16ELA007: Introduction to Systems Engineering for Projects
Group Project Coursework

Introduction

Three tutorial groups will collaborate to build a tracker capable of visually tracking a land vehicle (bicycle) and providing its co-ordinates during a trip of no longer than three minutes. Each of the three tutorial groups will provide one subsystem for the tracker.

Most of the project details have already been provided in the SEMP assignments (1-4). This document provides some general information and:

1. Key project dates
2. Specification of the Group Project Report
3. Specification of the Group Presentation
4. Specification of the Individual Report
5. Specification of the Delivered Systems Assessment

The intended learning outcomes for the project are provided.

Other previously provided information is also included for clarity and essential information from the previously provided SEMP assignments is repeated in Appendix A.

Learning objectives

Intended Learning Outcomes

The project addresses the following ILOs from ELA007:

(1) Knowledge and Understanding

- Describe and explain the essential systems engineering life cycle activities identified in the Systems and Software Engineering Standard ISO/IEC 15288.

- Describe and explain the application of Systems Engineering, and the role of a Systems Engineer, in a technical project.
- Integrate knowledge from different technical disciplines (as taught in Part A) in the creation of a useful system.

(2) Skills and Attributes

- Plan technical projects using a systems approach.
- Apply basic Systems Engineering techniques to a technical project.
- Create basic systems artefacts: lifecycle and project management plans, causal loop diagram, requirements document, simple architecture design document.

(3) Key/transferable skills

- Make verbal and written presentation of technical information in a clear and precise manner.
- Identify, analyse and report published sources of information in support of projects and assignments.

Experience

Students will gain practical experience in:

- Group work to deliver a (sub-)system
  - This should include planning, allocation of tasks, collaborative design
- Collaborative integration
  - This should include negotiation with other groups, understanding of interfaces (technical and social), testing and assessment
- Application of a systems engineering process
  - Creation of project lifecycle, ideas generation, development of systems requirements from customer/user requirements, simple architectural design, interface specification, verification and validation
- Project management
  - Scheduling, work breakdown, simple risk analysis, monitoring of progress, milestones and deliverables
- Application of theory to practice
  - Use of theory and techniques from modules to design a system
- Communication
  - Written and verbal communication of project outcomes

The project will draw on knowledge developed in:

- ELA007 (Introduction to Systems Engineering for Projects)
- ELA001 (Circuits)
- ELA003 (Electronics A)
- ELA004 (Signals & Systems)
- ELA010 (Programming and Software Design)
- MAA303 (Mathematics A)

Timetabled Sessions

During Semester 2, the timetable for this ELA007 until week 07 is as follows:

Tuesdays, 14:00 – 17:50: practical sessions in rooms W1.28 and W1.29. From 16:00 room W1.21 will also be available.

- Students carry out system development in groups

- In general, project mentors will be available to support students, but there will not be any formal teaching

Thursdays, 09:00 – 09:50: drop-in sessions

- Professor Henshaw will be available in room W2.70 for consultation about the project

Students are advised that when not in use for scheduled classes, the computer rooms W1.21, 1.28, 1.29 may be accessed for practical work.

mbed tuition

Familiarity with programming the mbed will be taught during regular timetabled sessions of ELA010.

An information sheet with practice exercises for the mbed is available on LEARN, in the "Project" block for ELA007

Key Project Dates

Tuesday 31st January 2017	Project briefing
Dates to be notified	Locker Keys available for collection according to allocated time ***to be posted on LEARN***
Monday 27th March 2017 (14:00 – 17:00)	Demonstration Day (location to be advised)
Tuesday 28th March 2017 (14:00 – 17:00)	Contingency Demonstration Day (this will only be used if rained off on the Tuesday)
Friday 5th May 2017, 17:00	Group Project Report submission deadline
Friday 5th May 2017, 17:00	Data file containing latitude and, longitude co-ordinates, velocity, and time for the calculated position of the vehicle during one of the tests
Monday 8th May 2017 (09:00 – 17:50)	Group Presentations Groups will be allocated a single time slot during these periods
Friday 12th May 2017, 17:00	Individual Report submission deadline
Friday 12th May 2017, 17:30	Data file for latitude, longitude, co-ordinates measured on vehicle will be made available on LEARN.
Tuesday 16th May 23:30	Submission deadline for validation document comparing the measured position data (from the previously submitted data file) with position data supplied from the vehicle.

