School of Computing and Information Systems

Unit Outline

KXA404 Embedded Systems

Semester 2, 2010
Sandy Bay Campus, Hobart
Newnham Campus, Launceston

Unit Coordinator
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Please note that Dr. Waheed Hugrass and Dr. Vishv Malhotra will be sharing the lecturing duties during the semester.

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UNIT OVERVIEW

Introduction
The objective of this unit is to present the basic principles of writing software for embedded systems. The unit will start by introducing the concept of an embedded system from a hardware perspective covering the important aspects that a software designer should be aware of. From there, the unit will look at: development methods, software architectures, interrupts, real time operating systems, and the principles and practise of developing a working system.
The students will program the OOPIC board to perform simple tasks. While the OOPIC does not allow the students to experience the full range of embedded system design tools, it can be an enjoyable educational experience

Prerequisites
None
Unit Weight
12.5% of one academic year

Teaching Pattern
Lectures: 2 hr/wk
Tutorials: 1 hr/wk

Unit Content
A brief summary of the areas looked at:

- Introduction and examples of embedded systems.
- Distinguishing features of embedded hardware.
- Distinguishing features of embedded software.
- Embedded systems development tools.
- The OOPIC microcontroller and its IDE.
- Basic Embedded Software Engineering
- Time-triggered operation of embedded systems.
- Real time operating systems.
- Testing and debugging.
- Tools for verification of safety and progress properties of the system.
- Modelling systems with independent concurrent components using Linear Transition System (LTS).
- Verifying and debugging system models using LTS Analyser (LTSA).

For more information see the section titled 'Content' on the unit website.

Learning Outcomes
On successful completion of this unit, you will be able to:

1. Explain the important characteristics of an embedded system that differentiate it from other computing systems.
2. Demonstrate an understanding of the architecture and design issues for embedded systems.
3. Demonstrate an understanding of real time programming issues.
4. Demonstrate an understanding of simulation tools to verify safety and progress property of the systems.
5. Develop simple embedded applications using the OOPIC microcontroller.
6. Discuss current industry and research issues associated with embedded systems development.
7. Discuss current embedded system technologies.

Generic graduate attributes
The university has defined a set of generic graduate attributes expected in its graduates. [http://www.utas.edu.au/policy/attributes_grads.pdf](http://www.utas.edu.au/policy/attributes_grads.pdf) Your course is designed to enable you to develop generic skills that are valued in, and expected of, graduates. These are skills that you will need to develop over time. Hence you are encouraged to look for opportunities, as you study each unit, to reflect on and improve these skills.

Knowledge:
The architecture of embedded system, hardware-software codesign, embedded software development, interrupt servicing mechanisms, real-time operating systems, CAN and I2C buses.
Problem-solving:
Design simple embedded systems based on the OOPIC board.
Verify and debug system models using LTSA.

UNIT ASSESSMENT

Assessment Pattern
Internal (40%), Exam (60%)

Assessment Summary
<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Tests</td>
<td>15%</td>
<td>2:00 pm on Wednesday of weeks 4, 6 and 8</td>
</tr>
<tr>
<td>Assignment 1</td>
<td>5%</td>
<td>3 PM Wednesday 18/8, Week 6</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>5%</td>
<td>3 PM Wednesday 22/9, Week 10</td>
</tr>
<tr>
<td>OOPIC Pracs</td>
<td>15%</td>
<td>Week 12</td>
</tr>
<tr>
<td>End of Semester Exam</td>
<td>60%</td>
<td>University Examination Period</td>
</tr>
</tbody>
</table>

**Assessment Items**

**Item 1**
- **Title:** Short Tests
- **Type:** In-Semester - learning tasks
- **Task Length:** 50 minutes or less
- **Weighting:** 15%
- **Links to Learning Outcomes:** 1, 2, 3, 4, 5, 6, 7
- **Due:** 2:00 pm on Wednesday of weeks 4, 6 and 8
- **Description:** Tests will form the basis for discussion of the following tutorial

**Item 2**
- **Title:** Assignment 1
- **Type:** In-Semester - individual assignment
- **Task Length:** not applicable
- **Weighting:** 5%
- **Links to Learning Outcomes:** 5
- **Due:** 3 PM Wednesday 18/8, Week 6
- **Description:** Assignment 1 will be distributed in week 4.

