



MSc/BEng/MEng* Degree Examinations 2013/14

DEPARTMENT OF COMPUTER SCIENCE

Embedded Systems Project (EMPR)

Open Group/Individual* Assessment

Issued: Wednesday, Week2, Spring Term 2016

Submission and Feedback due:

Upload of Code/Design to repository

Embedded Systems Project Software Submission [5%] (Spr/10/Wed) 2016

Feedback: 20th Apr (Sum/2/Wed) 2016

Demonstration of Work Completed

Embedded Systems Project Demonstration [40%] (Spr/10/Fri) 2016

Feedback: 22nd Apr (Sum/2/Fri) 2016

Submission of Written Report

Embedded Systems Project Report [55%] (Sum/3/Wed) 2016

Feedback: 25th May (Sum/7/Wed) 2016

All students should submit their work through the electronic submission system:

<http://www.cs.york.ac.uk/student/assessment/submit/>

An assessment (or part of an assessment) submitted after this deadline will be marked initially as if it had been handed in on time, but the Board of Examiners will normally apply a lateness penalty to the whole assessment.

The feedback and marks date is guided by departmental policy but, in exceptional cases, there may be a delay. In these cases, all students expecting feedback will be emailed by the module owner with a revised feedback date. The date that students can expect to see their feedback is published on the module descriptor: <http://www.cs.york.ac.uk/modules/>

Your attention is drawn to the Guidelines on Mutual Assistance and Collaboration in the Departmental Statement on Assessment: <http://www.cs.york.ac.uk/student/assessment/policies/#AcademicMisconduct>

Any queries on this assessment should be addressed to Dr Crispin-Bailey, chrisb@cs.york.ac.uk

Answers that apply to all students will be posted on the EMPR webpage.

EMPR ASSESSMENT 2015-16

The 2015/16 EMPR assessment will be based on a scanning sensor platform (Appendix 1), which utilises a dual-sensor head consisting of infrared and ultrasonic sensors, mounted on a servo motor assembly. When interfaced to the MBED board, the module will allow the sensor head to be turned through an angular range of around 180 degrees, under control of the MBED board, and sensor readings may be taken at any available position or positions, to compose a sensor profile of one or more readings. The (ultrasonic and infrared) sensors are primarily concerned with measuring the range of objects, based upon their respective principles.

The project goals are divided into two distinct working sections:-

- The **group** component, worth 30 marks, is to be undertaken in groups of four students, unless otherwise specified by the tutor (according to exceptional circumstances). Full cooperation and collaboration is permitted within the group for this task. Groups are expected to conduct themselves appropriately and professionally (see Appendix 2).
- The **individual** component, worth 10 marks, is to be undertaken by each distinct team member as a personal endeavour. No collaboration is permitted on this component. Teams are allowed to cooperate in providing essential information about the main group component, where the individual component is to connect/interface to it.
- **Further guidance** :- Groups are allowed to agree a collective system specification that facilitates individual project interfacing, however any failure of the group to meet this specification is not to be considered to be a mitigating factor in limiting an individual's component outcome.

Assessment Marks (100 marks { 40 + 55 + 5 }) :-

The explicit project aims and objectives are set out in Table-1 (Group project requirements) and Table-2 (individual project options). The marks are broken into three main parts as noted below:-

Assessment by Demonstration (40 marks) :-

- Under normal circumstances, the total mark allocated for the group demonstration will be duplicated for each team member. For example, if Team-5 gains 28 marks in the group project, then each team member will be allocated 28 marks for that component.
- Each student should choose ONE individual component labeled IC1 to IC6. Assessment marks are allocated according to Tables 3 and 4 for work demonstrated as fulfilling the group component and the individual component.

Assessment by Report (55 marks) :-

A written report will be submitted, according to the content and marks defined in Table-5. Note that whilst the group project is the larger part of the total marks for demonstration, the individual component is more prominently weighted in the written report.

Code/Design Submission (5 marks) :-

A fixed 5 mark award is allocated for each individual candidate when they personally upload a set of 'code/design' files by the designated deadline in Spring Term. Code includes all group solution code plus your individual code (or circuit diagrams etc. if relevant).