Groups

Students are grouped by tutorial group and the list is available on LEARN. For clarity, the groups are structured as shown in Figure 1.

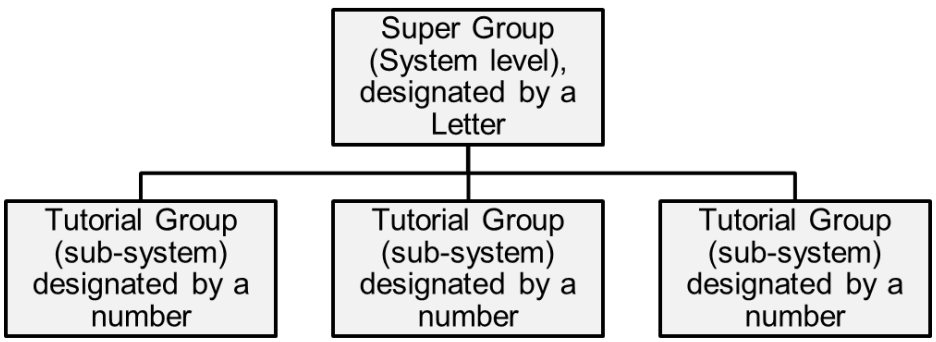

Figure 1: Group Structure

Resources

The following resources will be provided:

Each group will be issued with one mbed LPC1768 with application board, one compass and one GPS. A three axis accelerometer is built into the application board.

Each group will have a budget of £10.00 with which to purchase suitable base upon which the sight may be mounted (the procedure for acquisition will be issued in a separate document). **Only equipment ordered through the school will be paid for in this way. Students are welcome to purchase materials themselves (if they wish), but this will not be reimbursed.**

Groups will be permitted to book up to 23 hours of 3D printing time; however, note that a) access is limited and so it may not be possible for every group to gain access, and b) a sight can be constructed without using 3D printing. The booking procedure for the 3D printer is issued in a separate document.

Lockers are provided in Room W1.21 for each Tutorial Group in which to store equipment and the constructed system. Starting equipment is provided in the locker at the outset.

One member of each tutorial group will be issued with the locker key and will be responsible for the return of the key and equipment at the end of the project.

PLEASE NOTE there will be a schedule for locker key collection issued on LEARN.

Support

Academic support for this project is available through the following sources.

The project consultants are Prof. Henshaw; Drs Dwyer, Chauraya, and Gong; and Mr. Snape. Members of this team will be available in the project rooms (W1.21/28/29) for advertised periods between 14:00 and 17:50 on Tuesdays from week 1 to week 7.

Personal Tutors will be available for consultation on matters associated with the project during the usual Monday tutorials, but please note that their role is advisory and that specific project matters will be dealt with by the project consultants. Students are strongly encouraged to use the tutorial sessions as opportunities to develop their project and technical competence through discussions with their tutor and with each other.

Prof. Henshaw will be available for consultation on Thursday mornings 09:00 – 09:50 in room W2.70. Groups should arrange meeting times in advance.

System demonstration and data collection

A set of six runs will take place on Monday 27th March[1] from 14:00. During this time, students will be able to demonstrate their tracking systems and take readings for analysis.

The first three runs will be practice runs, the last three will be the trips that students are expected to track and provide results as part of the assessment.

It is expected that all members of every team will participate in the demonstration session

[1] If the weather is inclement, then the tests will take place on the morning of Tuesday 28th March instead.

General notes on reports

Referencing

Students are expected to use the School's recommended referencing style: IEEE Numerical as defined by the School (Appendix B).

