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MATTHIAS THÖMEL

Project Reference

Customer Information

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1. Quality Assurance

Document	
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Related Documents	
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Version en-1.12	Added Bosch	M. Thömel	2012-01-27
Version en-1.13	Added CUDA	M. Thömel	2013-01-23
Version en-1.14	Added Höft und Wessel AG	M. Thömel	2014-01-13
Version en-1.16	Added Bosch AI + Android	M. Thömel	2016-06-16
Version en-1.17	Added Linux Driver	M. Thömel	2016-12-19
Version en-1.17	Added Linux File Observer and TensorFlow	M. Thömel	2017-06-06
Version en-1.18	Added ESP32 IoT, Android, EFM32	M. Thömel	2019-10-02
Version en-1.20	Added I project AILO	M. Thömel	2019-12-30
Version en-1.23	DPRE Smart ESP32	M. Thömel	2021-09-06

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2. Project Reference

The following reference describes all relevant projects Matthias Thoemel has worked on. The last entry is the most actual one.

Programming of an universal graphical visualization system for measurement data visualization, m+p PLOT1000.

Period: 1986 (6 MM)

Hardware: HP1000 (RTE-A), HP9000 (HP-UX)

Software: FORTRAN, C

- Activities:
- Development of several drivers for plotters and displays
 - Migration of the software from RTE-A to HP-UX

Development of an universal user interface data input and output using masks for HP2392 series terminals running on a HP1000.

Period: 1986 (4 MM)

Hardware: HP1000 (RTE-A/L), HP9000 (HP-UX)

Software: FORTRAN, C, HP2392A escape sequences

- Activities:
- Optimization of the I/O drivers for the MUX interface
 - Implementation of the whole functionality of the terminals
 - Development of other drivers for the HP-UX console
 - Migration of the software to HP-UX

*o p e n***Order data management system for the “Klöckner” Steelworks,
Georgsmarienhütte, Germany with material counting and quality assurance**

Period: 1987 (4 MM)

Hardware: HP1000 (RTE-A)

Software: FORTRAN

- Activities:
- Development of modes to manage the order data
 - Interfacing to external measurement systems for the quality assurance
 - Hardware and software customer support
 - Documentation and reference manual creation
 - Customer training and support
 - Extension of the software at customers site

**Order data management system for the “Blankbetrieb, Klöckner” Steelworks,
Georgsmarienhütte, Germany with material counting and quality assurance by
laser diameter**

Period: 1987 (3 MM)

Hardware: HP1000 (RTE-A), laser diameter

Software: FORTRAN, IMAGE/1000

- Activities:
- Software design for about 70% of the system
 - Development of a formula interpreter for the parametrical assignment of the workers
 - Management software for the data management
 - Interfacing to the laser diameter
 - Report generator for the “X/R-Regelkarten” printout

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- Interfacing to the IMAGE/1000 database to all parts of software
- documentation
- installation on site

Data acquisition of a measurement buoy in the North Sea

Period: 1988 (3 MM)

Hardware: HP85 (BASIC), HP1000 (RTE-A), Modem

Software: BASIC, FORTRAN

- Activities:
- Design and realization of the whole system for a HP 85 and HP 1000.
 - Development of a simple transfer protocol
 - Installation of the software at Technical University Hannover, Germany

Measurement data acquisition at the “Grosser Wellenkanal, Franziusinstitut”, Technical University Hannover, Germany

Period: 1988 (3 MM)

Hardware: HP1000 (RTE-A), as mass storage device: 4 UMATIC-Video recorder connected via PCM module

Software: FORTRAN

- Activities:
- Interfacing to the VCR's at HP1000
 - Development of a special m+p PLOT 1000 drivers for endless plotting
 - Installation and training

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**Measurement data acquisition and management for a research project at the
“Landesamt für Landwirtschaft, Braunschweig”, Germany**

Period: 1989 (3 MM)

Hardware: HP 9000 (HP-UX), HP front end (BASIC, 68000 Assembler)

Software: C, BASIC, 68000-Assembler.

