**oCPS Career Development Plan**

*This CDP should be established by the ESR in consultation with the supervisors within the first two months of the ESR’s PhD program. It will be revisited every six months and should be used as a pro-active monitoring of progress in the researcher’s career.*

1. Personal Details

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| **Full name** | Tahira Iqbal |
| **oCPS-ESR no.** | 10 |
| **Start date** | 1.11.2017 |
| **Host organisation** | Fortiss |
| **Department** | Software Dependability Group (SD) |

1. Guidance

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| **Supervisor** | Harald Ruess |
| **Daily supervisor**  *(if applicable)* | Holger Pfeifer |
| **Academic supervisor**  *(applicable for ESR4, 5, 6, 9, 10, 14, 15)* | Supervisor from TU Munich, to be confirmed |
| **Co-supervisor  (1st secondment)** | To be decided |
| **Co-supervisor  (2nd secondment)** | To be decided |
| **Arrangements on guidance** *(e.g. frequency, form)* | * Weekly meeting with the supervisors. * Weekly SD group meeting. * oCPS bi-monthly webinars. * oCPS face-to-face seminars twice a year. |

1. Project Details

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| **Project title** | Machine Learning in the engineering of Adaptive and Trustworthy Control Software |
| **Project description**  Cyber Physical Systems (CPS) are based on the integration of hardware, software and other service component. In the development of control software for adaptive and trustworthy Cyber Physical System (CPS) different collaborations are required from multiple disciplines, like mechanical engineering, electrical engineering and computer science. For such CPS, development support and collaboration with partners from the different disciplines is required till the end of the life cycle. Requirements are inputs to the planning and developing process for building the software. Inadequate Requirements Engineering (RE) is one of the main sources for the failure of development projects and culminates in exceeding budgets, missing functionalities or even the abortion of the project. In RE, one has to cope with the resulting variety of stakeholders and their multitude of different and possibly contradictory goals. This creates challenges for requirements elicitation, documentation, and management, especially with the involvement of different background stakeholders and users. In addition, the distinct key aspect of the RE, e.g., who wants functionality, what functionality do the end users want, etc., is difficult as compared to a traditional software system. However, involvements of different user background can make requirements engineering process complicated. Some of the useful information can be missed or declined. To deal with these RE problems caused in the developments of CPS needs to minimize and automate for making the system cost and time effective. The main goal of this project to identify the RE related problem especially for cyber physical system. As a solution, Machine Learning (ML) is a potential candidate. That will help to automate the system for overcoming the RE problems in this domain.  The main contribution expected through this project is bridging the gap between state-of-the-art RE theory and industrial practices, developing a tool with the enhancement and improvement of the targeted problem. That will ultimately contribute to improve the development of CPS. | |
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1. Research Objectives

*Objectives and results to be obtained, together with planning. (Intended) results that can be mentioned are: progress reports on the research that is carried out, presentation at conferences/workshops, a description of the desired results (anticipated publications [each ESR is expected to publish 2-3 conference or journal publications each year], knowledge, techniques, applications, instruments and suchlike). The level of information should be relatively general. In case the ESR is enrolled in a 4-year PhD program, then please add a brief summary of the 4th year plan. The 4th year will not formally be part of nor be funded by oCPS. It is important for the ESR though to develop a 4-year plan in such cases.*

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| **Year 1** | *Concrete planning* |
| 1. Preliminary literature review on Software engineering and Machine Learning 2. Literature survey on Requirement Engineering and Machine Learning 3. Formulation of research problem(s) to solve 4. Submission of result to a conference |
| **Year 2** | *In year 2: broad outline: goals and what further research activity or other training is needed to attain these goals* |
| 1. Formulation of the research problem to solve 2. Provide solution for the formulated problem 3. Submission to conference or journal to review |
| **Year 3** | *In year 3: broad outline: goals and what further research activity or other training is needed to attain these goals* |
| 1. Write up for PhD dissertation 2. Submission to conference or journal |
| *(Year 4)* | *Optional: Only to be filled in if the ESR is enrolled in a 4-year program.* |
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1. Training

*The training plan will include scientific and professional training as well as specialized training in accordance with the ESR’s preferred career path (academic, industrial or entrepreneur). ESRs are obliged to credit at least 24 EC.*

*Training offered within oCPS is depicted at the end of this document, updates of training planned within oCPS can be found on the oCPS website* [*http://ocps-itn.eu/*](http://ocps-itn.eu/)*.*

* 1. Project Related Training

*Research knowledge and skills to be acquired during the period of the PhD project. Competence in experimental design, quantitative and qualitative methods, relevant research methodologies, data capture, statistics, analytical skills. Acquisition of new expertise in areas and techniques related to the researcher’s field and adequate understanding their appropriate application. Training in specific new areas, or technical expertise, secondments, courses or lectures that need to be taken for this purpose and the participation in seminars, colloquia, and suchlike. (Note: all training is anticipated to take place in the 3-year active participation of the ESR in the oCPS program, also for ESRs enrolled in a 4-year program.)*