Front sheet

All reports should have front sheet that includes the following:

- Title
- Author('s) name(s) and student number(s)
- Module code and name of coursework
- Date
- Number of words (excluding diagrams, reference lists, and appendices)

All reports should have numbered pages in the form: page X of Y (where Y is the total number of pages), placed at the bottom centre of each page.

Appendices

Appendices contain information that may be referenced in a report but is not essential to explain the findings of the report. For instance, selected results may be included in a report sufficient to justify the findings, but the full set of results (which are too extensive for inclusion) may be placed in an appendix. Thus, students may find it helpful to attach one or more appendices to their reports, but should keep in mind that only the main body of the report actually attracts marks. As a general rule: a report should be wholly understandable by itself, but an appendix may provide supplementary information to the reader.

For the Group Report, the SEMP is required as an appendix, but will not be marked: it has already been marked as coursework in semester 1.

Friendly advice on assessment criteria

The tables in the sections below provide a detailed description of the criteria against which reports and presentations will be assessed. If you choose not to write about one of the criteria (e.g. no technical content, or nothing about project management), then you should not be surprised if you do not get any marks in that category. Tutors will only mark what they read in the reports or hear in the presentations; they cannot mark what is in your head but missing from the report or presentation.

Submission of reports

Only electronic submission of reports is permitted. Completed reports should be submitted in MSWORD or PDF format on LEARN before the deadline. Reports may be updated up until the deadline; the last submitted version will be marked.

In the case of group reports and group data files, one student should take the responsibility for submission on behalf of the whole group. It is up to students to agree on the final submitted version.

All reports will be submitted to Turnitin[2].

[2] Plagiarism checker

Deliverables

Deliverable 1: Specification of Group Report – Submission 5th May 2017, 17:00

The group concerned with this report is the Tutorial (sub-system) Group. The report is worth 25% of the overall marks for ELA007.

The project report should be written using the following section headings:

- Abstract (150 words strict maximum)
- Project Description, including aim and objectives
- Systems Engineering approach
    - Note that the SEMP will be included as an appendix (not marked); this section should give a very brief summary of the approach used, but explain in more detail deviations from the original plan and comment on the merits and deficiencies of the approach taken
- Project Management
    - The approach and techniques used should be reported, together with an assessment of their effectiveness
- Design
    - Subsystems and integration into the system should be described. Key design drawings and photograph of completed design should be included.
- Error Budget
    - Analysis of error sources and an estimate of the whole system accuracy
- Results
    - The results obtained should be presented appropriately.
    - The calculation method for validating the measurements against the co-ordinates from the vehicle should be included.
- Discussion
    - An analysis of the system performance and results should be provided. It is recognised that the final validation against vehicle measured co-ordinates is not available at the time of writing the report, so no comment is expected on this.
- Conclusions
    - The overall outcome of the project, including key learning points should be provided. Recommendations for changes to the system design, the systems engineering approach or the project management approach may be included.
- References
- Appendices (not marked)

The word limit for the report is 5,000 words (excluding diagrams, reference list, and appendices). The number of words must be reported on the front sheet of the report, and reports that exceed the limit may have 10% of the total report mark deducted.

The marking criteria are shown in Table 1 and guidance to expectations in Table 2.

Criterion	Brief description	Proportion of marks
Technical Design	Design quality and choice of design artefacts; competence of mathematical and technical aspects of design; application of quality control; appreciation of measurement and errors; correctness of mathematics; accuracy of technical discussion; adoption of critical viewpoint; logical deductions; analytical prowess.	40%
Systems Approach	Application of Systems Engineering techniques; appreciation of whole systems perspective; choice of methods; adoption of a critical viewpoint; accurate analysis of systems aspects;	25%
Quality of Presentation	Clarity; precision and concision; Writing quality (Grammar/Spelling); suitability and presentation of diagrams; captions and cross-referencing;	20%
Project Management	Organisational structure (roles and responsibilities); project management plan and implementation; management of risks; appreciation of effectiveness of project management approach	10%
Use of Reference Sources	Suitability of references; adequacy of referencing (acceptable number of references); correctness of references format; correct approach to citing sources.	5%
	Total for Report	**100%**

Table 1: Marking criteria for group project report

The group project report will be marked as a single document and given a mark summed from the contributions of each of the categories in Table 1. Individual marks will be allocated to students in the following manner: all students will be asked to score the other members of their group using the standard Web-PA tool on LEARN; this will enable the overall mark to be allocated appropriately between the members of the group. Note that tutors may apply moderation to these marks if they consider it necessary.

