Designing the algorithm of profiler’s decision-making

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Abstract. In this paper, a package of information profile characteristics is proposed and formed based on the specified requirements, which are decomposed into three packages (kinect, thermal imaging, and visualization). They are processed on different hardware and software platforms. Designing a profiling algorithm only allows you to make a guess about possible involvement in an act of unlawful interference or an attempt to perform an unauthorized action. The actual threat can be identified only on the basis of an in-depth personal search of the alleged offender and the items transported and transported by them. Specialists in the use of face identification methods are called profilers, but there are not enough special information applications to improve the efficiency of such specialists’ work. Detection of suspicious fragments in human anthropometry in appearance and behavior occurs during psychological testing by a Profiler, which is understood here as a visual diagnosis of the internal state of a person through visible manifestations of characteristic signs that may indicate an upcoming illegal act, so the use of information technologies will allow more accurate and memorizing, as well as comparison increases the probability of a correct Profiler decision. An algorithm for generating decision-making Profiler theoretically increase the analytical work of specialists, and study of this issue was included in the study qualification of the employees of the linear police Department on transport, in particular at the airport and Stavropol train station as there is a conclusion of the chief of the police Department.

Keywords: WS-profiler, video profiling, Kinect profiling, commutation system, human mnemoanthropometric structure, multi-factor profiler characteristics, profiler, decision-making support system, thermal-imaging profiling, digital information.

1. Introduction
There currently exists a problem of constant worldwide fight against terrorism. However, this problem is still insufficiently resolved due to the deficiency of common global counter-terrorism information space and common counter-terrorism policy, politicization of recognized characteristics by experts, lack of clear and qualitative definition of terrorism, the concealment of terrorist practices and acts of terrorism in almost all countries of the world. At present fight against terrorism comes to the fore; moreover, there increased a number of unfair competitors, who penetrate into different spheres of operational dynamics of organizations with different forms of property. Based on the above profiling becomes a topical trend of research. The goal of research is implementing a sub-system of decision-making by expert-profiler in order to improve the quality and increase the efficiency of executing the decision on the detection of suspicious persons.

First successful investigations were carried out in cooperation with transit police officers on the basis of anthropomorphic mnemosigns with the use of Kinect software platform and equipment. This enabled
to expand the range of research activities and to practice the tactics of multi-factor profiling (adding thermal-imaging scanning and visual comparison). Profiling research enabled to perform observations even more carefully, to intentionally study the environment and the behavior of a person, as well as to search for new suspicious signs and to establish cause-and-effect relationship and to unconventionally address the problems, which arise in course of work execution. Present day international situation does not provide any encouraging forecasts that problems in the field of security will disappear in the 21st century.

Profiling is based on a concept that any person may appear to be a terrorist or an unfair competitor and any object may appear to be an explosive device, weapon or a device for information interception, etc. Therefore, any actions performed as a part of the technology under consideration are aimed to either prove or disprove this assumption. Consequently, profiling should be understood as the identification of potentially dangerous people and situations in course of profiling activities [1]. In order to ensure adequate safety and security it is reasonable to use classical methods of criminal intelligence operation, identification and technical devices for video monitoring in combination with up-to-date psychological methods, such as profiling, which is used to identify persons prone to illegal activities [1]. Concepts of oriental medicine and vast clinical experience of “face reading” have also been studied [2]. Based on the above profiler’s decision-making system has been suggested.

2. Materials and methods

The beginning of the research work is reflected in the program of primary personal identification by mnemonoanthropometry of human skeleton [3]. Such investigations were facilitated by the discussion of information system for biometric identity authentication with experts.

Profiling is a new direction in psychological science that has appeared relatively recently and allows you to decipher nonverbal components used in interpersonal communication, but information technologies in this direction are not used enough. The analysis of scientific papers gives the right to say that profiling is an opportunity to get the most objective information about the potential danger of the subject and can be effectively used for preventive measures in the first echelon of inspection to prevent terrorist acts on transport and places of mass congestion of people. Profiling has already been used on the territory of the Russian Federation and in some countries on international flights at the airports of Pulkovo, Sheremetyevo, Domodedovo, etc. This technology is also used abroad: in the United States, Israel, and other countries in a number of airlines to ensure security at airports.

Research includes the following methods: system analysis, logical method, search and cognition methods, abstraction method, and other methods of scientific research. After designing the decision support system, the Profiler developed a block diagram of the multi-factor profiling software platform. The Profiler's decision support system is designed as a computer program. Taking into account the proposed three directions of automation of the Profiler's work with the arm, block diagrams of video profiling, thermal imaging profiling, and Kinect profiling were developed.

Simulation of profiling processes was performed in MP NPO “OOO IT-Video” laboratory; as a result, the possibility of further research activities has been confirmed.