**Item 3**
- **Title:** Assignment 2
- **Type:** In-Semester - individual assignment
- **Task Length:** not applicable
- **Weighting:** 5%
- **Links to Learning Outcomes:** 3, 4
- **Due:** 3 PM Wednesday 22/9, Week 10
- **Description:** Assignment 2 will be distributed in week 8.

**Item 4**
- **Title:** OOPIC Pracs
- **Type:** In-Semester - learning tasks
- **Task Length:** Not applicable
- **Weighting:** 15%
- **Links to Learning Outcomes:** 5
- **Due:** Week 12
- **Description:** You will be given an individual (randomly chosen) practical task to perform using the OOPIC board. The mark awarded will depend on your ability to complete the task successfully within the allocated time and the quality of your software.

**Item 5**
- **Title:** End of Semester Exam
- **Type:** Formal Examination
- **Task Length:** 2 hours
- **Weighting:** 60%
- **Links to Learning Outcomes:** 1, 2, 3, 4, 6, 7
- **Due:** University Examination Period
- **Description:** No materials are permitted in the exam (i.e. closed book)

See the 'Assessment' section in unit website for more detailed information about assessment items.

**How your Final Grade will be determined**

Overall assessment will be based on the student’s performance throughout the semester as well as in a formal examination. In order to achieve a pass (or better) result, a student must obtain:

1. at least 45% of the total mark for in-semester assessment items
2. at least 45% of the mark for the formal examination
3. at least 50% of the overall mark

**UNIT RESOURCES**

**Unit Web Site**

This unit is Web Supplemented. This means that the use of the Web is optional for this unit. The unit website contains unit information and resources. The unit website is accessed from http://www.utas.edu.au/coursesonline/. You will need to use your university email pop account username and password to log on to the MyLO system. Once authenticated by the system your
personalised MyLO Learning Online area will be displayed. It contains links to the websites that you have permission to access - including the website for this unit.
If you are not able to access the unit website, please contact the University IT help desk:
Entrance Level, Morris Miller Library, Sandy Bay Campus;
Entrance Level, Launceston Campus Library, Newnham Campus.
Telephone: 6226 1818 and 1300 304 903.
The 1300 number is a local call from within Tas, with the exception of mobiles.
Email: servicedesk@utas.edu.au
Website: http://www.utas.edu.au/servicedesk/student/index.html

Prescribed Text
None

Readings
Readings will be introduced on a weekly basis to coincide with the current topic under discussion. Some general books, available in the library, that will act as good reference material are:

- "Programming and customizing the OOPic microcontroller", Dennis Clark, 2003.

Software
The software that you will need to access the unit website and to study this unit, including general purpose software such as word processors, is provided on the computers in the School's computing labs. If you intend to use software on other computers please check that the versions are compatible.

GENERAL RESOURCES

School Website
School of Computing and Information Systems - Faculty of Science, Engineering, and Technology.
http://www.cis.utas.edu.au

Faculty Website
Information and Resources for Faculty of Science, Engineering and Technology students are available on the faculty website at: http://www.utas.edu.au/scieng

University Website
Information and Resources for 'Current Students' are available on the university website at:
http://www.utas.edu.au/students/

School Help Desk
Contact the School Help Desk if you have any queries or problems with accessing, using, or printing from the computers in the School of Computing and Information Systems labs.

In Hobart the Help Desk is located on level 3 in the Centenary Building, and is open from 10:00am-12:00pm, and 2:00pm-4:00pm Monday-Friday. The phone number is 6226 2929.