- Activities:
- Design of the software
 - Development (BASIC and Assembler for front end)
 - Installation of the software at customers site
 - Documentation

**Control of a measurement device to measure the surface of aluminum plates
with laser measurement devices, ALCAN Germany**

Period: 1990 (4 MM)

Hardware: HP1000 (RTE-A), own centronics interface at HP1000, own timer hardware on top of a breadboard for HP 1000, Video card for HP1000

Software: FORTRAN, IMAGE/1000

- Activities:
- Conception and Design of the software
 - Design of parts of the hardware
 - Development of the software
 - Fast level curve algorithm
 - Interface to IMAGE/1000 database
 - Development of the Hardware
 - Integration of hardware and software at ALCAN, England
 - Documentation

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- Installation at ALCAN, Germany
- Training

Further development of SAVEM (noise analysis system) for the HP1000, VW Wolfsburg, Germany

Period: 1990 (6 MM)

Hardware: HP1000 (RTE-A), measurement data acquisition with HP1000 extension cards

Software: FORTRAN, Image/1000

- Activities:
- Development of a new structure of the whole user interface
 - Development of a formula interpreter
 - Extension of the graphical data representation
 - Installation at VW, Wolfsburg, Germany
 - Documentations
 - Training
 - Support of the system

Common development of GUI's

Period: 1991 (2 MM)

Hardware: HP9000 (HP-UX)

Software: C, X-Windows

- Activities:
- Introduction of employees to the programming with Xt-Intrinsics and the X-Window functions under HP-UX

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System for measurement and analysis of fuel injector at L'Orange, Germany

- Period: 1990 (9 MM; 3 MA)
- Hardware: HP1000 (RTE-A)
- Software: FORTRAN, Image/1000
- Activities:
- Project leader and coordinator between m+p and freelancers
 - Development of drivers for the measurement
 - Implementation of software
 - Installation at customers site

Training for the HP Paragon including 68000 and 56001 processors at HP, Seattle, USA

- Period: 1991 (6 MM; 2 MA)
- Hardware: HP-Paragon: fast measurement data acquisition module
- Software: C, Assembler 56001 / 68000
- Activities:
- Training in USA
 - One week practical work with the system to be able to decide if m+p will use this device for the new systems to develop

Development of a personnel administration and management system for the personnel of a big concert organizer, Hannover Concerts, Germany and for a big security company, KKS, Germany

- Period: 1992 (6 MM)
- Hardware: PC (MS-DOS)
- Software: DBase 4, Clipper.
- Activities:
- Design and development of the system

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- Installation and administration at customers site
- Onsite support

Development of a cross compiler for Dbase 4 to Clipper 5.0

Period: 1993 (2 MM)

Hardware: PC (MS-DOS)

Software: C, DBase4, Clipper

- Activities:
- Design and Development of the cross compiler under Borland Turbo C
 - Special challenge: realization of the window technique of Dbase under Clipper

Development of a MIDI out interface for an old instrument

Period: 1993 (1 MM)

Hardware: 8031-Prozessor

Software: 8031-Assembler

- Activities:
- Conception of hardware and software
 - Development of hardware and software
 - Implementation into the instrument

Development of several promotion games

Period: 1993 (18 MM; 3 MA)

Hardware: Z80-Hardware (own product)

Software: Z80-Assembler, GNU-C-Compiler

- Activities:
- Adaptation of GNU compiler to hardware target

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- Development of an own multi tasking system
- Game coding in C
- Documentation

Project planning, realization and authoring for the public project “Der Wellenreiter” for the technical journal “ELRAD”

Period: 1992-1993 (15 MM; 3 MA)

Hardware: 56001 digital signal processor, 68008 micro controller, PC, several interface circuits

Software: C, C++, 56001-, 68008-Assembler

- Activities:
- Conception of hardware and software
 - Development of the software for all processors
 - Documentation of the software
 - Writing the articles for the journal

Development of applications on top of AutoCAD 12 and 13 for an architectural application, arso, Hannover.

