**Framework for Setting-up Student Projects**

This document details the work involved in setting up student projects each year before the teacher and students seminar held in February. The details provided are described in three parts.

* **Part 1:** Selection process of students
* **Part 2:** Different models of forming groups
* **Part 3:** Lessons learned and enhancements

**Part 1: Students Selection Process**

There are two selection processes, called the ***standard selection process*** and the ***fast track selection process***, as shown in Figure 1. The standard selection process has the following five steps.

**Step 1 (Proposal for Themes):** EPIC management team should be responsible for selecting relevant themes for each year and contact suitable industry partners to be involved. In 2017, the proposals came directly from the industry and were published for students. Since some of the proposals’ clarity were not sufficient to understand the scientific contribution for a master or a bachelor degree level, students and supervisors had to spend time on clarifying the research focus. In order to avoid this situation, the academic staff will be directly involved in step 1 in 2018. The themes should represent the relevant research focusses and the current business trends each year. The EPIC team should actively look for relevant themes throughout the year and finalise them till the 20th of September. An example of forming a theme is following.

*“The EPIC team of the Technical University of Hamburg is involved in research of enhancing reliable wireless communications, while the Aalborg University is involved in research of enhancing secure wireless communications. One of today’s key research application areas is platooning. If there is a chance to involve a company which works in doing research or producing hardware/software for platooning applications, the theme could be “Secure Reliable Wireless Communications for Platooning applications”*

**Step 2 (Short company proposals for sub topics):** Once the themes are finalised, there is a one-month period to collect short company proposals for each identified theme. This is the main responsibility of the EPIC team. We believe that a one-month duration is sufficient provided that the EPIC team has already identified industry partners to be contacted. Some examples for sub topics for the theme of *“Secure Reliable Wireless Communications for Platooning applications*” are as follows.

***Sub topics for technical aspects:***

* + Modelling of reliable wireless communication
	+ Analysing the security threats
	+ Evaluations of platooning performances in different scenarios

***Sub topics for business aspects:***

* + Identify future market segments
	+ Identify gaps in different areas of technology development

**Step 3 (Students’ applications):** The deadline for students to apply for the selected themes is on the 20th of November. The students can select a ***maximum of two themes*** and submit their applications with a short CV indicating their interests in the selected themes. We emphasise here to select a Theme in order for us to make sure that there are enough students to form groups for sub projects based on students’ interests and competences. An open, fair and transparent selection process is applied at each university.

**Step 4 (Form groups):** This is the most challenging step, as there could be 2 worst case scenarios: Firstly, there are insufficient students to form groups and the secondly, most of the students are interested in a few themes. This step requires some virtual meetings as well as a physical meeting to finalise the matching of students’ requirements to groups. The local EPIC partner will be responsible to contact local students, if required.

**Step 5 (Seminar in February):** Before step 5, the following documents should be available for all the selected students to get to know some of the pre study materials.

* Problem Based Learning
* Agile Software Development
* How to use collaborative tools
* Team work / conflict resolution



Figure 1. Work flow of the student selection processes

As shown in Figure 1, the objective of the ***fast track selection process*** is to have the flexibility to integrate other topics that can be proposed by academia or industry later, but not later than the deadline for the student applications.

**Part 2: Different models of forming groups**

We propose 4 different types of models to show the interaction between different students in each group depending on student’s requirements. The requirements in detail are (a) what is the technical contribution, (b) whether his/her work depends on other students, (c) what is the start and end of the thesis and (d) how many ECTS’ are required, etc. As shown in Figure 2, there are four possible models. Model 1 shows how students can work independently when they have heterogeneous requirements, while the model 4 shows where students have to synchronise their work in a team.