In Launceston the Help Desk is located near the entrance to the computing labs and is open from 10:00am-12:00pm, and 2:00pm-4:00pm Monday-Friday. The phone number is 6324 3447.

Both help desks will accept queries over the phone outside the standard opening hours.

The computer labs at the Cradle Coast Campus are maintained by ITR - please contact the University Help Desk for assistance with these computers.

Computing Facilities
The School has PC labs (running Windows XP), Mac labs (running Mac OS X 10.6), and special purpose Networking labs at the Newnham and Sandy Bay campuses. All students are provided with logins for Windows, Macintosh and Unix environments. If you have not used these facilities before please contact the School Help Desk to collect your account details. If you would like to access these facilities after hours please contact the School Help Desk.

In Hobart, there will be 4 PC Labs, 2 Mac Labs, and 1 Networks Lab in the Centenary Building. In Launceston, there
are 2 PC Labs, 1 Mac Lab, 1 Networks Lab, and one Multipurpose Lab in Building V.

Use of Facilities

Use of computing facilities provided by the School is subject to the School's Ethics Guidelines, details of which are posted at [http://www.cis.utas.edu.au/cisview/ethics.jsp](http://www.cis.utas.edu.au/cisview/ethics.jsp). Copies of the guidelines are also available in all School labs. The School's facilities may only be used for study-related purposes, and may not be used for personal gain. Anti-social behaviour in labs such as game playing, viewing pornography, loud discussion, audio without the use of head-phones, etc is strictly prohibited in all labs at all times. Eating, drinking, and smoking is not permitted in the labs. Before being granted access to the School's facilities, you will be required to sign a declaration that you have read and understand these guidelines, and that you will abide by them. Disciplinary action may be taken against students who violate the guidelines.

Learning Strategies

If you need assistance in preparing for study please refer to your tutor or lecturer. For additional information refer to the Learning Development website: [http://www.utas.edu.au/learndev/](http://www.utas.edu.au/learndev/)

If you will be using MyLO for the first time and would like some information on how to use MyLO refer to the following website: [http://www.utas.edu.au/coursesonline/mylo-support.htm](http://www.utas.edu.au/coursesonline/mylo-support.htm)

Some of the units you will study use videoconferencing to deliver lectures and tutorials. To enable you to get the best out of a videoconference please refer to the following guide: [http://www.its.utas.edu.au/videoconf/vcstudentguide.pdf](http://www.its.utas.edu.au/videoconf/vcstudentguide.pdf)

Help resolving concerns about this unit

In the first instance you should contact your lecturer. If the matter is not resolved then you should contact the Head of School. If the matter is still unresolved and you would like to know who to contact or the procedures for resolving your concern refer to the following website: [http://acserv.admin.utas.edu.au/complaints_info.html](http://acserv.admin.utas.edu.au/complaints_info.html)

The Tasmanian University Union (TUU) may also be able to assist.

The School reserves the right to alter the details contained in this Unit Outline. Students will be advised of changes to the outline via their University email account and it remains the responsibility of the student to check their email for such changes.

Occupational Health and Safety

The university is committed to providing a safe and secure teaching and learning environment. For more information see [http://www.admin.utas.edu.au/hr/ohs/pol_prof/](http://www.admin.utas.edu.au/hr/ohs/pol_prof/)

University Services and Support

If you are experiencing difficulties with your studies or assignments, have personal or life planning issues, disability or illness which may affect your course of study, you are advised to raise these with your lecturer in the first instance.

The University has staff available to assist you, such as the:

- Learning Development Advisor
- Student Counselor
- Careers Advisor
- Disability Officer

For more information and contact details see the Services and Support section on the University 'Current Students' web page: [http://www.utas.edu.au/students/](http://www.utas.edu.au/students/)

GENERAL ASSESSMENT

Approach to Learning

The University is committed to high standards of professional conduct in all activities, and holds its commitment and responsibilities to its students as being of paramount importance. Likewise, it holds expectations about the responsibilities students have as they pursue their studies within the special environment the University offers.