Period: 1995 (8 MM; 2 MA)

Hardware: PC

Software: AutoCAD12/13, DOS4GW-Extender, C

- Activities:
- Analysis of architectural rules for stairways
 - Development of the software
 - documentation
 - further tools for the architectural application

*o p e n***Development of a cross compiler between AutoLISP (AutoCAD language) and C up to the AutoCAD version 12C2 using the WATCOM 9.5 to 10.5 and Microsoft Visual C++ 2.0 and 4.0 compilers.**

Period: 1995 (8 MM; 2 MA)

Hardware: PC

Software: C / C++ (several Compilers)

- Activities:
- Analysis of the LISP language
 - Concept of the C structures to match the AutoLISP functionality
 - Development of the cross compiler
 - Development of emulation libraries for C
 - Writing the user manual

Development of big function for the control center of a BDE system under Windows 3.11 including: development of an own BASIC interpreter with embedded databases and formula interpreter to create complex printouts of all events logged in the BDE system.

Period: 1996 (16 MM; 4 MA)

Hardware: PC

Software: C / C++ under Windows 3.11

- Activities:
- Conception and Development of a report generation tool including the BASIC and formula interpreter
 - Training
 - Project management for the control center software

*o p e n***Conception and development of an input and output system for a 66302 microcontroller on top of pSOS+ including implementation of a own BASIC and formula interpreter into this IO system.**

Period: 1996 (4 MM; 2 MA)

Hardware: 68302-Prozessor, FLASH- and other hardware components

Software: pSOS+, MRI-C-Compiler

- Activities:
- Conception of a BDE operation system on 68302 microcontroller
 - Conception of the IO system on top of pSOS+
 - Development of several drivers for the IO system
 - Implementation of the BASIC and formula interpreters

Analysis and programming of a boot daemon for HP-UX 9.5 to boot connected HP1000 via bootp protocol.

Period: 1997 (3 MM)

Hardware: LAN-Interface HP9000, LAN-Interface HP1000

Software: C (HP-UX 9.5)

- Activities:
- Analysis of the boot process on the HP1000 LAN card (via sniffing)
 - Conception and development of the bootp daemons, able to boot 16 HP1000 in parallel.
 - Implementation of the daemon in a industrial environment to serve up to 150 HP1000 computers connected to several servers.

*o p e n***Planning, realization and marketing for a network spy/sniffer.**

- Period: 1998 (2 MM)
- Hardware: Windows 95, NDIS3-Interface (LAN interface or dial out adapter)
- Software: C (LCC Win32)
- Activities:
- Analysis of the protocols: TCP, IP, NETBIOS, FTP, HTTP, SMTP, NNTP, UDP
 - Conception and development of the GUI (Realtime mode of Windows 95)
 - Development of the system software to access the NDIS adapter of Windows

Planning, realization and team lead of a complex database project. Customer wanted a unique database API for several databases with possibilities to transfer database information across system borders and with possibilities to merge database trees.

- Period: 1998-1999 (27 MM; 3 MA)
- Hardware: PC, Sun, other Workstations (NT and Unix)
- Software: Unix - C-Compiler, MSVS 6.0 C++
- Activities:
- Practice into all database APIs
 - Planning of the common interface and of the driver control structures
 - Development of the API and database drivers
 - Development of a transparent transport layer to bring the data together
 - Implementation of this API into given applications

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- Presentation of the system to department managers
- Team leadership
- Development of hierarchical analysis and merge functions

Planning, development and team leadership of a data broker system for an internet based information system with about 60000 access per hour.

Challenge: no access should be taking longer than 3 seconds but the database had a size of about 60 MB. Solution: a Linux cluster with a binary tree for the data.