* **Model 1:** This is suitable for a theme in which the students can work independent of each other. As a common contribution, all team members should join EPIC virtual meetings to share their work in order to complete the EPIC joint report. The EPIC joint report is an independent report of students’ Theses. This is written by each individual student to explain how they work in a group to achieve the EPIC objectives. Each student should complete this report in order to obtain the EPIC certificate. This is the easiest model to supervise in terms of the different objectives of the work, as students can work more autonomously. The main question here is how to encourage students’s collaboration on writing the EPIC joint report.
* **Model 2:** Compared to model 1, model 2 provides a joint part in the thesis itself. This could be the analysis of the problem, the state-of-the-art section, the design of the flow chart, etc. This model works when students have dependencies, but not very complicated to achieve depending on each other. This will work very well, if all students can start and end the projects with overlapping period.
* **Model 3:** Compared to model 2, this model has more dependencies right from the beginning. This is very challenging to supervise if all requirements of students and the focus of each work are very heterogeneous. The thesis focus should be identified and must be clear to everyone from the beginning. In this model, it is very important to synchronise students’ activities.
* **Model 4:** This model should be introduced only if all students are planning to start and complete their work during the same period. This requires very close supervision to monitor the progress of each piece of work as one student performance may affect the others’ work.



Figure 2. Four different models to form groups

The above proposed models require a clear definition of how students can reflect the joint work and how they collaborate in a team. Each student has two supervisors: an EPIC supervisor, who should be a member of the EPIC project and a local supervisor who is an expert in the relevant research from the home University of the student. The local supervisor does not necessarily to be a member of EPIC project. The EPIC supervisor is responsible for all sub projects under a single theme where he/she has a right contact to the industries. The EPIC supervisor is responsible to help in clarifying project tasks if there are any conflicts, help in setting up additional telcos/meetings with the industry and also to keep informing the local supervisors to help students to clarify issues. The local supervisors are mainly responsible to supervise the students according to home university regulations. If the local supervisor thinks the scientific contribution is not enough or tasks are being delayed due to the cooperation, he/she can talk to the EPIC supervisor to find a solution.

* **Definition of the Joint work:**
	+ **EPIC report:** As indicated in Table 2, each group should provide this report. This is a short report consisting at least 5 pages and describing the problem that all the students worked on, how it was approached and dealt with, how different aspects were considered, and the final joint results. In case the project was split into different parts, how was this done, how were the parts related, and how did they contribute to the final result.
	+ **Joint Thesis work:** If there is a joint part of the work, this should be indicated in the Thesis as a separate chapter. This is valid only for model two to four. There may be students who are not required to summit a thesis. In this situation, they can contribute for the joint work in terms of video presentations, sharing of code via GitHub/GitLab and preparing of required documentations.
* **How to define the collaboration for each group (specially for model two to four)?**
	+ **Feedback and discussion:** Once the students join the first physical meeting in February, each group should plan to have their virtual meetings (how often, who will organise, etc) and if required physical meetings as well. If there are any conflicts within a group, the students should inform their EPIC supervisor. The EPIC supervisor is mainly responsible to solve the issues with the industry and also further to contact local supervisors to take further actions if required.
	+ **Peer assessment:** All students of a group are encouraged to have regular virtual meetings and to assess each other’s work in 3 steps. They are at the beginning, the middle and the end of the project work.
	+ **Defined interfaces:** If the thesis work involves with software design and developments, the interfaces between different work done by different students should be documented properly.
	+ **2nd Physical meeting:** The second physical meeting should be required for the model four as it involves the joint cooperation throughout the whole period. This could be an optional meeting for the rest of the models.
	+ **Joint results/publications:** In addition to the joint Thesis, the students may publish their results as a separate technical document or as a joint publication at the end of the project period.

In general, all four models can be used in EPIC. Table 1 shows a summary of the four models, comparing different requirements of a group. Three notations used are:

* “-“ indicates that the model is not recommended to use,
* “+” indicates that it is possible to use this model, but with very close supervision,
* “++” indicates that this model should work very well in general.