Instructions on the use of Web-PA will be issued towards the end of the project. The criteria against which students will score colleagues are listed in Annexe 1.

<40%	Poorly written and containing errors; little evidence of research or development of their own ideas; poor design and insufficient understanding of technical and systems engineering methods. Insufficient referencing and/or incorrectly formatted references; little evidence of effective teamwork.
40-49%	Reasonably well written with few errors; have introduced their own ideas and evidence of reading beyond the lecture notes. Deliberate selection of appropriate methods and systems engineering techniques; evidence of clear understanding of technical and systems engineering methods; references properly included; evidence of teamwork.
50-59%	Competently written with only minor errors; clear evidence of wider reading and development of original ideas; evidence of competent selection of technical and systems engineering methods; evidence of competent technical understanding and critical analysis of work; appropriately and accurately referenced throughout; clear evidence of effective teamwork and competent planning.
60-69%	Well written throughout with no errors; good use of reference material and evidence of original ideas; evidence of thorough understanding of technical and systems engineering methods and competent selection and application thereof; appropriately and accurately referenced throughout; clear evidence of strong teamwork; good planning and management of project (including specific management of risks).
>70%	Excellently written with no errors; supported by wide reading and excellent selection of reported sources; evidence of creativity; in-depth understanding of technical and systems engineering methods, evidenced through careful selection of techniques and excellent application thereof; appropriately and accurately referenced throughout; excellent teamwork, planning, and project management (including evidence that all appropriate project management documentation has been effectively used).

Table 2: Attainment guidelines for marking the group project report

Deliverable 2: Data File – submission 5th May 2017, 17:00

A data file containing latitude, longitude (co-ordinates), and velocity (2 components) with time for one of the test trips must be submitted. This is the same data that will be used by students to compare with data measured on the vehicle itself. Acceptable formats are txt, csv, or xls.

Failure to submit the file will result in zero marks for the validation file (deliverable 6) of the assessment.

Deliverable 3: Group Presentation - 8th May 2017

The group concerned in this presentation is the super-group (i.e. three tutorial groups combined). Each super-group will be required to present to the assessors (only) at a scheduled time on the presentation day. The presentation is worth 10% of the overall mark for ELA007.

The presentation will last for 20 minutes followed by 10 minutes of questions from the assessors (30 minutes total). The time limits will be strictly applied.

The title of the presentation is **"Systems Integration"** and it should cover this topic with reference to the group's experience of integration in the group project.

The marking criteria are shown in Table 3 and guidance to expectations in Table 4

The group presentation will receive a single mark derived from contributions of each of the categories in Table 3. Individual marks will be allocated to students using Web-PA scores (see Annexe 1).

Criterion	Brief description	Proportion of marks
Quality of Presentation – structure/ organisation	Organisation of material and logical flow of the presentation; time keeping and pace	20%
Quality of Presentation – verbal style and clarity	Projection of voices; clarity of description; ability to engage audience	20%
Quality of Presentation – visual	Use of visual aids; quality of slides (if used); visual impression created by presenters	20%
Technical and Systems Content	Quality of the technical discussion; clarity of systems engineering descriptions	20%
Competence at Answering Questions	Accuracy and clarity of answers	20%
		100%