Period: 1998-1999 (10 MM; 3 MA)

Hardware: PC, HP-Workstations

Software: Unix - C-Compiler

- Activities:
- Design of the system
 - Team leadership, time planning
 - Development of socket IO for the cluster
 - Installation at customers site

Development of driver software for a OROS measurement data acquisition module for test systems in the military and space area.

Period: 1999.8 – 1999.10

Hardware: OROS Front end, PC

Software: MS-Visual Studio 6.0

- Activities:
- Design of the driver
 - Development under C (PC and OROS OS TMS320)

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Cooperation in a big project to bring the internet protocol to Japanese mobile users (PPDC).

- Period: 1999.11 – 2002.4
- Hardware: Multi processor system (several Power PC's), T1-Interface (US-Standard), Ethernet-Interfaces, Ericsson own hardware, Sun-Workstations
- Software: VxWorks (PPC), GNU-Compiler (Unix), ClearCase-Development-Environment (Unix), Streams (Unix und Sun)
- Activities:
- C-Design of the T1 Streams Driver
 - C-Design of the L2-Protokoll Streams Modules
 - C software design to improve the performance
 - Development of the flow control across three protocol layers
 - Documentation

Software development to synchronize several multimedia systems for one big surround video screen for 3D games (Reality.Engine).

- Period: 2000.11 – 2001.4
- Hardware: PC – Pentium, N-VIDIA graphical board
- Software: MS-Windows 98, NEMO (Multimedia-System)
- Activities:
- C-Design of the TCP/IP synchronization system
 - Design of a virtual world to demonstrate the system

Design and development of Software for a system vendor for traffic lights and traffic control systems including a special research project, Stoye GmbH, Köln

- Period: 2001.5 – 2003.12
- Hardware: Motorola DSP56826, PPC604, PPC860, Pentium

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Software: Windows-XP, VxWorks, own RTOS, JAVA, CORBA, VisiBroker (on PPC), TCL/TK, MS-DEV 6.0

- Activities:
- Development of an own DSP Multitasking Realtime Operating Systems (miniRTOS) for the Motorola DSP 56826
 - Realization of old modem standards on top of the DSP realtime OS inside the DSP56826
 - Development of a normal FSK modem for the DSP
 - Development of a very old modem standard using FFT, iFFT and FIR inside the DSP
 - Development of a test environment for the DSP software on top of TCL/TK including the development of an own DLL to get access to the DSP software under test.
 - Development of a speech analysis, data compression, encryption and vice versa for a encrypted phone connection
 - Development and Research of a own Video CODEC to get video data transferred via ISDN cable with about 2 frames per seconds in realtime, using PPC860 and 604. Including JAVA client to decompress and visualize the pictures
 - Development of a multi messaging system with voicemail, fax, SMS, mail on an embedded system including the FAX GDI and the receive of answers. Controlled via CORBA interface
 - Development of several drivers and device for VxWorks

System design, Software design and Software programming for the C55 DSP in the OMAP5912 / OMAP5946 (Trinity) Chip of Texas Instruments as Extension to DSP/BIOS.

Period: 2004.4 – 2007.2

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Hardware: TI OMAP 5912 / OMAP 5946

Software: DSP/BIOS, Chip Support Library, Code Composer Studio, TCONF, ClearCase, ClearMake, ClearAudit

- Activities:
- System design of a multi applications environment on top of DSP/BIOS for dynamic applications in the TI C55
 - Development of the application management
 - Development of the new and fast memory management for all memory types (replacing TI's MEM-functions)
 - Development of the inter processor communication between tasks inside the DSP but also to the ARM-Core (with zero-copy functionality)
 - Development of the DMA management to simplify the usage of the C55-DMA Controller
 - Development of analysis functionalities as extension to the DSP/BIOS (task-tree-view, memory usage, etc...)
 - Additional optimizations for all C55 DSP programs (RAMSET, Stackmove to internal memory)
 - Setup of a new build environment for the DSP team of the project to support different targets and different projects
 - Design and development of a driver management framework for startup, shutdown and power drop events (stop, start situation) on ARM core.
 - Technical support to all software developers