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| --- | --- | --- | --- | --- |
|  | **ECTS + Type of Thesis** | **Duration** | **Heterogeneous focus (technical, business, etc)** | **Recommended number of students** |
|  | same | different | overlapping | Non-overlapping |
| **M1** | + | ++ | + | ++ | ++ | 2 to 3 |
| **M2** | ++ | + | ++ | - | + | 2 to 4 |
| **M3** | ++ | + | ++ | - | + | 2 to 9 |
| **M4** | ++ | +/- | ++ | - | + | 2 to 6 |

In 2017, only the first three models were used. The Table 2 compares 3 specific projects related to first 3 models used during 2017/2018 EPIC cycle.

Table 2: Three types of models used in 2017/2018

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Num of students** | **Type of Thesis** | **ECTS required** | **Duration** | **Focus of the Thesis** | **Joint part** | **Other comments** |
| **Model 1 – Smart Logistic project** | 2 | S1 Bachelor students from UiS | 18 | April – June, 2018 | Business aspects (How Industry 4.0 helps for SMEs) | EPIC report | Organized an additional physical meeting for UiS student (S1) to visit TUHH and the company. During this visit, S1 was able to interview a professor at TUHH and clarify some questions from the company.  |
| S2 Master student from TUHH | 30 | June – Dec, 2018 | Technical aspects (evaluation of communication networks) | EPIC report |
| **Model 2 – IoT project** | 3 | S1 | 30 | Feb-May 2018, exam in June | Model of Trust in IoT/Industry 4.0 (Business Informatics)  | EPIC report + joint chapter  | 2 students from Aalborg (technical), 1 student from Riga (business informatics). The student from Riga (S1) undertook an additional visit to Aalborg in order to work closer with the Aalborg students. |
| S2 | 30 | Feb-May 2018, exam in June | Trust and authentication in IoT/Industry 4.0 (Blockchain) | EPIC report + joint chapter |
| S3 | 30 | Feb-May 2018, exam in June | Trust and authentication in IoT/Industry 4.0 (Blockchain) | EPIC report + joint chapter |
| **Model 3 – HoneyJar project** | 9 | S1-S5: Semester project | 15 | Feb-May, exam in June | System development, technical aspects. | EPIC report, Plan of Action, joint system development. | An additional physical seminar was organized in Barcelona (UPC) in order to discuss with their UPC supervisor, and to present and get feedback from the industry partner Talaia Networks. |
| S6-S7: Project of Smart Solutions Semester | 24 | Feb-July 1 | Business aspects | EPIC report, Plan of Action, joint system development. |
| S8 Project work | 8 | Feb-May | Technical aspects: Machine learning | EPIC report, Plan of Action, joint system development. |
| S9 Project work | 5 | Feb-May | Technical aspects: System architecture | EPIC report. |
|  |  |  |  |  |  |

**Part 3: Lessons learned and enhancements**

This section briefly discusses the challenges we faced during the first EPIC cycle and the new features that are planned to introduce for the second year of EPIC project.

* **Challenges**
	+ **Matching company objectives and academic objectives:** From the beginning of EPIC cycle, the Universities should always check the quality of the industrial proposals and should involve in keeping the right balance between the industrial requirements and the scientific contribution of each project.
	+ **No clarity in company objectives and subject to be changed later:** This can be solved only If the Universities involve from the beginning to make the project objective clear for both students and the industry.
* **New features introduced for 2018/2019 EPIC cycle**
	+ **Initial supporting materials**
		- Introduction of the students to each other before the seminar by a small booklet with one page of information about each student.
		- Better (technical) introduction to the projects/themes before the seminar, to make it easier to have qualified discussions already in the seminar.
	+ **Supervisor agreements**
		- We intend to introduce the supervisor agreement to all the groups during the physical meeting in February, 2019. This agreement shows how students expect the supervisor’s contribution in terms of virtual/physical meetings, how to provide feedback (via emails, via online platforms, etc) and so on. for both EPIC supervisors as well as for local supervisors.
	+ **Changes in the selection process**
		- Fast track selection process and the module four will be tried out in 2018/2019 EPIC cycle
		- Project themes are decided by the Universities and then the companies provide proposals for sub topics within these themes (see Figure 1). This may enrich the clarity of the project objectives for both students and the industry.