COMPUTING HONOURS PROJECT SPECIFICATION FORM
(Electronic copy available on the Aula Computing Hons Project Site)

Project Title: Developing Device Drivers in Rust

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Programme of Study: BSc (Hons) in Computing Science

Supervisor: Paul Keir

Moderator: Stephen Devine

Outline of Project:
Device Drivers within Operating Systems suffer from numerous issues, one of which being the use of unsafe programming languages. This project seeks to test if Rust would be a suitable, safe candidate to replace the C programming language in drivers, exploring exactly how this task might be carried out.

Rust is a young systems programming language with a focus on safety through various features. From its compiler to its model of memory management. It is my intent to attempt to write a Linux driver in Rust to test its suitability for applications within drivers and the wider world of Operating System and Kernel development. Doing so would allow me to highlight where Rust may make improvements or prevent errors when compared to that of C.

During the project, I also want to gain a fundamental understanding of drivers in their present state. I plan to investigate how they are developed, uses, tools and differences between major Operating System vendors. How they link to the Kernel and rest of the OS. I want to utilise this project to thoroughly investigate and highlight the issues surrounding device drivers, discussing previous works that have attempted to alleviate driver issues.

Rust continues to grow in popularity and more developers call for it to replace C and C++. It is therefore necessary to test its suitability for integration into existing systems and to test if Rust truly has potential to eventually replace such programming languages.

A Passable Project will:

- Review literature on Device Drivers and related issues.
- Discuss previous works, other methods/ideas
- Highlight how Rust can be used to improve applications and safety
- Develop a basic Rust driver.
- Evaluation of Rust driver with explanation and results.
- Discuss recent works that relate or will progress the field.

A First Class Project will:

- Provide detailed literature review highlighting most prominent, key issues of topic at hand which form the basis of this project.
- Discuss previous research efforts, results and findings – how they relate to and inform the project work.
- In-depth technical discussion on Rust's security features, how these compare to that of C/C++ and areas where improvements may have been made.
- Develop a working Rust driver that can control (or give basic functionality to) an external computer peripheral (Mouse, USB stick, Simple gamepad/controller).
- Detailed evaluation of end product and comparison to an existing equivalent in C.
- Detailed discussion on recent findings, work, events that strongly relate to the project in order to highlight future opportunities, research and potential developments.

Reading List:

Corbet, J. Rubini, A. Kroah-Hartman, G. (2005) *Linux Device Drivers 3rd Edition*

Li, Z. Sun, M. Wang, J. C.S. Lui, J. (2019) *Securing the Device Drivers of Your Embedded Systems: Framework and Prototype*

Gaynor, A. Thomas, G. (2019) *Linux Kernel Modules in Rust*

Choum A, Yang, J. Chelf, B. Hallem, S. Engler, D. (2001) *An Empirical Study of Operating Systems Errors*

Palix, N. Calves, C. Thomas, G. Lawall, J. Saha, S. Muller, S. (2011) *Faults in Linux: Ten Years Later*

Chen, H. Mao, Y. Wang, X. Zhou, D. Zeldovich, N. Kaashoek M. F. (2011) *Linux Kernel vulnerabilities: State-of-the-art defenses and open problems*

Resources Required: *(hardware/software/other)*

Personal workstation with Linux OS installed
Raspberry Pi 400 (used as development/test machine)
VirtualBox (as backup for driver development)

RUSTC Compiler
VSCodium Open Source Code Editor
Git
GitHub
Trello (project/task management)

Marking Scheme:

	Marks
Background	10
Literature Review	20
Development	40
Experiments	10
Conclusion	10
Reflection	10

AGREED:

Student	**Supervisor**	**Moderator**
Name: Kyle Fraser Christie	**Name:** *Paul Keir*	**Name:** *Stephen Devine*

IMPORTANT:

(i) By agreeing to this form all parties are confirming that the proposed Hons Project will include the student undertaking practical work of some sort using computing technology / IT, most frequently achieved by the creation of an artefact as the focus for covering all or part of an implementation life-cycle.

(ii) By agreeing to this form all parties are confirming that any potential ethical issues have been considered and if human participants are involved in the proposed Hons Project then ethical approval will be sought through approved mechanisms of the School of CEPS Ethics Committee.