**Team leader for the Widget Development Group for a customer Project.
Additional: Software developer for difficult problem solutions and consultant
for other teams**

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- Period: 2007.2 – 2008.1
- Hardware: TI OMAP 5912 / OMAP 5946
- Software: Own XML Crosscompiler, ARM Compiler, MS-DEV 8.0 (2005)
GnuMake, Python, Perl, ClearCase, others
- Activities:
- Requirements analysis customer requirements and workshops together with the customer in order to get the best requirement for the sub-project
 - Team leadership to get a totally new team working as fast as possible
 - Design of software concepts needed by the whole team to perform the required tasks
 - Support of other sub projects and their members to get them working
 - Pre-integration (CC) of work packages of widget team
 - Project planning (MS Project) for the team
 - Migration of free software to the project (from MS to ARM compiler)
 - Customer meetings to cover open issues and to organize workflow and workpackages

Team and project leader for a developer team of 15 developers for a HMI development. Consulting tasks and system design for the whole project

- Period: 2008.6 – 2010.1
- Hardware: PC, SH4 (and other)
- Software: JAVA (J9 / Java 1.6), Eclipse, SVN, Tortoise, FindBugs, Checkstyle and others

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- Activities:
- Team setup (team size 15 developer, project size 50 developers and HMI modelers) fast ramp up of new developers to get productive in the project
 - Development of a process for error management, parallel software development, integration strategy and VW group wide interface strategies
 - Team and project leadership for 15 developers
 - Code reviews
 - technical requirement definitions
 - consulting for system design, head unit functionality BAP, hardware targets, development methods, testing methods and project leadership at all
 - technical workshops and presentations

System designer and senior developer / architect for a HMI- and navigation module (embedded Linux and t-kernel on an ARM-Multicore System on Chip)

Period: 2010.2 – 2013.9

Hardware: Triton processor (3 Core ARM architecture, embedded Linux), MOST-Bus

Software: Embedded Linux (Monta Vista), SQLite embedded, uBuntu X86 Linux, t-kernel, C/C++, STL, Eclipse-CDT, GNU EABI Toolchain, K2L MOST Tooling, Trace-Tool, perf for Linux, Lauterbach-Debugger, ClearCase

- Activities:
- primary port of existing software to X86 Linux
 - primary port of existing software to embedded Linux for GNU EABI gcc inclusive changes of build system to enable cross compilation with GNU EABI

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- introduction of an Eclipse CDT remote debugging environment on X86 Linux with remote connected ARM Linux embedded system
- developer workshops for C/C++, build system, download system and remote debugging for project ramp up
- presentation of two module samples at Detroit/US (2011)
- development of a memory tracing tool as preload library on embedded Linux
- development of a function tracing tool as preload library on embedded Linux
- re-design of a media player database for embedded Linux SQLite
- C/C++ code reviews
- Coaching and control of the media player development group at Monta Vista
- Bug searching and analysis in the complete system (MOST, external components, HMI module)
- Leadership for a performance taskforce in the t-kernel domain
- Support of all developers for debugging, bug analysis, code design, architecture and system design
- Coworker on performance analysis workgroup for embedded Linux
- Performance analysis of several processes in the embedded Linux
- Analysis of audio issues in the complete system (MOST, external components, t-kernel, Linux)

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- Care of all developers and team leader for technical issues
- Technical team lead and developer for the Media Player Core group
- Development of a State Machine Framework for generated state machines out of the ArgoUML
- Development of a very fast SQLite3 abstraction for a media player application

Private project in parallel: massive parallel image data processing on Nvidia GPU with stream processors with CUDA

Period: 2012.12 – ongoing

Hardware: Nvidia GPU (GT-260)

