THESIS SUPERVISOR'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**NuttX RTOS CAN Bus Driver for Espressif ESP32C3**
Author's name:	**Jan Charvát**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Measurement – K13138
Thesis reviewer:	Ing. Pavel Píša, Ph.D.
Reviewer's department:	Department of Control Engineering – K13135

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — **challenging**

How demanding was the assigned project?

The project required deep understanding of processor system function (interrupts, registers), CAN bus operation as well as to study NuttX operating system and kernel code writing.

Fulfilment of assignment — **fulfilled**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

All points has been fulfilled and work has been delivered in shape that after a minimal number of expected iterations it has been accepted into NuttX operating system mainline. It passes review from more Espressif core NuttX developers and it has been immediately (after the first publication) ported even ported even to Extensa based ESP32 family by Espressif microcontrollers family. The driver functionality has been successfully tested together with pysimCoder CAN bus blocks in cooperation with Dion Beqiri and thorough load testing was done in cooperation with Matěj Vasilevski as the target of his work on CAN latency tester.

Activity and independence when creating final thesis — **A - excellent.**

Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.

The student started work in time and result is submission into mainline more than month before (6.4.22) deadline. Cooperation on testing between students worked great way and cooperation with NuttX community as well.

Technical level — **A - excellent.**

Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?

Result is functional mainlined driver with appropriate comment lines.

Formal level and language level, scope of thesis — **B - very good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

I am not English language expert but I consider the text as well understandable and documenting work done

Selection of sources, citation correctness — **A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

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III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The result of the work is the useful driver accepted for NuttX operating system and welcomed by more representatives from Espressif company.

Related timeline of building open SW and HW CAN ecosystem:

2003 – my attempt for unified/company neutral CAN bus drivers for GNU/Linux designed during my winter vacations (investment of university/research time unwanted by group head), still used in industry applications according to support requests. Not enough influence to convince big players, Volkswagen with SocketCAN succeed. Helped to reused parts of LinCAN to support some of the hardware.

2005 – Stanislav Marek's thesis, CAN for H8S, update LinCAN bitrate computation, offered and used by SocketCAN, used by each CAN bus application on GNU/Linux system, algorithm reused even by this NuttX thesis

2013 – I have steered RTEMS GSoC Jin Yang's slot for work on SJA1000 CAN bus emulation for QEMU

2016 – Martin Jeřábek theses provided CAN latency testing on Zynq system (reused for ESP32C3 driver testing)

2018 – QEMU accepted CAN bus subsystem, XilinX builds their emulation on this base and document it in manuals

2019 – Martin Jeřábek and Odřej Ille worked on CTU CAN FD open-source VHDL IP core under Volkswagen subsidiary contract negotiated by me, continuation of work done by Onřej Ille for doc. Jiří Novák

2020 – Jan Charvát implemted CTU CAN FD QEMU emulation, I invested to state that allows it to submit, XilinX Versal emulation builds on it

2020 – Jaroslav Beran under doc. Jiří Novák reused CTU CAN FD on Intel FPGA SoC, used even to test CAN FD at Elektroline.cz and the contributed by fixes to NuttX SAMv7 drivers

2021 – Michal Lenc multiple contributions to NuttX under Elektroline.cz funding including multiple CAN drivers, helped to understand CAN support in NuttX

2022 – CTU CAN FD accepted into Linux kernel mainline (lot of effort by Ondřej Ille and me)

2022 – Matěj Vasilevski implemented time-stamping for CTU CAN FD (helped to test Jan Charvát's work) and updated XCAN lost work, firs round of mainline reviews passed

The track record show how to build open technologies for multiple systems and it is great to see that Jan Charvát's previous work was used to test driver which allowed later to provide test system for his second work in the CAN bus area. Providing students with knowledge and references to real and open code is a must when they apply for top rank developer and architect positions in the technology building and advancing companies and students should be warned in advance if they are only attracted by GNU/Linux related topics but their work bit-rots due to mentors attitude and NDA's.

The grade that I award for the thesis is A - excellent.

Date: **6.6.2022** Signature: