Master of Technology in Intelligent Systems

IS Capstone Project Guidelines & Requirements 2020

Institute of Systems Science
National University of Singapore

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1. INTRODUCTION

As part of the Masters of Technology in Intelligent Systems (IS), you are required to plan and carry out an Intelligent System development project. The IS development project is designed to be a building block for you to consolidate and put into practice the skills, tools and techniques you have acquired. The hands-on experience will give you the opportunity to analyze the problem or needs of a functional area in your organization and, suggest and apply Intelligent Systems engineering techniques to provide identifiable benefits. The project may take the form of building a workable application or a prototype system which will/can operate within an organization. Alternatively, it may involve the experimental research and development (R&D) of Intelligent systems such as robotics, vision systems, IoT, autonomous vehicles, etc.

The capstone project will formally begin in **March** of your second year of study, but it is necessary to begin planning the project immediately. You will work on the project in teams of four to five students and **you will be jointly responsible** for finding a project. Note that single person projects are only acceptable under very special circumstances and you should discuss this with the Programme Chief.

2. OBJECTIVES

The objectives of the IS Capstone Project are as follows:

- To design and develop an Intelligent System.
- To apply the knowledge and technical skills you have/will learn in the Master of Technology programme in a practical/commercial situation.
- To make use of at least one of the IS problem-solving techniques which you have/will learn in the programme.
- To produce good documentation and reports describing the various aspects of system development.
- To describe and discuss the progress made during the project in a series of presentations.
- To provide tangible benefits to the sponsor company

3. CAPSTONE PROJECT STRUCTURE

The Capstone Project work consists of 2 Phases:

Phase 1	Two (2) Months duration. Main Activity: Initial investigation and experimentation
Phase 2	Four (4) Months duration Main Activity: System development and final testing

The deadline for each Phase is given in the next section 4, while a description of the deliverables can be found in PART II: Project Requirements

4. SCHEDULE

The schedule for planning and implementing the project is as follows:

Date	Activity	Deliverable
Phase 0: Project Proposal & Plan		
Now	Begin actively seeking projects. Discuss with your lecturers.	
Now	Draft & submit your project proposals (use Project Proposal Template)	Submit Draft Proposal to Programme Chief
15 Dec	Approval by ISS (31st Dec)	Approved Project Proposal
Phase 1: Problem modeling & Project Planning (30% marks)		
1 March End April	Complete domain familiarization User Requirement specifications Conduct knowledge/data acquisition Initial System Design Exploratory Data Analysis Build Prototype (PoC) Project Planning Prepare formal Project Proposal & Plan Give first presentation	Submit Detailed Proposal & Progress Update Report (combined into 1 report) to LUMINUS – 5 days before presentation date Team Presentation (6.30-10pm)
- IMPORTANT - **Intermediate Progress Reports <u>must be submitted</u> upon request by supervisors**		

Phase 2: Complete Project (70% Marks)		
1 June End September	Complete Implementation Complete V&V and Testing Complete User Acceptance Prepare Final Report. Report on the results Give a Presentation and Live system demo	Submit to LUMINUS • Technical Paper (Team work) • Individual accomplishment report • IS System (softcopy) 5 days before presentation date Give Final Presentation to ISS Conduct a Live System Demo

You are encouraged to submit draft versions of all reports before the stated deadlines so that your Project Supervisor can provide feedback, suggest improvements, etc.

If a student is unable to meet a deadline for a deliverable, marks for that deliverable will be forfeited. Under certain circumstances an extension to a deadline may be given BUT a formal request (with supporting documents such as MC, employer's letter, etc.) must be made to the ISS Supervisor (cc: Programme Chief) at least **<u>one week</u> BEFORE** the deadline stating the reason for the requested

extension, and in the case of the final report, **three weeks** before the deadline. In general extensions will only be given when the circumstances involve factors outside of the students' control.

Note that the Capstone Project is a compulsory module worth 6 MC, and you must successfully complete the capstone project with a Pass grade. The Capstone Project grade will contribute towards the overall CAP for your graduation.

5. SOURCING FOR PROJECTS

The project should ***ideally*** come from one of the team member's employers. Note that it is acceptable for a team member to also be the client representative or subject matter expert. You should begin discussing possible projects with your employers now.

If it is not be possible to find a project in your employer or any other organization, then you should consider the following alternatives:

- Develop an **IS system or product** for which you perceive there is a need. In this case, it is useful to find credible potential users of the product who are prepared to assist you in user requirements specification, testing and acceptance.
- Other propositions will be given due consideration.

6. PROJECT IDENTIFICATION

When identifying your capstone project, you should first consider the application areas and/or problem domains within your own company.

You can consider commercial oriented projects or R&D type projects. For example:

- **Commercial oriented projects**: those that result in a working prototype or demonstration system (e.g. a diagnostic system, industrial automation robot & vision system, conversational robots, etc.);
- **R&D type projects**: those that perform an investigation or exploration (e.g. an investigation into the use of deep learning for predicting (say) tsunamis, or an investigation into the application of wearable IoT sensors to detect human movement disorders, etc.)

If you do not have access to complete domain data, you can use fabricated but *realistic* data. However, real data will be needed for any projects involving data mining or machine learning.

Give consideration to where the domain expertise and knowledge and data is located and how easy it is to access. For example, patient data from hospitals are unlikely to be shared openly. It will be very helpful if a member of your project team works for the company sponsor or has expertise in the problem domain being considered.

Potential IS projects and techniques fall into these broad categories (refer to your course notes for more details):

Coursework	Potential Application Areas
Intelligent Reasoning Systems	**Build systems that problem solve across business & engineering domains** *e.g. IBM Watson, Geico instant online quotes*
Pattern Recognition Systems	**Build systems that recognise and take actions based on patterns found in data** *e.g. traffic data monitoring, smart appliances, surveillance data, social media*
Intelligent Software Agents	**Build software agents that act on behalf of humans in diverse transactions** *e.g. shopping bots, PDA's*
Intelligent Robotic Systems	**Build advanced robotics and automation systems** *e.g. cooperative robots, robot home helps, shopping assistants*
Intelligent Sensing Systems	**Build systems that make decisions based on visual, audio and speech inputs** *e.g. crowd monitoring, face recognition, medical sensing, vehicle control*
Practical Language Processing	**Build systems that understand and process natural language** *e.g. mine social media for sentiments, build intelligent chatbots*

When identifying projects, it is important to realize that many real world applications will necessarily involve applying conventional software engineering methods as well as AI technologies and sometimes the proportion of AI may be small. This is acceptable as long as the AI component makes a justifiably significant contribution to the success of the overall project. You are encouraged to discuss with your lecturers to help you decide whether the project comprises a significant AI system.

7. STANDARDS, METHODS AND RESOURCES

These deliverables will be reviewed and assessed by ISS staff and will form part of the overall project grading.

You are encouraged to use the techniques you have/will be taught during the MTech course, unless clients have strong reasons for wishing you to use alternative methods.

You are encouraged to follow appropriately any prescribed methodology for your project.

You are encouraged to use the computer hardware/software available at ISS, but you may use the client's equipment if this is preferred.

Each team must have **at least 4 students**, and not more than 5 students. Single person teams will **NOT** be accepted unless the company data or domain knowledge is confidential. You must seek prior permission from the Programme Chief.

You are expected to manage your project effectively. Your success depends on how effectively you work as a team towards common goals and objective.

You are each expected to expend about **30 man-days** of effort on the capstone project. The work should be undertaken in your own time or time that has been allocated in the programme timetable.

8. DRAFTING PROJECT PROPOSALS

Each team is required to submit a Draft Project Proposal using the given template.

Your proposal should describe the following:

- **Aims and objectives** of the project
  Start off by providing a brief background of the project including a description of the domain and problem area. Subsequently, describe the **aim** of your project - what is it that you want to achieve. Then describe the **objective** - how do you go about to accomplish your aim.

