Full Title | Internet of Things Project
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Status | Uploaded to Banner
Start Term | 2020
NFQ Level | 07
ECTS Credits | 10
Module Code | ELEC07085
Duration | Stage - (26 Weeks)
Grading Mode | Numeric
Department | Electronic & Electrical Eng
Module Author | Michelle Lynch
Co Authors | Natasha Rohan

Module Description
The Internet of Things (IoT) project module provides a structured engineering project experience in the general application area of the Internet of Things. Students develop an individual project in a collaborative learning environment, with structured support lectures, laboratories and mentoring on selected subject areas. The module progresses from idea creation, research and planning through design, build, coding, test, problem-solving, presentation and demonstration, while incorporating agile principles. Students focus on technical skills and soft skills concurrently throughout the module.

Learning Outcomes
On completion of this module the learner will/should be able to:

1. Research an IoT based application area and create a project proposal, following general requirements.
2. Discuss a selected IoT application area, including industry, trends, technologies, ethics.
3. Investigate & select suitable hardware and/or software elements to use in a project, following general guidelines.
4. Develop, integrate, build and test hardware and/or software elements of a project, on a specified Internet of Things development platform.
5. Apply problem solving techniques to technical and other issues that arise in the context of a project.
6. Manage project deliverables throughout the project timeline in an agile environment.
7. Contribute towards a collaborative working environment, as well as work independently towards project goals.
8. Demonstrate project technical functionality, and understanding of technical and mathematical concepts and implementations incorporated.
9. Communicate project ideas, design and deliverables, using professional tools and guidelines.

Indicative Syllabus
In the initial phase of the IoT module, technical and soft skill topics can include:

- Overview of the Internet of Things (IoT) area, including technologies, applications and current trends.
- Consideration of IoT in the more specific area(s) of the academic Programme being undertaken.
- Guidelines on performing research using online sources, data-sheets, code re-use, referencing.
- Writing a project proposal.
- Developing and refining an architectural block diagram of the project.
- Project planning, including organisation, configuration management, log books and deliverables.
- Selecting hardware and software components.
- Technical introduction to the specific IoT development platform(s) to be used, for example Arduino IDE & development boards.

Examination of Arduino (or other) software, libraries, hardware, interfaces and power considerations. Structured technical laboratories focus on the development tools, running example projects, basic troubleshooting and debugging techniques.

Subsequently, topics include general technical and soft skill topics which will be common to many of the students' IoT projects. Laboratories include more tailored mentorship, supporting the creating, developing, testing, execution and delivery of an individual IoT project. Topics can
include:
- Serial interfaces, analog and digital sensor interface, common environmental sensors such as temperature/CO2.
- Networking an IoT project, eg Ethernet, WiFi or alternative RF modules, Bluetooth.
- General programming topics, eg control, functions, modular programming, files, variables, object-oriented programming, coding style.
- Embedded programming constructs, eg delays, interrupts, timers.
- Modems and interfacing, eg GPS, GSM.
- Motors, eg DC, servo, stepper, and PWM concepts.
- Basic client-server concepts and implementation.
- Basic web-page development.
- Presentation display and/or plotting of data.
- Data analysis and data storage.
- Problem-solving techniques.
- Creating project summaries, both verbal and written.
- Poster design, including the pitch, layout, style, use of visuals and/or text.
- Presentation skills, including personal style. Guidance on effective use of presentation aids such as MS PowerPoint.
- Preparing for, setting up and running a technical project demonstration.
- Handling questions in the context of a project demonstration or interview. Answering questions at a whiteboard.
- Report writing, including layout, style, content and appropriate engineering diagrams and visuals.

Teaching and Learning Strategy

The teaching and learning strategy comprises a combination of practical mentored laboratories and supporting lectures. An authentic engineering project process is followed, with incremental development and delivery of elements and milestones, incorporating agile development principles. Independent learning is promoted, with students developing an individualised project from idea creation through execution, incorporating enquiry based learning, and requiring critical thinking and problem-solving. All projects have common technical IoT elements as well as communication and presentation requirements, for which supporting lectures are designed. A collaborative learning environment is fostered throughout.