TABLE 1 – TEAM PROJECT SYSTEM REQUIREMENTS

| MEASUREMENT | |
|--|---|
| M1 | MBED provides a CALIBRATION MODE in which it accepts two (or more) manually set calibration points to calibrate its distance scale. |
| M2 | MBED provides a TAPE-MEASURE MODE in which it can measure distance whilst the sensor head is stationary. |
| M3 | <p>MBED provides a SCAN MODE in which the sensor head can be rotated by the servo through its full range, and distance measurements taken at multiple points* during the rotation.</p> <p><i>*Must have at least 20 points in the scan range , preferably more.</i></p> |
| M4 | MBED provides a MULTI-VIEW MODE where the system can combine two or more sweeps of an object such that if the object is rotated between sweeps an all-round profile of the object can be created, (for example four sweeps with object rotated 90 degrees per sweep). |
| | |
| USER INTERFACE | |
| UI1 | Onboard LCD displays distance continually in TAPE-MEASURE MODE . |
| UI2 | KEYPAD or other custom hardware (not a pc) allows parameters and modes to be changed, including :- { sweep speed, samples per sweep, start and stop positions } { tape mode, sweep mode, multi-view mode, calibrate } |
| UI3 | LCD panel display shows relevant information during sensor scans :- { sweep mode , required speed, samples per sweep } { sensor values, servo angle, current distance, average distance } |
| | |
| External PC Data Display | |
| D1 | Displays raw sensor data as it is acquired |
| D2 | Displays scan sweep(s) as graphical plot or suitable graphical representation relevant to the mode the system is operating in * |
| D3 | Plot updates in real-time (i.e. data is updated during a sweep, not after) |
| | |
| * for example 'radar plot' , overhead view, bar graph. | |

BASIC TECHNICAL SPECIFICATION (INDIVIDUAL WORK COMPONENT)

Each team member should attempt one individual goal without assistance from their team members. Collaboration with respect to informing the candidate about any existing 'team solution' S/W and H/W interfaces is permitted where the work requires to interface to that resource.

Individual component must attempt ONE of the following :-

TABLE-2 INDIVIDUAL COMPONENT OPTIONS

| | |
|------------|--|
| IC1 | Devise a plot system that displays a dynamic 'history' of past sweeps (with fading display plots for example). |
| IC2 | Use distance scan profile to generate a list of 'objects' (on the ARM processor) : <i>{ large/small cylinder, large/small cuboid }</i> <i>{ location angle in sweep pattern }</i> You should display the results on the PC or LCD as a list of objects or display them as a graphical 'map' |
| IC3 | Implement an improved scan mode with higher performance - <i>using averaging or accumulation of sweeps ?</i> - <i>combine multiple sensors perhaps ?</i> , - <i>movement or change detection ?</i> |
| IC4 | Use of the large bitmap lcd panel module (if available) to display a scan image or plot. |
| IC5 | tracking the nearest point/object using narrow sweeps which move to follow the object. |
| IC6 | A self-proposed task, <u>approved by the tutor in advance of its undertaking</u> – examples : Use Audio Feedback in some way, labelling plots with individual object measurements, using multiple scans at different locations to create a map, etc. |

TABLE-3 ALLOCATION OF MARKS FOR DEMONSTRATION OF GROUP PROJECT WORK

| GROUP MARKS AVAILABLE (TOTAL OF 30 MARKS) | Mark Range |
|--|------------------------|
| BASIC TECHNICAL SPECIFICATIONS MET | 0 – 12 |
| ADDITIONAL TECHNICAL COMPETENCE | 0 – 12 [note a] |
| EFFECTIVE GROUP WORKING AND MANAGEMENT <i>includes working arrangements and the impression of each member being able to highlight a balanced set of contributions at the demo.</i> | 0 – 6 |
| <p>[note a] Goal indicators for this component are as follows :-</p> <p>(0 – no evidence of technical skill/knowledge beyond the bare minimum) (3 – Some degree of enhanced operation in some functions & technical knowledge of them) (6 – Significantly enhanced implementation in some key functions & tech knowledge) (9 – Significantly enhanced functionality in most functions & technical knowledge) (12 – all areas undertaken with significantly enhanced technical outcomes & knowledge)</p> <p>Marks awarded can be any value 0 through to 12 to reflect how closely the outcome aligns to the example indicators given above.</p> <p>[note b] Group members who fail to attend the demo will automatically receive Zero for all above parts, and will be advised to make a mitigating circumstances request if appropriate to their situation.</p> <p>[note c] Group members who repeatedly fail to engage and contribute to the group (even after tutor intervention) will be required to demo on their own and will be assessed only on their own specific contributions (using the scheme above).</p> | |

TABLE-4 ALLOCATION OF MARKS FOR DEMONSTRATION OF INDIVIDUAL PROJECT WORK

| INDIVIDUAL MARKS AVAILABLE (TOTAL OF 10 MARKS) | Mark Range |
|--|-----------------------|
| BASIC TECHNICAL SPECIFICATIONS MET <i>Based on the chosen goals and their successful demonstration, and explanations of technical detail (including any questions from the markers).</i> | 0 – 6 |
| TECHNICAL ACHIEVEMENT & KNOWLEDGE <i>Based on the chosen goals and their successful demonstration, and explanations of technical detail (including any questions from the markers).</i> | 0 – 4 [note d] |
| <p>[note d] Goal indicators for this component are as follows :-</p> <p>(0 – no evidence of technical skill or knowledge) (2 – Moderate Evidence of Technical expertise and/or knowledge) (4 – Significantly technical achievement and knowledge demonstrated)</p> <p>Marks awarded can be any value 0 through to 4 to reflect how closely the outcome aligns to the example indicators given above.</p> <p>[note e] The above marking scheme relates to a standard group of 4 students. Variations to the marking scheme are only likely in exceptional circumstances, this may include having to work in a group of three due to divisibility of the students on the module, or where illness forces a group to reduce to three.</p> | |

