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Summary of the project "Testing search technology to enhance prison security"

The Estonian Ministry of Justice and the Prisons Service under its administration, together with the State Chancellery and GScan, started the project "Testing search technology to enhance prison security" at the end of 2023. This is a project of the Public Sector Innovation Fund of the State Chancellery and it is funded by the European Union Cohesion Policy for the period 2021-2027. The aim of the project was to develop and test a myontomographic system for enhancing prison security through the use of search technologies. The project lasted one year and ended in December 2024.

Description of the problem

Estonian prisons receive parcels, letters and persons on a daily basis (11 000 visitors per year in Estonia). Among these, prohibited goods, such as drugs, psychotropic medicines and tobacco products, are constantly being smuggled into prison. Prisons face a major challenge in tracking down such contraband, as it can be quite skilfully concealed in personal belongings, grooming equipment and even the human body. Finding banned substances in the human body is particularly difficult, as new regulations also prevent searches of minors, for example. Prisons do not have the capacity to search individuals effectively enough to prevent all contraband from entering the prison.

The aim of the project

The aim of the project is to develop a scanner, based on myontomography, capable of efficiently, rapidly and safely detecting illicit substances and objects, including those on or in the body. The scanner to be created

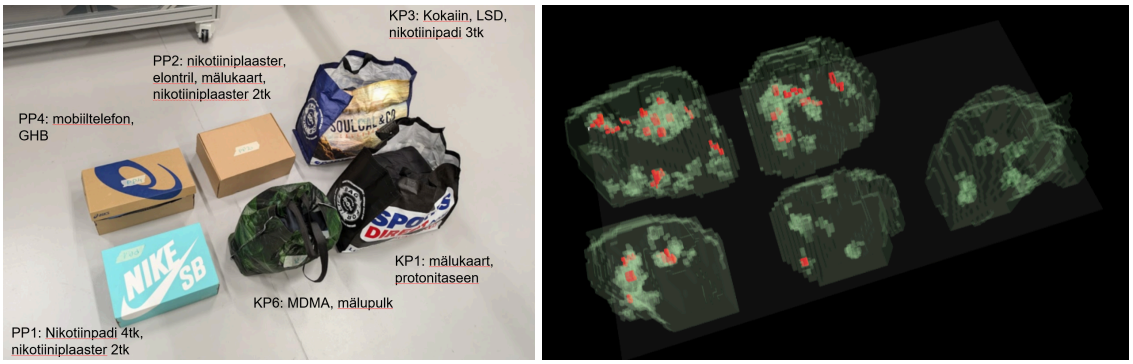
- is safe for humans, uses natural radiation;
- allows automatic detection of substances and objects;
- has no ethical limitations - the scanner does not create an image of the person being scanned, but only detects prohibited substances and objects.

Project implementation

The project was carried out in four phases. In the first, analysis phase the needs of prisons were specified, the technologies in use today were examined, and the work processes of prisons were mapped. In the second phase, a unique hardware and software solution was developed to address the specific tasks presented by prisons. In the third phase, the training of the system started. The scanner was introduced to a number of prohibited substances and the machine learning algorithms learnt to distinguish between them by analysing the impact of these substances on the trajectories of the muons that move through them. In the fourth phase, the project was summarised and an in-depth analysis was carried out to identify the steps that still needed to be taken in order to improve the myon tomograph so that it could be used in a real prison environment.

Results achieved

Thanks to the project, we have confirmed that myontomography can be used in security applications, both for non-invasive screening of objects and people.
We verified that it is possible to create a tomography application that automatically detects the prohibited substances (without operator intervention and subjective judgement).



The picture on the left shows test kits (bags/boxes of everyday items with prohibited substances/objects hidden inside) prepared for scanning. The picture on the right shows the result of the scan of the myontomograph through the system's user interface (in red are the possible prohibited substances/objects).

We set out the way forward for technology development. The aim is to increase the accuracy and efficiency of the tomograph. Algorithms and electronics need to be improved and upgraded, and machine learning needs to be pursued on a larger scale.

The project has been co-financed by the European Cohesion Fund.