Table 3: Marking criteria for group project presentation

<40%	Poorly presented with inadequate visual aids and weak technical content; most of the presenters are of a weak standard and the overall presentation is poorly organised; boring; unable to answer most of the questions satisfactorily.
40-49%	Most of the presenters achieve a reasonable standard; the overall presentation has a logical flow and a reasonable technical content; few errors; most presentation materials are satisfactory and clear; most questions are answered satisfactorily; time keeping is good.
50-59%	Competent presentation with only very minor errors; the presentation flows in a logical way and shows clear prioritisation of information; good technical content clearly explained; all presenters achieve a satisfactory level and most are good; visual aids are all clear; all questions are answered competently; time keeping is good.
60-69%	Good presentation that is interesting to audience; no errors; all presenters achieve a good standard and all presentation materials are of a high standard; technical content is very good and flows logically throughout the presentation; material is included in a well-balanced way; learning from the project experience is clear; all questions are answered well; time keeping is good.
>70%	Excellent, engaging presentation that comprehensively covers the topic of systems engineering and shows clear evidence of learning from the project experience. All presenters are clear and articulate; all visual aids are informative, clearly understandable and engaging; presentation develops in a logical order and exactly meets the time requirements. All questions answered well.

Table 4: Attainment guidelines for marking the group project presentation

Deliverable 4: ELA007 Individual Project Report – Submission 12th May 2017 (17:00)

This report is worth 40% of the overall marks in ELA007 (Introduction to Systems Engineering for Projects) module.

This is a reflective piece of writing that focuses on the student's individual role in the application of the systems engineering approach in the group project. The title of the report is:

"My role in the application of systems engineering in the group project"

The word limit for the report is 2,000 words (excluding diagrams, reference lists, and appendices). The number of words must be reported on the front sheet of the report and reports that exceed the limit may have 10% of the total report mark deducted.

The report should list all the systems engineering methods that have been applied but describe in detail only those in which the student played a significant role. For these methods the report should explain why they were selected and how they were tailored; it should analyse how well they worked and how application of them could have been improved. Marks will be awarded for the demonstration of a critical and analytical approach to this assignment. The marking criteria are provided in Table 5 and guidance to expectations in Table 6.

It is appreciated that Part A students have only been introduced to a limited number of methods in systems engineering. They will learn about methods and tools in more detail in parts B and C. The expectation for this report is that students can competently describe methods to which they have been introduced in Part A lectures, together with knowledge they have gained through their independent study.

Because this is a reflective piece of writing, this is one of very few assignments in which the use of the first person is acceptable.

Criterion	Brief description	Proportion of marks
Technical Quality	Quality of technical discussion in terms of precision, concision, and appreciation of measurement and errors; demonstrated understanding of technical aspects.	25%
Systems Appreciation	Appreciation of whole system perspective; understanding of systems engineering techniques; understanding of the nature of systems integration.	25%
Quality of Presentation	Clarity and quality of written work (including grammar and spelling); clarity of diagrams and illustrations; choice of methods and presentation of data and information.	20%
Critical Approach	Demonstrated ability at reflection; depth of critical analysis.	20%
Use of Reference Sources	Selection of appropriate reference material; citing and referencing.	10%
		100%

Table 5: Marking criteria for individual project report

<40%	Poorly written and containing errors; little evidence of research or development of student's own ideas; insufficient understanding of technical and systems engineering methods; lack of analytical thinking; Insufficient referencing and/or incorrectly formatted references.
40-49%	Reasonably well written with few errors; student has introduced own ideas and evidence of reading beyond lecture notes. Evidence of clear understanding of technical and systems engineering methods; demonstration of some analysis and critical thinking; references properly included.
50-59%	Competently written with only minor errors; clear evidence of wider reading and development of original ideas; competent description of technical and systems engineering methods; evidence of competent technical understanding and critical analysis of work; appropriately and accurately referenced throughout.
60-69%	Well written throughout with no errors; good use of reference material and evidence of original ideas; evidence of thorough understanding of technical and systems engineering methods and appreciation of selection and application thereof; an advanced level of critical thinking and analysis; appropriately and accurately referenced throughout.
>70%	Excellently written with no errors; supported by wide reading and excellent selection of reported sources; evidence of creativity; in-depth understanding of technical and systems engineering methods, evidenced through clearly explained selection of techniques and excellent understanding of application thereof; excellent analytical and critical thinking applied to subject; appropriately and accurately referenced throughout.

