

Research Project Application Form

Graduate School of Natural Sciences

Use of this form is mandatory for all large research projects, notably final thesis work (“afstuderen”). It must be handed in by the student at the student desk (“studentenbalie”), Buys Ballot Building room 184b, prior to starting the project.

Student	
Name of MSc programme	Computing Science
First and last name of student	João Paulo Pizani Flor
Email address	joapizani@gmail.com
Student number	3860418
Project supervisor (first examiner)	
Name and title (must be a Utrecht University staff member)	dr. W. S. Swierstra
Faculty, department and Research group (chair)	Faculty of Science – Department of Information and Computing Sciences Research Group “Software Technology”
Email address	w.s.swierstra@uu.nl
Daily supervisor	
Fill out this section only if the project supervisor is not the daily supervisor!	
Name and title	
Affiliation	
Address	
Telephone number	
Email address	
Second examiner	
Name and title (must be a Utrecht University staff member)	Prof. dr. Johan Jeuring
Faculty and Research group (chair)	Faculty of Science – Department of Information and Computing Sciences Research Group “Software Technology”
Email address	j.t.jeuring@uu.nl
Research project	

Title	An embedded Hardware Description Language using dependent types
Location	Faculty of Science - Center for Software Technology
Starting date	10-02-2014
Ending date	03-09-2014
Number of ECTS	40
Short description of the project, including aims	<p>Computer hardware has experienced a steady exponential increase in complexity in the last decades. As the chip manufacturing process comes closer to its physical limits, processing power cannot be extracted anymore just from increasing transistor density. Now hardware designers face new challenges, and have to consider low-level concerns (such as error-correction, layout, etc.) earlier in the design process. These early optimization concerns make hardware validation and verification extremely hard and costly.</p> <p>We believe that recent developments in programming language research, more specifically the advent of dependently-typed programming, can be used to make hardware design a more efficient and less error-prone activity, and thus make the designed systems more reliable.</p> <p>This project aims to develop an Embedded Domain-Specific Language (EDSL) for hardware description, hosted in a dependently-typed programming language. The developed EDSL would provide the following benefits:</p> <ul style="list-style-type: none"> • The expressive type system of the host language will prevent big classes of design errors earlier, avoiding the cost of simulation. • Properties defining circuit behavior can be expressed in the <i>type</i> of the circuit, and a circuit model belonging to the type <i>provably satisfies</i> the property. • It will be possible to simulate and <i>extract</i> models written in our EDSL to other (lower-level) hardware description languages, preserving correctness. <p>The project encompasses two main stages: in the first stage, the focus lies on the capability to model <i>combinational</i> circuits, simulate these and extract netlists from them. After this first stage, we will incorporate into the EDSL the capability to model <i>sequential</i> circuits, with the same simulation and extraction characteristics.</p> <p>As final products of the research project, we intend to deliver a library for hardware description written in the <i>Agda</i> programming language, as well as naturally the thesis report, describing the theoretical underpinnings of the project and covering the usage of the library</p>
Agreements between student and supervisors	

Number of hours available for supervision	Approx. 30h
Planning/timing of the supervision (e.g. 'weekly meetings')	Weekly meetings
Agreed student work load (e.g. full time, 4 days/week, etc.)	Full time
Student absence (holidays, courses, etc.)	None planned
Supervisor absence (holidays, conferences, etc.)	3 weeks of holidays, possible conferences.
Intermediate evaluations of student performance (specify at least two dates)	Project evaluation meetings on April 17th and June 26th, 2014
Presentations to be held	Final presentation in late August, possible conference talks still to be defined.
Lab/group meetings to be attended	Software Technology group reading club, whenever appropriate.
Other activities agreed upon	
Primary assessment criteria (please see appendix for examples. Final presentation and written thesis must be part of the assessment)	As documented in the 'Docentenhandleiding Informatica'.
Copyright	
<p>By signing this document, the student declares to transfer the copyright of any and all products, including the tangible and intellectual products, of the research project to Utrecht University. The rights of the student by scientific standards to be a co-author of publications or to be otherwise acknowledged are still recognized.</p> <p>The student is allowed and must upload his final assessed thesis to the university publication archive IGITUR. At a later stage, the thesis may be made public via IGITUR, or its access may be restricted temporarily or indefinitely.</p>	
Signatures	

Student signature and date (Must be signed when form is handed in at the student desk.)	
Project supervisor signature and date (Must be signed when form is handed in at the student desk.)	
Master's programme coordinator name, signature, and date (Must be signed when form is handed in at the student desk.)	
Examination board member name, signature and date (Approval and signature will be obtained by student desk.)	

Appendix: an incomplete list of possible assessment criteria

- Level - Theoretical level, practical/experimental level, understanding of the underlying matter, amount of work in relation to number of ECTS
- Problem handling - Methods, techniques, design instrumentation, implementation, experiments
- Skills - Analytical skills, model building, distinguishing matters of major and minor importance, evaluation, independence, collaboration, self-reflectiveness, planning
- Effort and attitude
- Originality
- Relevance, valorization
- Report/Thesis - literature survey, problem statement, style of writing, quality of Dutch/English, report structure, textual structure, coherence/consistency, conclusions/recommendations, neatness
- Oral presentation - presentation/public speaking skills, structure, discussion skills, presentational aids