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Erlangen, Germany

STRUCTURE :

About me

EDUCATION
I completed my high school education in Prague, Czechia, earning A-levels in Mathematics, German, English, and Czech language. During this time, I enriched my academic experience by spending three months studying at Billroth Gymnasium in Vienna and Ackworth School in Ackworth, England. These international experiences taught me resilience and fueled my ambition to pursue higher education abroad. After graduating, I moved to Erlangen, Germany, to study Computer Science at Friedrich Alexander University (FAU). I am currently in my final semester, working on my thesis titled FPGA-Accelerated Selective Upload of JSON-Encoded Data for Wireless Sensor Networks.

stay in Ackworth

stay in Vienna

WORK EXPERIENCE
In my third semester at FAU, I embraced the opportunity to become a Mathematics tutor. This role combined my passion for mathematics with the challenge of teaching and presenting complex concepts to an audience of 80 students. Initially, it was daunting due to language barriers—German not being my native language—and the complexity of explaining advanced math problems. However, I developed my own teaching style, focusing on simplifying explanations and adapting to the unique learning pace of each student. I learned that it is essential to be patient, clear, and open to questions, as well as to admit when further research is needed to provide accurate answers in future lessons.

Later on, I started working as a 'Working student' at a company called SIS by UL Solutions. During my time there, I contributed to various projects, with some notable highlights:

- I gained hands-on experience with *Docker*, *Webots*, and *ROS* while assisting students from the University of Bayreuth on a project involving the pib-Robot (more details at pib.rocks),

which aimed to program the robot to play the game of Cornhole. The pib-Robot can be fully assembled at home, and through this project, I learned the basics of *3D print.*

- I assisted with the verification of Zephyr's Kernel implementation of Semaphore by modeling the implementation in the *formal language TLA+* and running it through the *model checker TLC*. This project taught me the concepts of *formal verification* and underscored its importance in ensuring reliable software systems.

- I developed a strong interest in *Zephyr* and completed a series of worksheets to deepen my understanding of its functionality. I then worked on several projects focused on Zephyr, *embedded systems*, and *IoT*. These included programming an FPI board with an Arduino connector and creating an interactive display for a massage device using LVGL. Through these experiences, I learned to *read electrical circuits* and gained hands-on experience with different boards, including *STM32, Nucleo, and Nordic*. Additionally, I developed teamwork skills by collaborating in a team where each member had specific assignments.

- I also gained introductory exposure to *Agile and SCRUM methodologies* during a workshop that creatively used LEGO pieces to build a model city.

FREE TIME
In my free time, I am passionate about sports, having practiced modern pentathlon from a young age. Currently, I focus on fencing with SGS Fechten and swimming with Turnerbund Erlangen. Additionally, for the past six years, I have been a summer camp leader and cook for children aged 10-15.

At FAU, I receive a scholarship for coordinating and organizing activities for international and Erasmus+ students. These activities include planning trips to major cities like Munich and Berlin, as well as visits to smaller towns, hiking excursions, and fun events such as mini-golf and pub crawls.

I have attended several Erasmus Youth Worker training courses focused on educating individuals who work with young people. One notable course took place in Larnaca, Cyprus, and was titled Games for Social Entrepreneurs. This course primarily taught us how to establish and manage a non-profit organization. The highlight of the training was developing a board game as the final project, which reinforced our learning and promoted practical application of the concepts.

Play Invention Hardware Internship

Prior experience showcasing skills and knowledge directly relevant for this internship:

Creative Thinking and Process: My experience as a leader for summer camps has greatly enhanced my ability to think creatively and improvise. In this role, I've had to quickly come up with interactive activities and solutions to keep participants engaged, sharpening my problem-solving skills and adaptability. This experience translates into my work, where I apply creative thinking to design interactive projects, develop engaging user experiences, and find innovative solutions to technical challenges.

Electronics and Soldering: Beyond university-level electronics courses and early experiments with Boffin, I am skilled in soldering components such as capacitors, resistors, and ICs onto circuit boards, ensuring robust connections and reliable functionality.

Coding: I am proficient in programming languages including Python, C, C++, Java, Scala, and the hardware description language Amaranth (formerly nMigen). My Computer Science degree has provided countless hours of hands-on experience through complex assignments, refining my coding and problem-solving skills.

Arduino/Raspberry Pi: Although I've worked on projects such as programming and soldering a custom stream deck with Arduino to control Spotify, I'm more experienced with Nucleo and STM32 boards. I primarily use Zephyr RTOS on these platforms, which allows me to tackle real-time embedded applications and complex hardware projects.

PCB Design and Manufacture: Although I am not currently experienced in PCB design and manufacturing, I am eager to learn more. I have a basic understanding of how circuits are structured and function, which serves as a solid starting point for developing my skills in designing and creating printed circuit boards.

Artificial Intelligence: I have a foundation in AI, having completed coursework that included Markov models, Bayesian networks, and probabilistic reasoning. Additionally, I have taken a course on deep learning, which provided me with hands-on experience in designing and training neural networks.

CAD Programs and 3D Printing: Although I haven't worked extensively with CAD programs, I am currently learning 3D printing. I am involved in printing the pib-robot from https://pib.rocks/, which is then used for education in schools. This hands-on experience is helping me develop a practical understanding of 3D printing techniques and processes.

Xylobot 2.0: A LEGO Mindstorms Robotic Project

Timeframe : 04/2024 - 09/2024

Xylobot 2.0 is a LEGO Mindstorms-based robotic project designed as an interactive learning tool that autonomously plays songs on a xylophone, transforming music education and engagement. Developed in a collaborative team environment, we combined our strengths to overcome both hardware and software challenges.
As a team, we engineered a moving platform equipped with motor-driven arms, capable of playing notes with precision and consistent timing. I primarily contributed to the hardware development, designing and assembling the moving platform and motor-driven arms to ensure precise note playing. Our teamwork was essential for navigating the complexities of integrating the hardware with the software and fine-tuning the system for accurate synchronization and performance. Regular team discussions and collaborative problem-solving sessions were crucial for iterative testing and optimization. This experience highlighted the importance of effective communication and leveraging each team member's skills to overcome challenges and deliver a seamless, functioning product. The project not only showcased our technical proficiency but also emphasized the power of teamwork in creating an innovative educational tool.

Team-members : Dila Su Celikkol, Si-Hoon Kang, Batuhan Semercioglu, Aneta Vetrovska

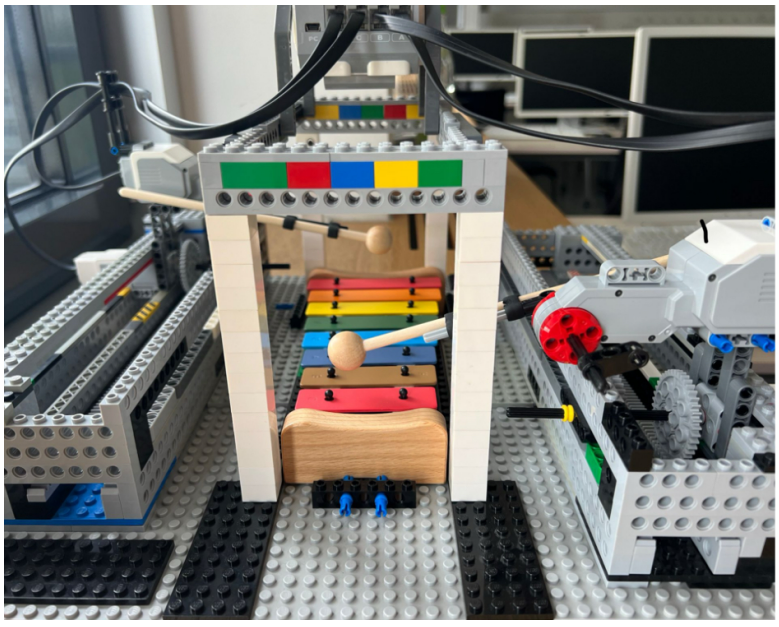
Final report (in German) : https://github.com/anetavetrovska/anetavetrovska/blob/main/lego-mindstorms-xylobot2.0/Xylobot_Dokumentation.pdf

Final presentation : https://docs.google.com/presentation/d/1Yl4XQo5_lWqnCuRUZ-fGwTtw2LvYfrgZreglIE5OIKQ/edit?usp=sharing