Table 6: Attainment guidelines for marking the group project report

Deliverable 5: Validation File, submission deadline 16th May 2017 (23:30)

A file containing measured data compared with vehicle data should be submitted. At the top of the file, and clearly labelled, there should be a comparison metric and a statement of whether the measurements were within or outside the error estimate provided in the error budget section of the group report. The comparison method reported in the results section of the group report should be used to provide the comparison metric.

Acceptable formats for this data file are: txt, csv, or xls.

To summarise, the file should contain:

Comparison metric and statement

Data measured by students

Data provided from vehicle

Only one set of trip data is required.

Annexe 1 – Web-PA Criteria

Group Report and Group Presentation Web-PA scoring

The following criteria will be used:

- Effort (scoring range: 0-5)
- Ideas contributed to the project (scoring range: 0-5)
- Technical Competence (scoring range: 0-5)
- Collaborative Behaviours (scoring range: 0-5)

For each criterion a mark of 3 represents "average with respect to this group". A mark of 0 indicates "no performance or no contribution"

Appendix A – Project Description

The information below has already been provided in coursework assignments SEMP01 – SEMP04. It is repeated here for convenience.

Engineering is an endeavour through which scientific and mathematical principles are applied to design, build, and operate machines, processes, and systems that achieve some useful purpose. Complicated and/or complex systems are usually developed by teams that take responsibility for specific activities or sub-systems which must be integrated into the overall system. Such an undertaking requires effective organisation, good technical understanding, and teamwork to achieve the goal of a well-engineered and efficient system. The purpose of this group project is to exercise the organisational, technical, and systems engineering skills and knowledge that students learn in Part A. The achievement of this project will require commitment, good judgement, and a systems perspective.

Each tutorial group will work as a team, with responsibility to design and build one sub-system of a tracker.

Project Aim

The overall aim of the project is to develop a hand-held tracking system, using which three confederates[3] can visually and accurately track an object (vehicle) moving on land and always on a line of sight to the observers.

Tutorial Group Aim

The aim for the Tutorial Group is to develop a GPS-based sub-system that measures angles in the horizontal plane made by a nominated object moving relative to an observer operating the device.

Description

Each tutorial group will build a sub-system of the overall system; only by combining data with the sub-systems developed by other groups can the system purpose be achieved. Using a GPS, Compass, accelerometer and mbed, together with a sight, the system built by the tutorial group should be able to follow the inclination of the moving object (Figure 2). Note Figure 2 is illustrative of the concept; it in no way determines the appearance of the design, which is open to the students to develop in their preferred way.

[3] The three confederates will be students, but they do not need to be part of the group that developed the specific sub-system