TABLE-5 WRITTEN TECHNICAL REPORT – REQUIRED SECTIONS AND MARKS

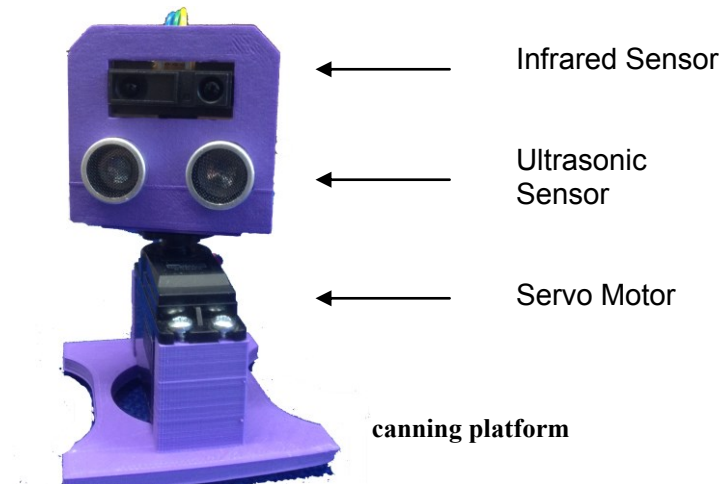
| Num | SECTION TITLE | GUIDANCE | MARKS (55 total) |
|-----|--|--|---------------------|
| R1 | Project Summary | one-page synopsis and review of the group and individual project goals, how the project went for the team, what the goals were, and what were the actual outcomes. | 5 |
| R2 | Professional Considerations | Half-page: discuss a professional, ethical, social or environmental issue associated with the use of your solution as a product. | 5 |
| R3 | Technical description of the group component implementation | Two pages + diagrams, describe the chosen design, discuss reasons for design choices and alternatives. | 10 |
| R4 | Evidence of Testing of group implementation | Two pages, detail the planned test strategy and detail the test results. | 5 |
| R5 | Technical Description of individual component implementation | Two pages + diagrams, describe the chosen design, discuss reasons for design choices and alternatives | 15 |
| R6 | Evidence of testing of individual implementation | Two pages, detail the planned test strategy and detail the test results | 10 |
| R7 | Evidence of preparation for assessment and team management | Copies of your mini-project formative sheets, copies of your group weekly team meeting minutes. | 5 |

ADDITIONAL GUIDANCE

- Please ensure that you include ONLY the sections identified above, and use the designated section numbers R1,R2, etc. Markers can not accept responsibility for locating wrongly numbered sections in order to award marks according to the scheme above.
- Page counts are indicative – there are no strict limits. However you should consider that providing ten pages where two were suggested will not result in five times more marks, and may result in a less readable (possibly lower marked) outcome. Equally, a ½ page is generally unlikely to cover the expectations of a section where a two page guide is given.
- Page count guides are based on TEXT – extra pages due to diagrams are acceptable (use of diagrams is encouraged).
- This report is to be written individually (each group member writes their own report in their own words). Sharing of working diagrams, data print-outs, screenshots, is acceptable.

Appendix-1

Dual-Sensor Scanning Platform



Primary Components :-



HC-SR04
ultrasonic sensor



Sharp 2Y0A21
infrared sensor



MC410 standard SANWA SRN102
One of these two – check your system to see which



NOTE – You are responsible for acquiring information on these devices beyond that initially facilitated – data sheets are to be provided on the module web-site, you should read these, and conduct whatever additional research you need to do to understand the correct operation of each device.

You may wish to designate research tasks to each group member to speed up the initial appraisal of technical issues.

Appendix 2

GROUP CONDUCT AND MANAGEMENT

- Teams should undertake to work effectively together for the full term and also to reasonably facilitate information they hold on the group project work when requested by a group member up until the written report hand in date has expired.
- Teams should hold weekly progress meetings, which are minuted, and have a chairperson and a minute taker (secretary). These roles should be rotated so that all team members perform each role at least once. Meetings should have an agenda, review tasks due for completion, and allocate new tasks.
- Meeting minutes should be signed off by each team member attending a meeting, and copies distributed to each team member (on paper or electronically). These must be submitted as part of the written report (See section R6 of report).
- Inevitably, some groups will encounter difficulties in team management. Illness and lack of engagement are the two key concerns which tend to occur. Teams are responsible for highlighting issues as they occur and not at the end of term in retrospect.
- Teams will be required to fill in a joint review sheet at the assessed demonstration session, and all team members are expected to declare that they have contributed fairly to the team work.
- Team members who repeatedly fail to engage at the group level (not responding to tutor interventions) should be aware that they may receive significantly lower marks for the group. (mitigating circumstances should be addressed to the MC committee).
- Teams who do not highlight team management issues as they occur will not be able to seek any leeway in the final mark allocation and are likely to get a low mark or zero for 'evidence of effective team management/working'