.