Scientific High-throughput and Unified Toolkit for Trace analysis by forensic Laboratories in Europe

Berichterstattung

Projektinformationen

SHUTTLE

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Projektwebsite

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Periodic Reporting for period 2 - SHUTTLE (Scientific High-throughput and Unified Toolkit for Trace analysis by forensic Laboratories in Europe)

Berichtszeitraum: 2019-05-01 bis 2022-10-31

Zusammenfassung vom Kontext und den Gesamtzielen des Projekts

SHUTTLE, acronym for 'Scientific High-throughput and Unified Toolkit for Trace analysis by forensic Laboratories in Europe', is a project financed by the European Commission.
The SHUTTLE project intends to develop a toolkit which facilitates the microtraces analysis collected in crime scenes.
To do so, SHUTTLE intends to run a Pre-Commercial Procurement (PCP) action between forensic institutes across Europe to mitigate the technical and financial barriers and jointly carry out the procurement of the necessary Research and Development (R&D) activities to develop a machine+toolkit that will integrate different tape analysis tools to automate the routine part of the work of trace evidence examiners and, eventually, strengthen further judicial and police cooperation.
More precisely, the forensic institutes will organise and manage a call for tenders and select the companies that will perform the necessary R&D activities to develop the SHUTTLE toolkit. Thanks to the EC funding (7.4M€ for the subcontracted activities), the SHUTTLE project will contribute to strengthening the forensic collaboration across countries and institutions in Europe and possibly beyond. It also will catalyse innovation by allowing public authorities to invest cost effectively in innovation by sharing costs and lessons learnt.

Arbeit, die ab Beginn des Projekts bis zum Ende des durch den Bericht erfassten Berichtszeitraums geleistet wurde, und die wichtigsten bis dahin erzielten Ergebnisse

The main result of SHUTTLE is the development and production of two prototypes that were successfully tested in 6 laboratories: the SMMART forensics toolkit by the TRACES Consortium, and the ARGOS toolkit by the AG SHUTTLE TOOLKIT JENA Consortium.

The other main SHUTTLE results can be summarised as follows:
- Requirements and specifications of the SHUTTLE toolkit were defined (D1.1). They were finalized in order to launch the call for tenders.
- Documents for call for tenders to execute the PCP were finalised in Year 2, validated by the EC and the Technical and Contracting Boards before release on 20 Sept. 2019.
- The project has engaged through SHUTTLE workshops, scientific & industry conferences, online communications, project videos to share findings and collect feedback.
- A V&V strategy, a system of round-robin samples and a benchmark tool were prepared. PCP Phase 1 evaluation was successfully completed. Phase 2 evaluation was successfully completed. The evaluation of Phase 3 final results was delayed, but finalised end of October 2022.
- Potentially relevant existing standards, candidates for pre-standardisation among SHUTTLE results, and possible process reported in D9.8.
- An online course on the use of the toolkits was developed and reported in D9.6.

In order to disseminate the SHUTTLE results and raise awareness of the two toolkits, two project

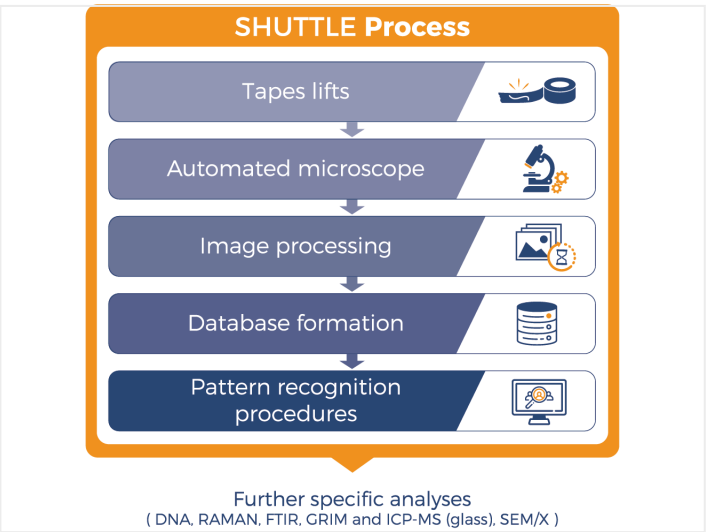
videos were produced and the toolkits were demonstrated during the EAFS 2022 conference in Stockholm, Sweden - event that gathered 1200 participants.

