

Minutes of SP4LIFE Workshop #3

Skopje, September 28-th, 2022 (on-line in ZOOM)

As part of the 14th ICT Innovations conference (conference web-site <http://ictinnovations.org>)

Participants:

Slovakia: Dr. Milan Tysler, Dr. Daniel Gogola, Dr. Fedor Lehocki, Eduard Znava

Belgium: Christophe Minetti

Serbia: Dr. Marko Spasenović, Teodora Vićentić, Stefan Ilić

North Macedonia: Prof. Ana Madevska Bogdanova, Prof. Katerina Zdravkova, prof. Vladimir Trajkovic, Prof. Nevena Ackovska, Ass. Prof. Magdalena Kostoska, BSc. Ivan Kuzmanov, Marija Sidorenko

Duration of the WS: 2 hours

Place: on-line, <https://zoom.us/j/98096100711?pwd=UStLV0tpbUJyaVVUK3FHb3Y5WXJoQT09>

The goal of the workshop was to review current achievements, hardware solutions and milestone tasks for the next six months.

Minutes

14.00 – 14.05 Opening session

prof. Ana Madevska Bogdanova and prof. Milan Tysler greeted the attendees. Dr. Turmus has joined the WS and had the opportunity to be informed about the latest development of the project. He appreciated the results obtained by young researchers.

14.05 – 14.30 Presentation of the current state according the WPs, each Co-director

All codirectors reported the activities of their groups during the period Jun-September 2022 (since Workshop2).

The first presentation was given by Dr. Tysler. He focused on the hardware part (WP2) and shortly reported about the last proposal, according to the previously sent HW specification. In IMS currently a HW configuration using MAX86150 ECG/PPG sensor, MAX32630 microcontroller board and PAN1780-AT Bluetooth module (with nRF52840 chip) is being tested. Drivers for the sensor module were prepared and BT communication using different modes and services is under investigation. Suggested software framework is arm Mbed-os6 and the programming language is C. He concluded that the planed tasks for M3 period in WP2 and WP3 are currently in a good position, the power source for the patch should be investigated in near future.

Dr. Spasenovic presented a summary of the progress of the graphene sensor development and emphasized the importance of the young researchers training missions (Bojana Koteska visited ICTM in Belgrade and Teodora Vicentic and Stefan Ilic are currently in the ULB lab in Bruxelles). He informed about the first joint paper, published in the journal Sensors (Vićentić, T.; Rašljčić Rafajilović, M.; Ilić, S.D.; Koteska, B.; Madevska Bogdanova, A.; Pašti, I.A.; Lehocki, F.; Spasenović, M. Laser-Induced Graphene for Heartbeat Monitoring with HeartPy Analysis. *Sensors* 2022, 22, 6326. <https://doi.org/10.3390/s22176326>). Their group has corrected the underspent funds from M1 and M2.

Prof. Madevska-Bogdanova presented a summary of the FCSE activities together with the latest published conference papers, to be presented at the ICT conference (29.09 – 01.10 2022). She also reported about the training missions of the FCSE group – Ana Madevska Bogdanova and Bojana Koteska in Taormina, Italy (MEMEA 2022) in June, Bojana Koteska in Belgrade, Serbia (ICTM) in July, and Katerina Zdravkova in Turku, Finland, (University of Turku) in July 2022.

Dr. Fedor Lehocki presented the flowchart model of prof. Masar, that describes the workflow of emergency services, focusing on the established AS-IS procedures in the flowchart that could be affected by introducing wearable sensor patches. The To-Be procedures will be finished in the next period.

Prof. Christophe Minetti (on behalf of codirector Carlo Saverio Iorio) reported about the advancement Teodora and Stefan are achieving during the three-week training mission in the ULB (till 3-th of October), training on wearable biocompatible materials, material testing, and electronics integration.

14.30 – 15.00 - Presentations of current research (young researchers)

The first presentation was held by Eduard Zlava (IMS), discussing his results on estimation of respiration rate from ECG signals. After unsatisfying results when using Python libraries, several own algorithms using heart rate variations, ECG amplitude variations or baseline wander were tested. Best results were achieved using the baseline wander method (accepted paper on ICT Innovations Conference 2022).

The second presentation was held by Teodora Vicentic (ICTM), reporting about the technical details of the two training missions (from FCSE to ICTM, Belgrade in July and currently from ICTM to VUB, Brussels).

- In Belgrade, different graphene settings were tried to establish a stable one. The optimal sensor was used to extract the heartbeat signal (a commercial Nonin II oximeter was used for HR comparison). In the next period, ICTM group will try graphene sensors with different substrate thickness and protecting layers.
- In Brussels, their work is training on wearable biocompatible materials, development of several biocompatible material and their testing.

The third presentation was held by Ivan Kuzmanov (FCSE) presented the best deep learning model for BP categorization and estimation of systolic, diastolic and mean arterial pressure (accepted paper in ICT Innovations 2022).

The last presentation was held by Daniel Gogola (IMS) (also on behalf of a new young researcher Richard Bagín). He presented the technical details of the electronics platform and testing board for the used ECG and PPG sensors on the patch prototype and for Bluetooth communication. He also presented the progress in the development of the corresponding software (sensor driver, UART communication, AT commands parsing, AT events handling, service creator, advertising data creator).

15.00 – 16.00 - Open discussion with prof. Milan Tysler as a moderator.

The main topic of the discussion was the proposed HW architecture with technical details, together with possible technical solutions. All codirectors discussed their point of view, according to their Work packages. Prof. Ana Madevska Bogdanova suggested that a visit from FCSE group (Skopje) to the IMS group (Bratislava) would be productive for the further development of the HW platform and corresponding SW modules (suggested date 7 – 11 November 2022).

The next project meeting, according to the schedule established during the WS2 in Belgrade, will be hosted by IMS in Bratislava in December 2022.

The WS finished at 16.00.

The minutes were taken by Ana Madevska Bogdanova and amended by Milan Tyšler.