Our progress documented in a video : https://www.youtube.com/watch?v=1qRwFpMZfbQ

Final result video : https://youtu.be/Gl_9VteRkBE

Final result :



FPGA-Accelerated Selective Upload of JSON-Encoded Data for Wireless Sensor Networks

Timeframe : 10/2024 - 02/2025

I am currently working on my thesis, which focuses on developing an FPGA-based system to optimize data processing for wireless sensor networks, under the supervision of Prof. Dr.-Ing. J. Teich, with support from M.Sc. Tobias Hahn and M.Sc. Pierre-Louis Sixdenier. The project involves creating a hardware filter capable of extracting numerical data from JSON records. This data is encoded in BCD and compared against predefined ranges for selective data uploads. This filter can be configured online for greater adaptability. I am exploring two approaches for range generation: an offline method based on historical data and an optional real-time online update method.
The system's evaluation includes functional tests on practical applications, such as air quality monitoring, to assess the energy savings achieved through data filtering and to minimize false negative rates, ensuring data accuracy. Additionally, I am conducting a comparative evaluation of energy overhead between the hardware implementation and a software version running on a Raspberry Pi 4 to highlight the benefits of FPGA acceleration.

Supervisors : Prof. Dr.-Ing. J. Teich, M.Sc. Tobias Hahn, M.Sc. Pierre-Louis Sixdenier

Used dataset : https://archive.ics.uci.edu/dataset/601ai4i+2020+predictive+maintenance+dataset

Snippet of code :

```
class AsciiToInteger(Elaboratable):
    en:     In(1)
    ascii:  In(8)
    bcd:    Out(4)
    next:   Out(1)

    def __init__(self):
        self.en = Signal(1) # either 1 or 0
        self.ascii = Signal(8) # ascii characters have 8 bits
        self.bcd = Signal(4) # one bcd number has 4 bits
        self.next = Signal(1) # either 0 or 1
        self.remaining = Signal(8) # integers representing ascii have max 8 bits

        super().__init__()


    def elaborate(self, platform):
        m = Module()

        with m.If(self.en):
            m.d.sync += [
                self.next.eq(1),
                self.remaining.eq(self.ascii)
            ]


        with m.If(self.next):
            m.d.sync += [
                self.bcd.eq(self.remaining % 10),
                self.remaining.eq(self.remaining // 10)
            ]

        with m.If(self.remaining == 0):
            m.d.sync += self.next.eq(0)

        with m.Else():
            m.d.sync += self.next.eq(1)

        return m
```

Stream Deck for Spotify

05/2024

I created a Stream Deck from scratch, powered by an ESP microcontroller, to enhance music interaction with Spotify. The device features multiple programmable buttons, which I assembled and soldered onto a custom PCB. Each button was programmed to perform specific functions like play/pause, skip track, and like a song, integrating with Spotify via a Python script and the Spotify Web API.

Final result video : https://youtube.com/shorts/MlymHIlvmGM?feature=share

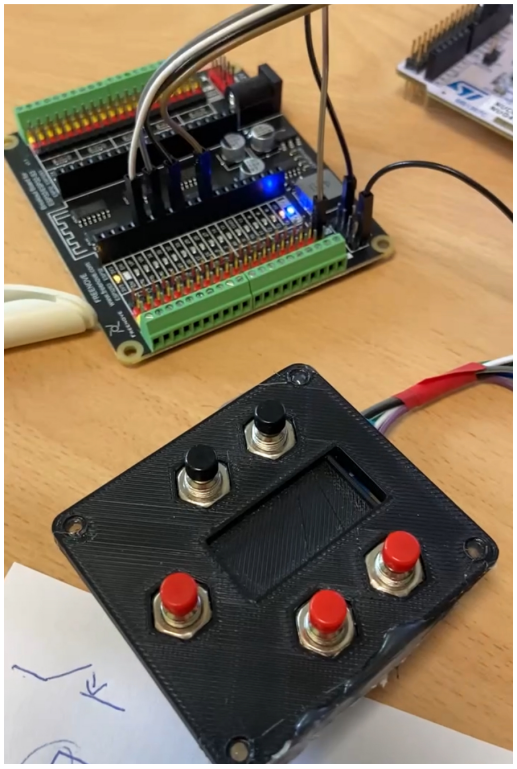
Final result :

