SS 2020
SPBA – Software Praktikum mit Bachelorarbeit

Topics @ Research Group
Multimedia Information Systems (MIS)

Wolfgang Klas (wolfgang.klas@univie.ac.at)
Gerald Quirchmayr (gerald.quirchmayr@univie.ac.at)
Belal Abu Naim (belal.abunaim@univie.ac.at)
Nour Jnoub (nour.jnoub@univie.ac.at)
Peter Kalchgruber (peter.kalchgruber@univie.ac.at)
Thematic Scope of SPBA

Resources
- Sensors, like:
  - Smartphone
  - Social Media
  - Real-time Crowd
  - Camera
  - Mic
  - ...

Application Domains
- Blockchain Applications
- IoT / Home Automation
- Fact Checking
- Individual Activity and Mood Recognition
- Real-time Crowd Sourcing

Information Security
- Legislative Compliance
- Attack (Pattern) Detection
- Attack Prevention
- Threat Information Handling

Technologies/Methods
- Blockchain Technology
- Machine Learning
- Natural Language Processing
- Image Processing
- Video/Audio Processing

Media Types
- Audio
- Video
- Text
- Image
- Sensor data
Thematic Scope of SPBA

• Blockchain-based applications & Technologies
  • Blockchain technology in various configurations
  • Local Ethereum blockchain platform of BlockchainSci-Lab
  • MultiChain Blockchain platform
  • Ethereum, EthereumJ, Smart-contracts

• Semantic Web Technologies
  • Web services, RDF, LOD, Microformat, JSON-LD, etc.

• Languages, Platforms, Libraries
  • Android, Java, GO, Python, P2P, Bluetooth, Wi-Fi,FFMPEG
  • Machine Learning Toolkits, scikit-learn, NLP tool kits

• Information Security
  • Legislative Compliance, Attack (Pattern Detection), Threat Information
Technologies and Platforms

- Robotics
  - EV3 Middleware Framework
  - Lego MindStorm Roboter,
  - ROS & ROS packages für EV3 (http://wiki.ros.org/Ros/Robots/EV3);
  - Raspberry PI 3
  - Java; C-based Arduino PL
  - Android, Open street maps (OSM)
If further information needed?

If interested in **1 topic** from MIS group, send an email with subject ‘SPBA-ss20’ as soon as possible to the advisor of the topic:

- NJx... Nour Jnoub: [nour.jnoub@univie.ac.at](mailto:nour.jnoub@univie.ac.at)
- WKx... Wolfgang Klas: [wolfgang.klas@univie.ac.at](mailto:wolfgang.klas@univie.ac.at)
- BAx... Belal Abu Naim: [belal.abunaim@univie.ac.at](mailto:belal.abunaim@univie.ac.at)
- PKx... Peter Kalchgruber: [peter.kalchgruber@univie.ac.at](mailto:peter.kalchgruber@univie.ac.at)
- GQx... Gerald Quirchmayr: [gerald.quirchmayr@univie.ac.at](mailto:gerald.quirchmayr@univie.ac.at)

Include your **skills & motivation** for the topic you want to work on!

If you are interested in **more than one topic** of the MIS group, send one email with subject ‘SPBA-ss20’ with the topics listed, which you are interested in, to all advisors (see above). We will synchronize internally and propose information.

**FINAL TOPIC SELECTION and ASSIGNMENT:**
We will consult with you on the final topic assignment.
WK1 Blockchain: Prüfungspass (Ethereum-based)

- Implementation of a “Sammelzeugnis” in terms of a digital, blockchain-based “Prüfungspass” for students of a course. Functions include:
  LV admission, to draw the place in the course, to withdraw in time, to submit assignments, to take a test, grading of assignments and tests, final grading according to overall rules, etc.

- Implement the logic by using Ethereum Smart Contracts and by using proof-of-authority

- Provided: Ethereum Blockchain infrastructure @ BlockchainSci-Lab of CS Faculty or @Azure Blockchain Services

- Technologies: Blockchain Technology, Smart Contract, Web Technology, Azure Cloud Services

26.02.2020
WK2 Blockchain: Prüfungspass (MultiChain-based)

• Implementation of a “Sammelzeugnis” in terms of a digital, blockchain-based “Prüfungspass” for students of a course. Functions include:
  LV admission, to draw the place in the course, to withdraw in time, to submit assignments, to take a test, grading of assignments and tests, final grading according to overall rules, etc.

• Implement the logic by using MultiChain Blockchain technology infrastructure @ BlockchainSci-Lab of CS Faculty

• Technologies: Blockchain Technology, Smart Contract, Web Technology
WK3 Demo of Blockchain application using Proof-of-Authority

• implement a demo application which illustrates the concept of proof-of-authority (in place of the very often used "proof-of-work" as, e.g., used in the Bitcoin Blockchain).

• For example, a possible application could be the implementation of the four-eyes principle (Vier-Augen-Prinzip) for officially approving documents by making use of two signers acting as proof-of-authorities.

• It may be based on a generic, configurable implementation to show different variations of the proof-of-authority concept, e.g., 1 signer, 2 signers, N signers.