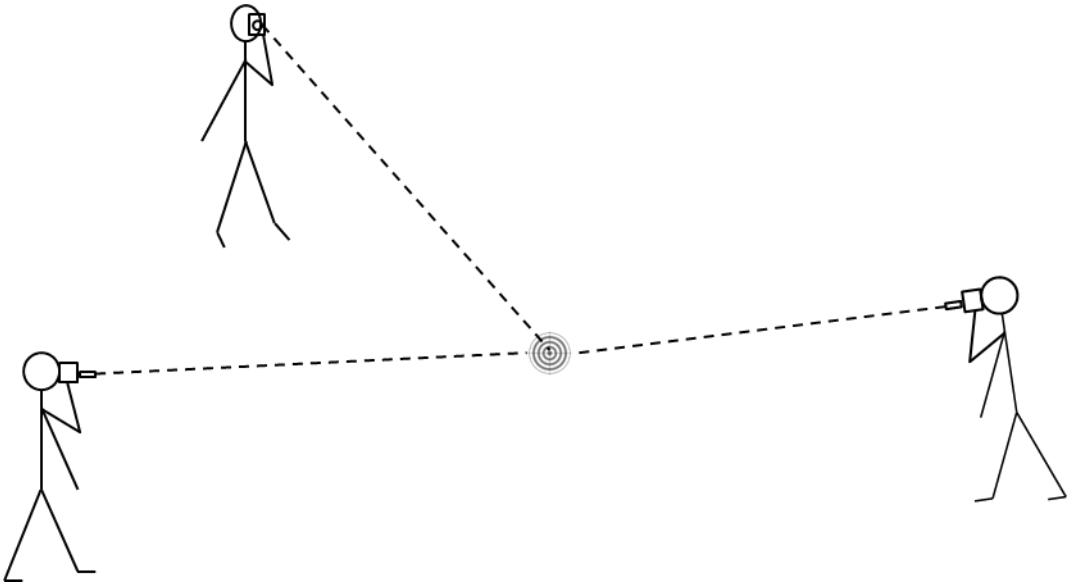

Figure 2: System concept

Using this concept, the tutorial group will combine with two other groups (as notified by supervision) to form a super group of three tutorial groups. Now it will be possible to measure the position of a moving object. The groups will demonstrate their system by tracking a nominated object pursuing a random path during a field trial on campus. Tracking will require the super groups to produce a set of co-ordinates and velocities for the object over a three minute period.

Details of the measured path followed by the object will be required in the final report.

Resources

The following resources will be provided:

- Each group will be issued with one mbed (LPC1768) with application board, one compass (CMPS03) and one GPS (EM-406A). A three axis accelerometer (MMA7760) is built into the application board.
- Each group will have a budget of £10.00 with which to purchase suitable mounting equipment for the wearable device.
- Groups will also be permitted to book 3D printing time. Details of booking procedure and permitted access time will be notified later.

Demonstration and data collection

The field trials will take place on one specified date. A series of trials will be recorded during which students will be able to demonstrate the competence of the system they have developed. Data collected by students will only be required in the final report; no measurements are expected to be provided by students on the day of the field trials.

Summary Customer Requirements

The System:

A tracker system is required

The overall system should be capable of tracking an object travelling on land (flat) at speeds up to 5.5 ms^{-1} approximately (within visual range of stationary observers) on campus.

The system must be constructed from three sub-systems consisting of hand-held tracking devices, as described in the SEMP03 coursework

The system will be demonstrated on one test day (to be specified by the customer)

Deliverables:

- One sub-system (hand-held tracking device) per tutorial group, as specified in SEMP03 coursework
- One Group Report per tutorial group as described below
- One data file containing latitude and longitude[4] co-ordinates and time for the position of the object during one of the tests. This may be in an excel spreadsheet, a .csv file or a .txt file to be submitted with the Group Report
- One validation document comparing the measured position data (from the previously submitted data file) with position data supplied by the customer and measured by the object. This file will be requested after submission of the group report.
- One Group presentation from the super-group (three tutorial groups) as described below
- One Individual Report per student, as described below

[4] Note that velocity will also be required.

Appendix B: Referencing

This information is from a slide pack provided by Ms. Alison Ashmore (Academic Librarian) to Part A students on 23rd January 2017.

IEEE numeric style

- IEEE is a numeric style
- Citations are numbered in the order of appearance
- Each citation number should be enclosed in square brackets [1]
- Format for author name is first name (or initial) and last name
- The title of the article (or chapter or conference paper, patent..) is in quotation marks
- The title of the journal or book is in italics

Book citation

Author Initials. Author's last name, *Book Title*, Edition (if not first). Place of publication: Publisher, Year.

[1] P.P. Silvester and R.L. Ferrari. *Finite elements for electrical engineers*, 3rd ed. Cambridge: Cambridge University Press, 1996.