The University’s Code of Conduct for Teaching and Learning states:

Students are expected to participate actively and positively in the teaching/learning environment. They must attend classes when and as required, strive to maintain steady progress within the subject or unit framework, comply with workload expectations, and submit required work on time.

You are expected to spend about 130 hrs studying in this unit - this includes attendance at scheduled teaching
sessions. (For a 13 week semester this is, on average, 10 hr/wk.) This is the amount of study time that the ‘typical’ student will need to reach the level of competence and understanding required to fulfil the unit objectives. You are expected to:

- attend all scheduled teaching sessions, unless otherwise notified by the unit coordinator
- prepare for, and actively participate in all scheduled teaching sessions
- complete the assigned learning tasks
- review what has been learnt
- complete assessment items and submit them on time
- access and be familiar with the information and resources available on the unit website
- seek help from teaching staff if you have any questions or difficulties in studying this unit

You are encouraged to read the university's Code of Conduct for Teaching and Learning. Part A describes the 'Responsibility of the University to Students' and part B describes the 'Responsibilities of Students to the University'.


It is expected that students will familiarise themselves with access and use of the MyLO system operated by the University for the electronic delivery of course materials, and for various forms of communication.

It is expected that students will consult email sent to their University email address at least twice a week for notices relating to the administration of the unit, and for notification of the results of assignments.

It is expected that students will read the background material specified in the course curriculum, will actively attend and participate in tutorials, and be prepared to discuss relevant issues arising with tutors, lecturers and fellow students.

Student Expectations of the Unit

Students enrolled in this Unit may reasonably expect the following:

1. To be able to contact a lecturer or tutor by electronic mail, to raise issues arising in the unit, either relating to content or student performance within the unit.
2. Subject to availability, to be able to discuss such issues in person with the lecturer or tutor.
3. That assignments will be marked and the marks will normally be returned within 3 weeks of due dates.
4. That all relevant notices regarding the administration of the unit, including any necessary changes, will be communicated to all students enrolled in the unit via email.

These expectations are in addition to those specified in relevant University regulations.

Plagiarism

Unless specifically stated in the specification of the assessment item provided on the unit website, it is required that:

- work submitted by a student is the work of that student alone OR
- where the assessment item is to be completed by a group of students, the work submitted by the group of students is the work of that group of students alone.

While students are encouraged to discuss the assignments in this unit and to engage in active learning from each other, it is important that they are also aware of the University’s policy on plagiarism. Plagiarism is taking and using someone else’s thoughts, writings or inventions and representing them as your own; for example downloading an essay wholly or in part from the internet, copying another student’s work or using an author’s words or ideas without citing the source.

"Plagiarism is a form of cheating. It is taking and using someone else's thoughts, writings or inventions and representing them as your own; for example, using an author’s words without putting them in quotation marks and citing the source, using an author's ideas without proper acknowledgment and citation, copying another student's work.

If you have any doubts about how to refer to the work of others in your assignments, please consult your lecturer or tutor for relevant referencing guidelines, and the academic integrity resources on the web at http://www.academicintegrity.utas.edu.au.

The intentional copying of someone else’s work as one’s own is a serious offence punishable by penalties that may range from a fine or deduction/cancellation of marks and, in the most serious of cases, to exclusion from a unit, a course or the University. Details of penalties that can be imposed are available in the Ordinance of Student Discipline – Part 3 Academic Misconduct, see http://www.utas.edu.au/universitycouncil/legislation/.