Assessment Strategy

Assessment is continuous assessment based, comprising a range of elements throughout the project process including technical functionality and demonstration elements, and communication and presentation elements. Rubric-based metrics are used throughout, which address performance in areas including research, technical content, demonstration of understanding, degree of complexity, initiative and engagement, organisation, communication style and content.

Repeat Assessment Strategies

Students can repeat the module in the Autumn session, usually by a practical and oral demonstration of their IoT project, with associated deliverables.

Indicative Coursework and Continuous Assessment:

<table>
<thead>
<tr>
<th>Form</th>
<th>Title</th>
<th>Percent</th>
<th>Week (Indicative)</th>
<th>Learning Outcomes</th>
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<tbody>
<tr>
<td>Assessment</td>
<td>Technical Functionality &amp; Demonstration</td>
<td>20 %</td>
<td>End of Semester</td>
<td>1,2,3,4,5,6,7,8,9</td>
</tr>
<tr>
<td>Assessment</td>
<td>Technical Functionality &amp; Demonstration</td>
<td>40 %</td>
<td>End of Term</td>
<td>1,2,3,4,5,6,7,8,9</td>
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<tr>
<td>Assessment</td>
<td>Report</td>
<td>15 %</td>
<td>End of Term</td>
<td>1,2,3,4,5,6,8,9</td>
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<tr>
<td>Assessment</td>
<td>Presentation</td>
<td>10 %</td>
<td>End of Term</td>
<td>1,2,3,4,5,6,8,9</td>
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<tr>
<td>Assessment</td>
<td>Poster</td>
<td>5 %</td>
<td>Week 20</td>
<td>1,3,4,6,8,9</td>
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<tr>
<td>Assessment</td>
<td>Video</td>
<td>5 %</td>
<td>Week 24</td>
<td>1,2,3,4,6,8,9</td>
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<tr>
<td>Assessment</td>
<td>Log</td>
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Blended Delivery Mode Average Weekly Workload:

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<th>Description</th>
<th>Location</th>
<th>Hours</th>
<th>Frequency</th>
<th>Weekly Avg</th>
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<tbody>
<tr>
<td>Practical</td>
<td>Laboratory</td>
<td>Engineering Laboratory</td>
<td>2</td>
<td>Weekly</td>
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<td>Lecture</td>
<td>Lecture</td>
<td>Online</td>
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<td>Weekly</td>
<td>1.00</td>
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## Required Reading Book List

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Publisher/Edition</th>
<th>ISBN</th>
<th>ISBN-13</th>
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<tbody>
<tr>
<td>Margolis, M.</td>
<td>Arduino Cookbook</td>
<td>O'Reilly Media, Inc.</td>
<td>9781449313876</td>
<td>1449313876</td>
</tr>
<tr>
<td>Lippman, B.</td>
<td>C++ Primer</td>
<td>Addison-Wesley Professional; 5 edition (August 16, 2012)</td>
<td>9780321714114</td>
<td>0321714113</td>
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<tr>
<td>Kernighan, W.</td>
<td>The C Programming Language</td>
<td>Pearson Professional</td>
<td>0131103628</td>
<td>9780131103627</td>
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<tr>
<td>Purdum, J.</td>
<td>Beginning C for Arduino, Second Edition</td>
<td>Apress</td>
<td>1484209419</td>
<td>9781484209417</td>
</tr>
<tr>
<td>Bayle, J.</td>
<td>C Programming for Arduino</td>
<td></td>
<td>1849517584</td>
<td>9781849517584</td>
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## Literary Resources

To follow.

## Online Resources

- [https://www.arduino.cc/](https://www.arduino.cc/)
- [https://www.adafruit.com/](https://www.adafruit.com/)
- [https://learn.sparkfun.com/](https://learn.sparkfun.com/)
- [https://www.instructables.com/](https://www.instructables.com/)
- [https://iot.stackexchange.com/](https://iot.stackexchange.com/)
- [https://iot forall.com/](https://iot forall.com/)
- [https://internetofthingsagenda.techtarget.com/](https://internetofthingsagenda.techtarget.com/)
- [https://www.smart-industry.net/](https://www.smart-industry.net/)
- [https://www.open-electronics.org/](https://www.open-electronics.org/)

## Other Resources

Other resources are available through the module's Moodle site.

## Programme Membership

GA_EAURG_B07 202000 Bachelor of Engineering in Automation & Robotics