• Technologies: Blockchain-IT infrastructure with initial configuration of proof-of-authority based on Ethereum Project
WK4 ROS-package for Lego MindStorm Robot

- Design und Implementierung des ROS-Package für die Steuerung des Lego MindStorm Roboters
- Lego MindStorm Roboter gemäß vorgegebenem Bauplan zu konstruieren
- Lego MindStorm EV3 & LejOS Betriebssystem für Lego MindStorm Roboter

Technologies: EV3 Middleware Framework (von MIS, eine Basis Library für das Ansteuern des MindStorm Roboter); Lego MindStorm Roboter, Aufbau gemäß Vorgaben; Basis Library für das Ansteuern des MindStorm Roboter; ROS & ROS packages für EV3 (http://wiki.ros.org/Robots/EV3 ); Raspberry Pi 3, recommended OS Ubuntu 15.10 bzw. 16.04
WK5 Finger gesture-controlled MindStorm Robot

- Komplettierung der Konstruktion eines Handschuhs unter Verwendung gegebener Bausteine
- Implementierung der Verarbeitung der Sensordaten des Handschuhs durch den Arduino Microprozessor
- Implementierung der Software zur Interpretation der Signale vom Handschuh und Steuerung des Lego-MindStorm Roboters
- Lego MindStorm Roboter gemäß vorgegebenem Bauplan zu konstruieren
- Implementierung der Software für das visuelle Monitoring (Status des Handschuhs, Befehle an Roboter, Status des Roboters) des Systems über einen separaten Bildschirm
- Test der Lösung im Rahmen einer Anwendung

- Technologies: Lego EV3 & LejOS Betriebssystem für Lego MindStorm Roboter; Lego MindStorm Roboter, Aufbau gemäß Vorgaben; EV3 Middleware Framework (von MIS, eine Basis Library für das Ansteuern des MindStorm Roboter); Raspberry PI 3 OS (z.B. OS Ubuntu 15.10 bzw. 16.04); Java; C-based Arduino PL
WK6 FactCheck - Precision Metrics

• Framework for the detection and resolution of conflicting structured data on the Web.

• Context-dependent comparison of structured data of various representations of one and the same real world object or artefact guided by so called precision metrics which is a flexible and sophisticated technique for logically comparing structured data values.

• Goal of the project is to design and implement an appropriate model for the representation of precision metrics, the construction of such precision metrics as well as the application of the metrics for evaluating the comparison of data values. Various precision metrics should be defined and compared using a test dataset of 900,000 entities. Results of the project are to be demonstrated by a running demo application.

• Technologies: web services, semantic web technologies, LOD, Microformat, JSON-LD; (a given prototype/demo available to start with!), Azure Cloud Services
BA1 – Audio Narrated Photo Presentations

• With the proliferation of mobile devices and applications that allow the users to take photos and record audio files that describe these photos, users become in need for tools that help them to organize their photos and the related audio files in professionally composed presentations. Linking an image with the most relevant part of an audio file that describes this image remains a non-trivial task for the users. This project aims at finding a solution for the described problem, i.e., an audio narrated photo presentations.

Technology: Android, Java, image processing, audio processing, NLP
Contact: Belal Abu Naim, belal.abunaim@univie.ac.at
Visiting new places enthuses users to shoot photos. In addition to the photos, users can record a voice narrative or even a video on those visited places. Users usually possess several devices, i.e., mobile phones, cameras, and other devices which can be used to generate different kinds of digital content. Having generated different multimedia digital content that can be linked to a place or a certain activity, users require a helping tool that enables them to organize those generated multimedia content in one multimedia document, we will call this multimedia document "Digital Diary". To make an added value for our tool, it is expected that the tool performs some analysis tasks on the generated multimedia content to identify some subjects that those content encode. One of those encoded subjects are identified, the tools retrieve some additional data on those subject from open linked data provides, e.g., DBpedia, and include those retrieved data in the Digital Diary.

Technology: Android, Java, image processing

Contact: Belal Abu Naim, belal.abunaim@univie.ac.at
BA3 - Distributed composition of multimedia content

• Multimedia content authoring has been a challenging research topic for many years. In view of the IoT, (X)aaS and SOA, multimedia content authoring can take a new form of distributed authoring. The goal of this project is to design and implement a new type of a distributed authoring process to author multimedia content. The process should make use of different devices, data sources, and services to collect multimedia content, compose a multimedia presentation, and produce a ready to present multimedia content on the target device.

Technology: Java, FFMPEG, Android

Contact: Belal Abu Naim, belal.abunaim@univie.ac.at
BA4 - X As a Service (XaaS)

- Service-oriented architecture (SOA) and cloud computing led to the existence of the acronym X as a Service (XaaS), e.g., Infrastructure as a service (IaaS), Platform as a service (PaaS), and so on. As a result of such architecture, many service providers make their services available on the internet. Services consumers can search and make use of the provided services in various ways and for various purposes. The goal of this project is built SOA system that makes use of such available services. Given an image that represents an object, e.g., an old-timer car, some famous artifact such as the "Mona Lisa", etc., the application should make use of the available services to: 1. recognize the object that an image represents. 2. Collects additional information about the recognized object from the available open data services. 3. Compose a multimedia document about the subject image.