The University and any persons authorised by the University may submit your assessable works to a plagiarism checking service, to obtain a report on possible instances of plagiarism. Assessable works may also be included in a reference
It is important that you understand this statement on plagiarism. Should you require clarification please see your unit coordinator or lecturer. Useful resources on academic integrity, including what it is and how to maintain it, are also available at: http://www.academicintegrity.utas.edu.au

Referencing

The preferred text referencing systems for the School is the Harvard system (also referred to as the author-date system). In your written work you will need to support your ideas by referring to scholarly literature, works of art and/or inventions. For information on presentation of assignments, including referencing styles: http://utas.libguides.com/referencing

It is important that you understand how to correctly refer to the work of others and maintain academic integrity. Failure to appropriately acknowledge the ideas of others constitutes academic dishonesty (plagiarism), a matter considered by the University of Tasmania as a serious offence. The university document on plagiarism contains information about referencing the work or ideas of others (see http://www.utas.edu.au/plagiarism/).

Submissions

The details of the submission method (paper, electronic or other) for each assignment will be supplied in a separate assignment specification sheet. All in-semester assignment submissions (including electronic submissions) are to include an Assignment Cover Sheet which includes a statement confirming that the submission is your own work. The Assignment Cover Sheet is available from the School Help Desk in Launceston and Hobart, and on the School's web site: http://www.cis.utas.edu.au/cisview/resources.jsp.

Students must take responsibility for the correct submission of their assignments. Students are expected to adhere to the following procedure for submission:

- Submitted files MUST be checked by the student to ensure that correct submission of the file has been undertaken.
- Students are expected to notify the Lecturer WITHIN TWO HOURS of submission if their files have not been submitted correctly.
- Students must take responsibility for safely backing up of their own files during the academic year to ensure that no files are permanently lost.

Extensions

Assessment items will not be accepted after the due date except under the conditions stated in the School policy on late assessment. http://www.cis.utas.edu.au/downloads/ExtensionPolicy.pdf (PDF - 100KB).

Review of Assessment and Appeals

1. It is expected that students will adhere to the following policy for review of any piece of continuous assessment.
   a. Within 5 days of the release of the assessment result, the student should request an appointment with the Lecturer. The student should be prepared to discuss specifically which section of the marking criteria they are disputing and why they consider the mark is inappropriate.
   b. Following this discussion, students may request a formal remark of the original submission (in accordance with Rule of Academic Assessment 111, clause 22.1). This remark will be undertaken, where practicable, by an alternative assessor.
2. Students may also request a review of the final result in a unit. The request and payment must be made within 10 days from the date of the result notification. Students are referred to Rule of Academic Assessment 111, clause 23 at http://www.utas.edu.au/universitycouncil/legislation/rule111.pdf and http://www.admin.utas.edu.au/ac_serv/flowchart_review_assesment.pdf.

Complaints Procedure

It is expected that students will adhere to the following policy for making any complaint or grievance directly related to a Unit:

a. In the first instance, students are to approach the Lecturer or Unit Coordinator concerned and arrange a time to speak with them about their concern.

b. If an issue remains unresolved, the student should approach the Head of School and arrange a time to speak with them about their concern.

If the School's internal policy of complaints is unable to resolve an issue, students should consult Ordinance 8 Student Complaints for further direction, see http://acserv.admin.utas.edu.au/complaints_info.html

Formal Examination
The formal examination is conducted by the University Registrar. The 'Current Students' section on the university website contains information about the conduct of, and timetable for, formal examinations.

**Final Grade**

Passing grades will be awarded based on the AVCC guidelines:

- PP at least 50% of the overall mark but less than 60%
- CR at least 60% of the overall mark but less than 70%
- DN at least 70% of the overall mark but less than 80%
- HD at least 80% of the overall mark

In order to comply with the benchmarks set by the Faculty of Science, Engineering & Technology for distribution of grades in units, both the in-semester and examination marks that students obtain may be adjusted either upwards or downwards. See [http://fcms.its.utas.edu.au/scieng/scieng/policies.asp](http://fcms.its.utas.edu.au/scieng/scieng/policies.asp) for details of the Faculty Assessment Guidelines.