Fortschritte, die über den aktuellen Stand der Technik hinausgehen und voraussichtliche potenzielle Auswirkungen (einschließlich der bis dato erzielten sozioökonomischen Auswirkungen und weiter gefassten gesellschaftlichen Auswirkungen des Projekts)

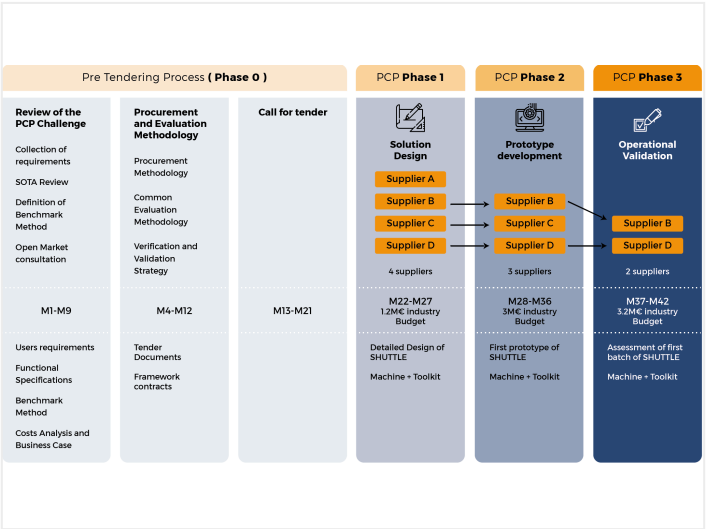
The SHUTTLE toolkit was designed to contain 4 tools. Each of these tools, as well as their fluent interaction, is required for optimal operation.
- Microscopic grade tape. Tapes have been used to recover microtraces for several decades. Their popularity is based on easy handling, low cost, and efficiency for many types of microtraces. A current disadvantage of tapes is that microscopic images acquired through tapes do not yield optimal image quality. Therefore, relevant microtraces are often transferred into glass slides to improve image quality. The tender included the supply or development of a tape that allows imaging quality comparable to glass slides and facilitate analysis on surfaces much larger than can be achieved by standard glass slides.
- An automated microscope that forms the eyes of the SHUTTLE toolkit. The aim was to acquire high quality images of microtraces that have been recovered using the developed tapes. The microscope will use a number of illumination modes for optimal discrimination and classification of microtraces. The microscope allows spectrometric colour analysis. The classification is aided by advanced polarisation analysis. The required spatial resolution is moderate, but the total field of view is large, while acquisition time must be acceptable. The SHUTTLE microscope uses a clear and intuitive software. The software allows the definition of a standard analysis procedure. In addition, there is a feature for advanced users that allows data acquisition using non-standard parameters.
- Algorithms for image processing that form the brain of the SHUTTLE toolkit. The algorithms process the images acquired by the microscope and classify the different types of microtraces present in the tape. The results of the algorithms is a table that contains a number of parameter vectors for every microtrace, such as the coordinates on the tape, the colour, polarisation characteristics, morphology, and class (e.g. ‘blood’, ‘fibre’, ‘glass’, etc.). These algorithms can be executed via a GUI (graphical user interface). Via this GUI, users can execute the algorithms developed within the SHUTTLE project. In addition, the can develop and share additional algorithms and plug them into the the GUI. Such additional algorithms may serve to classify additional microtraces, or to make a better subclassification. As an example, the SHUTTLE toolkit might classify a microtrace as a ‘hair’, while additional algorithms can discriminate and classify ‘scalp hairs, ‘pubic hairs’, ‘body hair’, or even discriminate hairs from different animals.
- A database and search algorithms, that form the memory of the SHUTTLE toolkit. This database contains the data (raw, processed or both) acquired by the microscope and processed by the image processing algorithms. The database structure is made in such a way that the data acquired by the SHUTTLE toolkit can be related to data acquired by other techniques. To achieve this, it is possible to add into the database parts that contain data from e.g. FTIR, MSP, dye analysis, etc. The database contains a robust back-end and a user-friendly front-end. The front-end should have the same look

and feel as (or even be integrated with) those for instrument and the image processing routines. The database focuses on experimental data and was not expected to contain case information (such as case identifiers, names of suspects and victims) to prevent security and privacy issues. The search algorithms should allow searches for similar samples in the database. The search algorithms yield numbers or probabilities that can be used to calculate the evidential value of a result, e.g. using Bayesian statistics.

We aim to make the SHUTTLE toolkit powerful and versatile to such an extent, that it will become an international standard in forensic microtrace evidence examination. Therefore, the specifications not only covered the technical aspects. Additional specifications were set on privacy issues, training, user-friendliness, long-term sustainability, and integration with other techniques.



The SHUTTLE process



The PCP process and timeline

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Permalink: https://cordis.europa.eu/project/id/786913/reporting/de