- **Project Requirements**
  Project requirements include what you and your team will need to carry out the project successfully. For example; knowledge/competency in certain IS method or technique, familiarity of the problem domain, acquisition of the domain knowledge/data, availability of domain expertise, hardware, devices, historical cases, verification & validation requirements, etc. If the project is for an employer, identify the users and experts and how you intend to access their time. You may also discuss some risks associated with the timely completion of the project, or the accuracy of the results.

- **Methods & Standards**
  Provide a brief overview of the approach to be taken. This must include the selected IS method or technique, specific Quality procedures (as required by your project sponsor), proper documentation and filing requirements, Verification & Validation methods, etc. This section should also state clearly the performance indicators to determine the success of the final system – for example, the system's performance against human experts or industry standards, etc.

- **Resource Requirements**
  Resource requirements of the project include hardware, devices, software packages and any other requirements that you will need to adequately implement the system.

Before your team commences work on the project, **ISS must approve** your proposal. After receiving ISS approval of your draft project proposal you will be expected to arrange a meeting with your assigned ISS Supervisor.

Please note that this is an initial or preliminary proposal. It is possible that it may change during the first few months of the project as unanswered questions become clarified. Any such changes must be discussed with your assigned supervisors\.

9. ASSESSMENT FORMAT

You will be assessed on the quality of your project. You must have a working system or a completed investigation. Your assessment will include all reports and presentations. Marks will be awarded base on team accomplishment as well as individual effort and contribution. The latter will be based on presentations and individual accomplishment reports.

The assessment weighting is as follows:

Phase I	
Report	15%
Presentation	15%
Phase II	
Technical Paper	20%
Presentation	20%
System Demo	20%
Sponsor/Panel Assessment	10%
TOTAL	100%

The table below is a summary of the assessment guide for the various deliverables.

Deliverable	**Assessment Guides**
Presentation	• Introduction, Conclusion • Organisation, Sequence and flow • Relevance, Completeness • Visual Aids, Clarity of explanation • Personal style • Handling of Q&A
Technical Paper and Reports	• Well written documentation of work • Flow/Grammar, Clarity • Substantial depth, Technical achievement • Appropriate References
Final System: Of type **Application**	• Complexity of problem • Innovativeness • Verification & Validation • Customer satisfaction/ Feedback • Overall functionality
Of type **Research**	• Complexity of problem • Novelty • Literature Review • Application of Methodology • Programmiing

10 CAPSTONE PROJECT REQUIREMENTS

Your success during this program will depend upon a variety of factors such as, how well you relate to other members of your team and the client company so as to be an effective member of a team working towards common goals and objectives; how effectively you manage your time so that you can complete the project assignments as planned; your ability to communicate with others in terms of gathering knowledge/data, conducting knowledge acquisition sessions, and applying knowledge verification and validation techniques. Last but not least, your ability to critically assess and identify the problem domain, state the objectives and evaluate the methodologies and techniques available in the design and construction of a workable IS systems or its prototype.

The purpose of this Project Requirements is to describe what is expected of you during the program. In the following sections, you will find checklists of work assignments to be completed during this period. This checklist can be used as a guide for the selection of tasks needed to complete your project assignment.

This Project Requirements can also be used as an aid for your supervisor from the sponsor company to track your progress.

This Project Requirements also serve as an administrative vehicle for ISS staff in the implementation, control and evaluation of the whole program.

The client organisation should be able to adapt and use the output from the program.

10.1 Familiarity with Project

All students in a team are expected to be **completely familiar** with all aspects of the work produced. Students should, however, divide the work assignments equally and complete specific assignments on an individual basis to make the most efficient use of the available time.