3. Results

Processed information passes through the commutation system (commutator), which is divided into three streams (Kinect, thermal-imaging and video) with subsequent integration into a single common packet in accordance with result-based division (packets No. 1-3). In order to transfer the information of the common packet it is suggested to use data-transmission system, which converts special carrier-signals into the form that is suitable for processing and submission to WS-profiler. Security specialists take their final decision by means of decision-execution system based on the results and analysis of the received information (since humans are social by nature, i.e. humans are always judged by other humans – it is a long-lasting evolutionary mechanism [4]) (Figure 1).
The requirements, which are used for the operation of decision-making support system have been specified. Such requirements have been determined based on evaluation parameters of three components: Kinect, thermal-imager and video. Kinect parameters are based upon mnemoanthropomorphic differences and the calculation of deviations. Thermal-imager parameters are derived from the segments of human thermal radiation (red glow on pre-defined body areas). Video images enable to determine psychological facial expressions, which have been evaluated by psychologists. After that the information moves to processing system, where it is compared according to specified requirements and, further on – to the input of the commutator, which distributes streams by their identity: Kinect, thermal-imager and video. Digital information signals at the outputs of all devices are integrated into a single digital flow. Then digital information flow is divided into three packets $\Pi=1\text{-}3$, which are unfolded into a common digital packet $\Pi1\text{-}3$ by means of $S$ multiplexer. Common digital packet $\Pi1\text{-}3$ moves to profilers’ workstation, where delivered information is processed and sent to the input of the decision-execution system by means of profiler’s software platform (the request for program is sent in order to obtain the certificate).

Based on the results of designing profiler’s decision-making support system there has been developed the flowchart for the software platform of multi-factor profiling [5] (Figure 2).
The system of profiler’s decision-making support is represented by a computer program. The program can be used on Windows operation systems together with installed MS Office 2007 programs (and later versions), with any browser. The system does not require pre-installation and is able to support both local and network operation, which is an advantage of this product. For network operation the user should preliminary provide access to information resources of a PC (server), where this software application will be located. Further on, it is required to use remote access or conventional network technologies in order to run a decision-support system executive file and to start system operation.

The designed profiler’s decision-making support system is represented by a program, which opens a dialog window with the following active components:

1. Active hyperlink «Emotions».
2. Active hyperlink «Intonation».
3. Active hyperlink «Gestures».
4. Active hyperlink «Postures».
5. Active hyperlink «Facial gestures».
6. Active hyperlink «Thermal-imager».

Figure 2. Flowchart of software platform for multi-factor profiling
Based on Figures 1 and 2 following algorithm of profiler’s decision-making process has been suggested (Figure 3).

![Diagram](image)

**Figure 3. Algorithmization of the process of profiler’s decision-making**

Structural charts of video profiling, thermal-imaging profiling and Kinect profiling have been developed with reference to three suggested directions of automation of profiler’s work with the WS.

The structural chart of video profiling is based upon the data of video monitoring and information-processing device. The parameters selected for decision-making are divided into two groups: facial gestures and pantomimicry, which are based upon human psychological profile, in particular upon the changes of facial areas and emotions. It is possible to perform the correction of facial expression and the selection of video simulation for the determination of operation modes (Figure 4).
The structural chart of thermal-imaging profiling operates on the basis of a thermal-imager, which identifies thermal areas of a human. Investigations show that thermal distribution within human body is not uniform under certain circumstances. Main control segments are distributed within the following areas: legs-and-chest, arms-and-chest, abdomen-and-chest. In order to receive more detailed information it is suggested to use gastroetiological, cardiological and spot measurement on human body (Figure 5).

The operational chart of Kinect profiling is based upon Kinect-system, which already works for mnemoanthropometry and investigated deviations from 0-axis into different directions in order to determine the behaviour of a human. Correction is performed based upon axis visualization and deviation points (Figure 6).
Figure 6. The structural chart of Kinect profiling

Based on charts in Figures 4, 5 and 6 following structural chart of multi-factor profiling is suggested (Figure 7).

Figure 7. The structural chart of multi-factor profiling

The structural chart operates as follows. At the first step mnemoanthropometric structure of a human is investigated with the help of Kinect [3]. Kinect conversions are sent to adder unit, set within the first packet of digital information and coded, if necessary [6]. At the second step information from thermal-imaging device is examined [7]; it also moves to adder unit and is processed as the second packet of digital information. During the third step human facial expression (including facial gestures and pantomimicry [8]) is identified; this information is also sent to adder unit, is digitized and forms the third packet of information. Thus, a three-packet multi-factor code of digital information is composed [9]. S
information processing device uses software platform of profiler’s information and creates a special-purpose code [10-15], which is used by the system of profiler’s decision-making support and is displayed in WS.

4. Conclusion
Due to constant development of information technologies and software platform of multi-factor profiling it is possible to improve the speed of decision-making and the reliability of personal identification.

The described results of the research paper are able to contribute to the solution of practical issues related to visual testing of human emotions, which are associated with simulation, suppression and concealment of expressive demonstrations, as well as the impact of individual-and-typical facial characteristics on facial gestures and some others. The accuracy of facial expression identification is inversely related with the field size of expressive meanings: the wider is the field size, the less is the accuracy of identification. The dynamic implementation of profiling information technologies into the operation of transportation security structure should provide significant benefit in this field. In fact, as laboratory tests show, even providing training on profiling with the use of multi-factor system and software platform for security officers by itself has positive effect on their subsequent attitude to their direct responsibilities, making them consciously change approach to their direct duties. It is significant that the implementation of profiler’s decision-making support system as yet another potential aspect in security maintenance will qualitatively contribute to the overall situation of fight against terrorism. The more practical activities based on innovation technologies in this field are implemented, the more theoretical approaches and trends with their practical implementation of information technologies are involved, the higher is the security level. Thereby we provide indirect impact on the situation, reducing the risk of new terrorist attacks.

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