Software: Windows, CUDA 5.0, WT (WebToolkit), Videoinput

- Activities:
- Development of a thread control and scheduling framework to let thousands of threads running and scheduling on the stream processors of the GPU
 - Development of a web front end to the CUDA software
 - Development of filter and recognition algorithms for the GPU stream processors

Software development and bugfixing for mobile devices used by public traffic services

Period: 2013.10 – ongoing

Hardware: ARM CPU

Software: WindowsCE 4.2, Subversion, MS Developer Studio

- Activities:
- Design and development of a UDP Scrambler which

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simulates the behavior of UDP used over air connection.

- Design and development of a protocol stack for a custom protocol used by traffic control station and moving public traffic vehicles
- Design and development of a software production workflow based on SVN version control using perl/tk scripts to simplify its usage.

Systemdesigner and Senior-Developer (embedded Linux on iMX6 Multicore)

Period: 2014.02 – 2015.09

Hardware: iMX6, Customer Hardware

Software: Embedded Linux, SQLite3 embedded, uBuntu X86 Linux, C/C++, STL, Eclipse-CDT, GNU EABI Toolchain, perf für Linux, ClearCase

- Activities:
- Coreteam Member for development of media player Core
 - Bugfixing and further development of media player
 - Design and Implementation of a content sharing function
 - Introduction of a state machine framework for phone component, developer training, design meetings for new component

Private Parallel Projects: Android Apps for Phone and Wear

Period: 2015.02 – 2015.07

Hardware: several Android Phones and Tables; Android Wear

Software: JAVA, Android JAVA API, Open GLES, Android Studio, Corel Draw, Video Editing

- Activities:
- Development of games and Apps on Android

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- TopLoad: Casual Game
- Adjustment: Casual Game
- Nexty – Advanced Bluetooth Chat for Phone and Android Wear (Watch)
- Phone Remote Control for Android Wear
- Complete production chain:
 - Planning, SW-Design, graphical design, implementation, Test, marketing (with videos)

Link <https://play.google.com/store/apps/developer?id=Matthias+Credits>

Linux Driver Development: DMA Driver / Device Tree Driver

Period: 2016.10 – 2016.12

Hardware: Altera SockIT (ARM CPU + FPGA)

Software: Linux kernel, C, gcc toolchain, make, Eclipse CDT, perl, GoogleTest

- Activities:
- Development of a DMA driver under Linux as part of a platform development for magnetic resonance spectrographs
 - Development of a memory tracing system having a very small performance impact, usable in userland and kernel space
 - With bash and perl scripts for visualization
 - Analysis of present driver(s)
 - Integration of google test framework and development of tests for all drivers
 - Software design for DMA driver
 - Configuration of the device tree for new DMA driver and for

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some old product drivers

- Development of a character device driver for scanning the device tree recursively, for the old product drivers
- Development, test, documentation

Linux Middleware: FileObserver for Business-Software

Period: 2017.02 – 2017-02

Hardware: Linux PC

Software: Linux, C++, g++, make, Eclipse CDT, inotify, boost, TCP/IP-sockets, GoogleTest

- Activities:
- Software design of a Linux file observer and file manipulator for a Windows business software
 - Development of the design with C ++, inotify and boost
 - Development of 80 Google tests (function and regression)
 - Test, documentation

Image recognition AI: Project with TensorFlow

Period: 2017.05 – 2017-06

Hardware: Windows PC

Software: Windows, python, Eclipse for python, TensorFlow, cv

- Activities:
- Private project for incorporation into TensorFlow, a framework for programming artificial intelligence (AI)
 - Content: Object recognition in images with simultaneous position determination of the objects in the recognition step
 - Use of a Convolutional Neural Network (CNN) with 3 convolution and 2 function networks

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- Result: Different objects are recognized and their position in the image is displayed.