Upon completion of the project, you will be able to:

- Describe and discuss your role and responsibilities undertaken during the program.
- Relate the experience gained to the roles and responsibilities of each member.
- Describe the organisation and the business objectives of the function/department for which the project is being developed
- Apply the skills acquired in the knowledge/data acquisition, modelling, implementation and validation phases for a chosen problem domain
- Document the IS system for a function/department of the client organization

10.2 Duration of the Project

The Capstone Project for part-time students is carried out during the second year of studies. It runs over 7 months from March to September. There is a month break in May for the student to study for the exams. However, the student may still continue to work on the project during this period

The Capstone project for full-time students is usually carried out as an internship with an external company. It will be a full-time industry attachment for 12 weeks.

10.3 Role of ISS Staff in the Project

The principal role of the ISS staff is to ensure that the students will benefit substantially from the program. Each student team will be assigned an ISS staff member as their supervisor for the duration of the project.

The ISS supervisor will serve as a consultant to the student teams regarding issues or questions that may develop during the project. Alternative ISS staff supervisors will be appointed whenever the primary supervisor is unavailable.

The ISS supervisor will conduct review meetings with the student team if possible, or the project team is to submit progress reports. These review meetings are to ensure that the students are on the right track and that the tasks can be completed by the end of the program. If the project turns out to be more involved and complicated than time allows, necessary action will be taken to trim the scope of the project. This is to be done with the consent of both the ISS supervisor and the client organisation supervisor.

The ISS supervisor will evaluate each student on an individual basis throughout the project.

10.4 Student Appraisal

The ISS supervisor will conduct individual review/counselling sessions with students regarding progress made during the period. The ISS Supervisor and the panel of assessors will review and grade the project reports and the project/system in terms of completeness and accuracy and appraise the student presentations.

Changes to project teams and/or project will only be considered in exceptional circumstances outside of the team's control e.g. withdrawal of a team member, resignation of a client supervisor or withdrawal of the client organisation from the project.

The team assessment will take into account these unforeseen difficulties and also how the team members work effectively as a team to overcome obstacles, whether personal, technical or management.

All team members are to participate fully in the project and all deliverables – this includes the Project Proposal, Project Reports, Project Presentations and System Implementation

The client organisation's management is requested to appraise the work done by the students during the period in order to provide feedback to ISS about their level of satisfaction and suggestions for improvement of the project assignments.

ISS will maintain contact with the students and sponsor organisations so that the quality of work completed by the students can be assessed.

10.5 Client Organisation's Responsibilities

Organisations proposing projects will be responsible for producing the following. Students who initiate projects within their own organisations should also try to ensure the following:

- Job related projects which will enable students to apply the concepts, methodologies, and techniques acquired during the course
- Supervisors who will be responsible for each of the project teams assigned to their organisation
- Experts who can articulate their knowledge to the students
- Make available all data that is required for the project to complete successfully
- Work space and other necessary resources (including hardware and software) for the students
- Access to information and personnel required to complete the project
- Administrative assistance to students for producing their reports, in particular, photocopying and other reproduction facilities

10.6 Client Supervisor's Responsibilities

The responsibilities of the client's supervisor include:

- Conducting the initial project meetings with the students to review the scope of the problem domain selected.
- Regularly review the progress of the students; to compare actual progress against planned progress and suggest corrective action, if necessary.
- Must sign off each report that is submitted to ISS as prove that they have read the report.
- Assisting the project teams to arrange the required knowledge/data acquisition sessions.
- Assisting the project teams to gain access to organisation resources required (e.g. documentation, personnel).
- Being available to students for questions and directions. If the supervisor is unavailable an alternative supervisor should be appointed.
- Contacting the ISS staff if questions arise regarding the student project.

10.7 Intellectual Property Rights

Typically, the sponsoring company has the rights to all IP arising out of the project that the student team has worked on.
ISS will not want to own any IP. However, ISS would like to have the rights to discuss the project or demonstrate the system purely for academic and learning purposes. ISS will also respect confidentiality requirements by companies if the request is made explicit. Companies who have issues relating to IP can raise it to ISS.