Book Chapter example

[2] C.W. Li and G.J. Wang, "MEMS manufacturing techniques," in *MEMS for Biomedical Applications*, S. Bhansali and A. Vasudev, Eds. Cambridge: Woodhead, 2012, pp. 192-217.

Journal Citation

Author(s). "Article Title". *Journal Title*, vol., issue number, pages, abbreviated Month. year.

[3] G. Bertotti. "General properties of power losses in soft ferromagnetic materials," *IEEE Transactions on Magnetics*, vol. 24, pp. 621-630, Jan. 1998.

E-Journal Citation

Author(s). (year, month). "Article Title." *Journal Title*.[type of medium]. Vol.(issue), pages if given. Available: site/path [date accessed].

[1] J. Seok, S. Idaparapati, H.W. Park, H-J. Choi, R.K. Singh, M. Jun. (2015). "Special issue on environmentally conscious technologies in mechanical engineering." *Advances in Mechanical Engineering*. [Online]. 7(5), pp. 1-2. Available from: DOI**:** 10.1177/1687814015585425 [21 Dec. 2016]

[2] P. H. C. Eilers and J. J. Goeman, "Enhancing scatterplots with smoothed densities," *Bioinformatics*, vol. 20, no. 5, pp. 623-628, Mar, 2004. [Online]. Available: www.oxfordjournals.org. [Accessed: 18 Sep. 2004].

Website Citation

Author(s). *Title of webpage* [Online]. Available: URL [Accessed: date]

[4] BBC News. *Microwave signals turned into electrical power* [Online]. Available: http://www.bbc.co.uk/news/technology-24897584 [Accessed: 19 Jun. 2015]

(If no web author, you can use a corporate author or failing that you can put Anon or just use the title of the site.)

Examples of notations within text (in-text citations)

There are a number of models available, which should be understood [1].

Bertotti [2] outlined some of these properties…

In a study using diakoptics [3] it was shown that…

Example Reference list

1] P.P. Silvester and R.L. Ferrari. *Finite elements for electrical engineers*, 3rd ed. Cambridge: Cambridge University Press, 1996

[2] C.W. Li and G.J. Wang, "MEMS manufacturing techniques," in *MEMS for Biomedical Applications*, S. Bhansali and A. Vasudev, Eds. Cambridge: Woodhead, 2012, pp. 192-217.

[3] G. Bertotti. "General properties of power losses in soft ferromagnetic materials," *IEEE Transactions on Magnetics*, vol. 24, pp. 621-630, Jan. 1998.

[4] BBC News. (2013, Nov. 11). Microwave signals turned into electrical power [Online]. Available: http://www.bbc.co.uk/news/technology-24897584

Citing additional material

Conference paper

[1] S. Adachi. "Intense vacuum-ultraviolet single-order harmonic pulse by a deep-ultraviolet driving laser," in *Conf. Lasers and Electro-Optics*, San Jose, CA, 2012, pp2118-2120.

Standard

[1] *Shunt power capacitors*, IEEE Standard 18-2012, 2013.

Thesis/dissertation

[1] J.O. Williams, "Narrow-band analyzer," Ph.D. dissertation, Dept. Elec. Eng., Harvard Univ., Cambridge, MA, 1993.

Patent

[1] J.P. Wilkinson, "Nonlinear resonant circuit devices," U.S. Patent 3 624 125, July 16, 1990.

Report

[1] P. Diament and W.L.Luptakin, "V-line surface-wave radiation and scanning," Dept. Elec. Eng., Columbia Univ., New York, Sci. Rep. 85, Aug. 1991.

Figures

If you are referring to a specific figure, table or equation from another source, place a citation number in brackets directly after their mention

e.g. as illustrated in [5, Fig. 1],

e.g. is presented in [5, Tab. 3]

Managing your references

- Bibliographic software available:
    - Mendeley
    - RefMe
- See tutorials on LEARN:

http://learn.lboro.ac.uk/course/view.php?id=3539

- Both tools enable you to create bibliographies in IEEE or Vancouver referencing format
- Cite them right (online tool) http://www.citethemrightonline.com/