Complete data routing module between UART and WIFI for IoT

Period: 2017.07 – 2017-11

Hardware: ESP32, Linux-PC

Software: Linux, xtensa-Cross-Compiler, freeRTOS, ESP-IDF, Eclipse CDT, GoogleTest, python

- Activities:
- Architecture and design of a data router on an ESP32 chip for an IoT consumer device. Focus on fastest data processing, highest reliability (no resets)
 - Implementation / extension of the driver software for the interfaces UART and WIFI AP / Station
 - Implementation of the router kernel and the routing state machine.
 - Implementation of Web protocols: WebSocket, UPnP, SSL
 - Design / Implementation 75 high-level module tests for the GoogleTest Framework
 - Implementation of an outside world simulator for the GoogleTests
 - Documentation and Testing

Android app for data acquisition and visualization

Period: 2017.11 – 2019-07

Hardware: Android Tablet/Mobile

Software: Android(X), SQLite, JAVA

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- Activities:
- Design and develop the entire app as an individual project. Including simulation of the measuring devices and test functions.
 - JAVA on AndroidX
 - GPU Supported graphics rendering of data plots
 - Extremely fast sqlite connection (for several million records per second)
 - ProGuard
 - Multilingual
 - Portrait and landscape support
 - WebViews / JavaScript connection to JAVA
 - USB host interface
 - GPS connection
 - Graddle Programming (Multiple flavors for the app)
 - dynamic views (generated at runtime)
 - Foreground service (for measurements in the background)
 - Unit testing / demo mode of the app
 - Obfuscation of part of the database (action against reverse engineering)

Google <https://play.google.com/store/apps/details?id=com.ibp.btl.biometer.hdm>
Play: [ter.hdm](https://play.google.com/store/apps/details?id=com.ibp.btl.biometer.hdm)

Migration / development of device software on EFM32

Period: 2019.05 – 2019-10

Hardware: EFM32

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Software: C

- Tätigkeiten:
- Migration of old C software to the new EFM32
 - Customization / redevelopment of low level driver for USART, I²C, A / D converter, flash memory, LDMA support, USB driver, low power mode
 - Connection of a Bluetooth LE modem for additional data transmission
 - Commissioning and test

Development of an artificial intelligence / machine learning

Zeitraum: 2019.10 – 2019-12

Hardware: Intel / NVIDIA GPU RTX2070

Software: C++14, Nvidia-Cuda-C, WebToolkit, OpenCV, OpenPort

- Tätigkeiten:
- Development of machine learning on the GPU using CUDA from NVidia: Fast, parallel comparison of memories (1.5 GB per 62.5 ms)
 - Preparation by DSP routines of the input signal on the Intel Core
 - Connection of audio and midi devices
 - Development of the user interface that runs in a browser using WebToolkit (C ++ 14)
 - Setting up an MSI installer for customer delivery
 - Design and implementation of a website for marketing:
<http://ailo.show>

*o p e n***Development of control software for a roof ventilation system**

Zeitraum: 2021.01 – 2021.10 (is running out)

Hardware: ESP32 / Custom hardware

Software: ESP-IDF-4.2, C, Eclipse-IDE, mbettls, AES, HTTP-Server, WIFI, HTML, JavaScript, JSON, SMTPAuth, OTA, MQTT, MODBUS, OneWire, diverse HW-Interfaces, SecureBoot, Encrypted App

- Tätigkeiten:
- Development of control and management software for roof ventilation systems on ESP32 with connected customer hardware
 - Architecture of all software modules
 - Design of all components
 - Patching of Espressif IDF to achieve 24/7 stability and to fix memory leaks
 - Development of the interactive machine-internal HTML page including JavaScript parts
 - Development of missing or unstable drivers (for example: OneWire, Modbus-Master-Serial)
 - Migration of open source libraries (for example: MQTTServer)
 - Design and implementation of an encrypted OTA update path on a Secure Boot ESP32 with auto-encryption active
 - Control of a large number of different components via various HW interfaces