Technology: Java, Android, Spring framework, JavaScript, HTML5
Services: DBpedia, clarfai, etc.
Object recognition and generating enriched multimedia documents (https://clarifai.com/demo)

Contact: Belal Abu Naim belal.abunaim@univie.ac.at
Blockchains store transactions and other relevant data in blocks, usually these blocks are stored in the file systems as binary files. Such a storing method makes the process of querying and retrieving the stored data from the blockchain complicated and in many cases inefficient. The goal of this project is to develop a blockchain system that makes use of semantic web technologies such as RDF to store and interlink the data. Within this project, you are expected to implement a blockchain system that captures and stores information about some real property, the owner of that property. You should use RDF graphs to store and interlink the data.

Technology: Java, Jena framework.

Contact: Belal Abu Naim belal.abunaim@univie.ac.at
BA6 - Game-based Learning

• With the proliferation of personal computers and mobile devices, users have the chance to experience various types of applications including the digital educational games. Educational games have educational purposes. They are designed to help users to learn about certain subjects or develop certain skills. Digital educational games are interactive play that teach users goals, rules, problem solving, and interaction. On the one hand, this project aims at studying the concepts of Game-based learning and gamification. And on the other hand it aims at applying these concepts on a digital education game.

Contact: Belal Abu Naim, belal.abunaim@univie.ac.at
NJ1 - Building an online review system for movies

• Social media and social networks changed our daily life dramatically, this is due to the fact that the number of user and their data increase every day. Consequently, it enables to apply datamining techniques to send recommendations to users regarding what is a genuine fact and what is a fake piece of knowledge. The aim of this project is to build an online review platform based on a database where data regarding users and samples of well-known movies should be saved and retrieved on demand. The functionality of the system should be a simple version of the Internet Movie Database IMDB where users can rate, search, add, update or delete movies and their reviews. This project should cooperate with the student who works on project NJ2.

• Results of the project are to be demonstrated by a running demo application.

• Technologies: Python, Flask and pillow, MySQL, HTML and CSS

Contact: Nour Jnoub nour.jnoub@univie.ac.at
NJ2 - Building an online fake review detection system

• Social media and social networks changed our daily life dramatically, this is due to the fact that the number of user and their data increase every day. Consequently, it enables to apply data mining techniques to send recommendations to users what is a genuine fact and what is a fake piece of knowledge. The aim of this project is to integrate different fake review algorithms that are already implemented in Python and Answer Set Programming aiming at providing a fake review detection system that run different functionalities (the predefined scripts) and highlighting the results in a proper way. This project should cooperate with the student who works on project NJ1.

• Results of the project are to be demonstrated by a running demo application.

• Technologies: Python, Flask and pillow, MySQL, HTML and CSS

Contact: Nour Jnoub nour.jnoub@univie.ac.at
PK1 – Ambient Home Messenger

• An ambient device is a decorative type of consumer electronics that displays information in a user’s environment and thereby requiring minimal user’s mental effort. To counteract the information overload, a stationary device called Ambient Home Messenger can record and play video and audio messages to persons registered to the device.

• The goal of the project is to design, assemble, and implement a device that is capable of recording and playing audio and video messages like a stationary answering machine. Thereby the device should recognize the person in front of the camera (using face recognition technology) and determine the receiver of the message (using speech recognition).

• Technologies: Raspberry Pi, OpenCV, scikit-learn

Contact: Peter Kalchgruber peter.kalchgruber@univie.ac.at
GQ1 – Threat Intelligence

There is plenty of open source information on cyber threats provided in varying quantity and quality. So it is necessary to evaluate the quality of a source according to a given set of weighted parameters. The goal of this project is to develop a tool for open source threat intelligence sources evaluation based on an approach described in the paper “A Quantitative Evaluation of Trust in the Quality of Cyber Threat Intelligence Sources” (1).

Technologies: STIX (Structure Threat Information Expression), OpenIOC (Open Indicators of Compromise), standard programming languages

Contact: Gerald Quirchmayr, Gerald.Quirchmayr@univie.ac.at

(1) ACM ISBN 978-1-4503-7164-3/19/08; https://doi.org/10.1145/3339252.3342112
GQ2 – Attack Pattern Learning

Recent cyber attacks do frequently consist of a combination of attacks. Firewall logs do usually protocol single events. The goal of this project is to develop a tool that can combine these single events with respect to parameters such as target, time, and origin of an attack into a pattern. These patterns can then be used to detect and analyse future attacks. Neural network technology can serve as basis for learning form firewall logs.

Technologies: pattern learning with neural networks, standard programming languages

Contact: Gerald Quirchmayr, Gerald.Quirchmayr@univie.ac.at
GQ3 – File less Malware Detection

This relatively new operating type of malware first emerged in 2017. Early examples of this malware were Frodo, Number of the Beast, and The Dark Avenger. Try to simulate the malware in a virtual OS and implement a process to detect and remove it, using open source IDS technology as basis.

Technologies: IDS, standard programming languages

Contact: Gerald Quirchmayr, Gerald.Quirchmayr@univie.ac.at