Programming an FPI board with Arduino connector

Timeframe : 09/2024 - 10/2024

I developed a project for Storz involving the programming of an FPI (Field Programmable Interface) board equipped with an Arduino connector, integrating I2C communication for enhanced functionality. The project included creating custom firmware using Zephyr OS. This firmware managed GPIO pins for programming tasks. I configured multiple GPIOs as inputs or outputs based on requirements and implemented a system to handle button interactions and task scheduling. The code featured functions for checking pin readiness, setting pin states, and controlling the power switch, incorporating a callback system to manage button-triggered events and handle debouncing for stable operation. Additionally, I used I2C to facilitate data transfer and communication between components, ensuring synchronized operations. This project highlighted my expertise in embedded programming, system integration, and developing reliable firmware for complex hardware interfaces.

Supervisor : Andreas Kurz



```c
int configure_gpio_pins(void);
int check_gpio_ready(const struct gpio_dt_spec all_gpio_pins[], size_t num_gpios);
void schedule_work_after_button_pressed(const struct device *dev, struct gpio_callback *cb, uint32_t pins);
void handle_button_press(struct k_work *work);
int program_pins(void);
int set_prog_pin_i(int pin_nr, int state);
int set_power_switch(int state);

static const struct gpio_dt_spec prog_1 = GPIO_DT_SPEC_GET(PROG_1, gpios);
static const struct gpio_dt_spec prog_2 = GPIO_DT_SPEC_GET(PROG_2, gpios);
static const struct gpio_dt_spec prog_3 = GPIO_DT_SPEC_GET(PROG_3, gpios);
static const struct gpio_dt_spec reset = GPIO_DT_SPEC_GET(RESET, gpios);
static const struct gpio_dt_spec success = GPIO_DT_SPEC_GET(SUCCESS_PIN, gpios);
static const struct gpio_dt_spec power_switch = GPIO_DT_SPEC_GET(POWER_SWITCH, gpios);
static const struct gpio_dt_spec btn = GPIO_DT_SPEC_GET(BUTTON, gpios);

static struct gpio_callback button_cb_data;
static struct k_work_delayable to_do_in_queue;

static const struct gpio_dt_spec all_gpio_pins[] = {
    prog_1,
    prog_2,
    prog_3,
    power_switch,
    reset,
    success,
    btn,
};

typedef struct {
  const char s_addr[4];
  const struct gpio_dt_spec *pin;
```

Forensic Informatik Project : Rhinographie

Timeframe : 04/2024 - 09/2024

As part of a classroom simulation for a course project, I performed a detailed forensic analysis of a seized Dell XPS computer. This analysis involved verifying data integrity, examining partition structures, recovering deleted files, and searching for specific content, such as rhino images, in line with the investigation scenario. I utilized tools like SleuthKit, photorec, and clamscan for a comprehensive analysis and ensured meticulous documentation, including hash value checks for data integrity at every stage. The project culminated in a detailed forensic report (available in German, link provided below) and concluded with an exam conducted as a mock courtroom trial, where I represented the forensic expert and my professor took on various other roles. This experience demonstrated my proficiency in digital forensics, systematic data analysis, and presenting expert findings in a formal setting.

Final report : https://github.com/anetavetrovska/anetavetrovska/tree/main/rhinographie-forensic-inf

Example of a found picture :

BEST course: Beyond Asimov’s Rules: Towards Intelligent Robotics

08/2023

BEST course: Beyond Asimov’s Rules: Towards Intelligent Robotics was an intensive, week-long program held at Carlos III University in Madrid, primarily focused on robotics and its emerging frontiers. The course featured a series of engaging and informative lectures that explored both the theoretical and practical aspects of intelligent robotics (see syllabus for details). Participants had the opportunity to visit advanced robotics and virtual reality laboratories, gaining firsthand exposure to cutting-edge technologies and research. A highlight of the course was a company visit to Marsi Bionics, where participants were inspired by their innovative work on robotic exoskeletons for kids and medical robotics.

More information : https://bestuc3m.es/best-course/

Syllabus : https://github.com/anetavetrovska/anetavetrovska/tree/main/best-course-robotics