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| **Year** | **Course** | **EC** | **Remarks** |
| **Year 1** | Practical Machine learning | 7.5 | Queen Mary Summer School, London. |
| Applied model predictive control | 2 |  |
| Seminar Course Cyber-Physical Systems | 2 | TUM |
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| **Year 2** | 1st secondment |  | KTH, Sweden |
| oCPS summer school II | 2 |  |
| Model-based design for CPS | 2 | Fortiss |
| Software Engineering Essentials (SEECx) | 2 | TUM |
|  |  |  |  |
| **Year 3** | 2nd secondments |  | TBD |
| Advanced Topics of Software Engineering | 2 | TUM |
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**Note:**

* **Due to the late joining in the program obligatory courses are already finished and 2nd secondments will be also in ESR year 3 i.e. oCPS year 4.**
* **Planned courses for year two are preliminary and subject to refinement.**

* 1. Personal Development Related Training

*Knowledge and skills to be acquired during the period of the PhD project. Personal presentation skills, skills in report writing and preparing academic papers and books, to be able to defend research outcomes at seminars, conferences, etc., contribute to promote public understanding of one’s own field. Issues related with career management, including transferable skills, management of own career progression, ways to develop employability etc. The courses or lectures that need to be taken for this purpose and the participation in seminars, colloquia, and suchlike. (Note: all training is anticipated to take place in the 3-year active participation of the ESR in the oCPS program, also for ESRs enrolled in a 4-year program.)*

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| **Year** | **Course** | **EC** | **Remarks** |
| **Year 1** | Professionalization and industrialization | 2 | TECHNO |
| German Language course for beginner level A1.1 | 2 | Fortiss |
| Innovation & Entrepreneurship | 2 | EIT Digital |
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| **Year 2** | Scientific Paper Writing for Computer Scientists | ≈ 2 | TUM |
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| **Year 3** |  |  |  |
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PhD student Supervisor

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Date & signature Date & signature

Training offered within oCPS (status 20.05.2016)

| **Category** | | **Course** | **EC** | **Responsibility** | **Planned time** |
| --- | --- | --- | --- | --- | --- |
| Secondment | obligatory | 1st secondment | - | Various | Year 1-2 |
| Secondment | obligatory | 2nd secondment | - | Various | Year 2-3 |
| Scientific training | obligatory | Communication systems | 3 | Prof. Johansson and Prof. Lukkien | M9-12 |
| Scientific training | obligatory | Control systems | 3 | Prof. Hirche and Prof. Engell | M9-12 |
| Scientific training | obligatory | Modelling and verification | 3 | Prof. Törngren and Prof. Chakraborty | M13-18 |
| Scientific training | obligatory | Embedded systems | 3 | Prof. Corporaal and Prof. Basten, ASCI | M13-18 |
| Professional training | obligatory | Organization, integrity & IP | 2 | TUE | M9-15 |
| Professional training | obligatory | Teaching and supervision | 2 | TUE | M18-24 |
| Professional training | obligatory | Scientific writing and presenting | 2 | Respective academic hosts | M7-30 |
| Professional training | obligatory | Innovation & Entrepreneurship | 2 | TECHNO, EIT Digital | M12-24 |
| Specialized training | elective | Enhancing insights in industrial design | 2 | Philips | M18-36 |
| Specialized training | elective | Processor design space exploration based on the Silicon Hive architecture | 2 | INTEL | M18-36 |
| Specialized training | elective | Optimal Control and Dispatch of Smart Grids | 2 | Siemens | M18-36 |
| Specialized training | elective | Simulation and analysis of embedded real-time systems | 2 | INCHRON | M18-36 |
| Specialized training | elective | Applied model predictive control | 2 | ODYS | M18-36 |
| Specialized training | elective | System development with the Imsys family of processors | 2 | IMSYS | M18-36 |
| Specialized training | elective | Model-based design for CPS | 2 | Fortiss/TUM | M18-36 |
| Specialized training | elective | Model integration and management | 2 | KTH | M18-36 |
| Specialized training | elective | Professionalization and industrialization | 2 | TECHNO | M18-36 |
| Specialized training | elective | Innovation & Entrepreneurship | 2 | EIT Digital | M18-36 |
| Webinar | elective | oCPS webinar I | - | Various | M7-30 |
| Webinar | elective | oCPS webinar II | - | Various | M7-30 |
| Webinar | elective | oCPS webinar III | - | Various | M7-30 |
| Webinar | elective | oCPS webinar IV | - | Various | M7-30 |
| Summer school | elective | oCPS summer school I | 2 | TUM, IMT, TUE | M18-42 |
| Summer school | elective | oCPS summer school II | 2 | TUM, IMT, TUE | M36-42 |
| Conference | elective | Special sessions at relevant conferences | - | TUE, TUW | M18-36 |
| Conference | elective | Workshops/tutorials at relevant conferences | - | TUM, KTH | M18-36 |