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CASES OF POOC TO DETECT THE HIGHLY DANGEROUS PERSON AND POSSIBLE CRIMINAL BY CCTV CONNECTED TO VIBRASYSTEM

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Abstract: *Carnivorous aquatic vertebrates came to land 360 million years ago. They should be adapted by gravity field. Accordingly, there was a evolutionary development in sense of equilibrium (balance) and then, it came true to vestibular nervous system in anatomy. The most appropriate movement was required all the time. This is directly connected to life's survival. The nervous system of vertebrate was elaborated in the process of the continuous selection that would be "Fight and Flight" and then, at the end, feelings would be taken place in its vertebrate. Now, when we human heard the astonishing sound, we might stagger and when we saw the terrible sight, we could see the case that was fell down in astonishment. Nowadays, a lot of victims happened at concert hall performed by American's artist in England and it made a citizen of the world not be repress his astonishment. In Korea, the environment of presidential security service was rapidly changed to the open circumstance. For this service, what is the most applicable solution based on keeping human rights and enhancing people friendliness? Isn't there the most appropriate selecting system that can detect the potentially suspect person by a contactless method through CCTV video image?*

Under a real time operational method, it will contribute very strongly to secure the crime prevention, if there is the monitoring and detecting application the potentially possible dangerous person by a very high accurate assessment that connotes aggression, criminal excitation, sensitivity and etc. with the abnormal range of human state. By the way, in some specifically scientific field, its kind of technology was commercialized and operated as a high confidence and reliability in Lie Detection system and then, we can expect the strong admissibility of evidence. In this connection, Henry Greely pointed, " If some one successfully develop to judge the complete and very high accurate. Lie Detection system or the skill of truth-compelling method, it will influence to all courts and furthermore, to all the judicial systems." Recently, there are lots of researches and studies to keep utilizing Lie Detection skill based on fMRI and brain prints identification. Among these kinds of technology, Vibraimage technology is to operate to detect and screen the highly suspect person (object) on the real time way by using a contactless CCTV video image. This study is to contribute to indicate proof materials and to verify Proof Of Operation Concept (POOC), and then to propose the possible utilization by the real cases.

Keywords: *Vibraimage, CCTV video image, vestibular system, counter-terrorism, Proof Of Operation Concept.*

1. Introduction

Although a lot of manpower and equipment are put into the protection of VIP at national important events and international events, there is a limit to detect terrorist and highly dangerous person among targeting unspecified crowd. In this environment, it is necessary to have a system to detect the potentially suspected terrorists and high-risk criminals from real-time video images through CCTV in advance [1, 2, 3, 7].

The right device is VIBRASYSTEM. The main principle is to search and detect the dangerous people in CCTV video images in real time. By calculating the analysis values from the micro-movement of the head/face and etc., which is the reflex-regulation function of the human brain, it is a system that detects the real-time suspects of potential terrorists or high-risk criminals in the crowd and then, informs them by alarm function. Also, the video images of the dangerous people identified as the potentially suspected terrorists and high-risk criminals can be automatically captured and sent to security guard or police via text messages (MMS service).

The result, judged to be a dangerous person, provides the objective data on suspect level so that the profiler can send the captured picture to the pre-registered manager (profiler) and perform a close examination. The recommended place of installing these equipment is an unspecified number of people such as airport, railway station, harbor check point and so on.

Vibraimage technology for detecting the potential suspect person or high-risk criminal was developed by a system for indicating the quantitative analysis of suspect level by comparing and matching the simultaneous correlation between brain waves and VI parameters analyzed by the real video images [6, 7]. This security application was proven for a long time by operating at many cases of installation and utilization around the world. Especially, since 2016 year in China, we have tested for proof of control at some major airports, high express train stations and national border guards and so on. For about 2 year POOC (Proof Of Operational Concept) examination and testing, VIBRASYSTEM in security solution could detect the very meaningful testing results here and there in China. Herein is to introduce the greatly surprising cases that were detected and captured by VIBRASYSTEM.

2. Theoretical basis

2.1. Vibraimage technology overview in security solution

It is a technology that visualizes the micromovements of the head/face through the real video image by the interaction of the brain vestibular system (equilibrium sensory function) by stimulation and measures and detects it with psychophysiological parameters based on the classification and combination of amplitude, frequency, symmetry [1, 2, 3, 8]. In other words, it refers to a technique of acquiring, analyzing and evaluating the real video information related to human psychophysiology and emotional state. Through lots of testing and verification, the non-contacting security application of VIBRASYSTEM has been optimized to develop and improve a method to quantitatively indicate and analyze the suspect level of potentially risk and dangerous criminal [1, 8].

2.2. Psychophysiological Relation

The vestibular system is the only one of somatosensory system that can distinguish the area from each other, and consists of two organs. Each vestibular system consists of two receptor groups, one group of three semicircular canals and the other group of otolith organ which consists of utricle and saccule. These vestibular receptors have two

functions: one is to tell us where the body is about gravity and the other is to tell us how the head moves and how fast it changes [1, 2, 3, 4, 5].

The vestibular system, which contributes to our balance and our sense of spatial orientation, is the sensory system that provides the dominant input about movement and equilibrioception [1, 2, 3, 4, 5].

The vertical human head position controlled by vestibular system by the means of head-neck anatomy. Two month old child begins to poise the head in vertical position on reflex level, firstly performs visible movements for it. Adult people also performs micromovements for poise vertical head position, because it is impossible to coordinate vertical mechanical balance of heavy object without movements.

Vestibulo-emotional reflex (VER) is a reflex 3D head movement that stabilized vertical equilibrium of head by producing head-neck muscle movement with the frequency depending on the emotional and psychophysiological state of a person [1, 2, 3, 4, 5].

Vestibulo-emotional reflex (VER) is the one of vestibular reflexes, linked human physiology and emotions. The signal generated by the micromovement of the head is also changed to electrical energy and sent to the central nervous system through the vestibular nerve [1, 2, 3, 4, 5].

The senses produce motion, and the perception produces behavior. There are general senses and special senses in the senses. The general senses have visceral senses, pain, itching, and proprioception. The special senses include visual, auditory, taste, olfactory, and balanced sense.

Only when information that we receive from the body — the actual vision, the touch, the proprioception (the sense of arms and legs positions in space) is integrated with the image of the body already remembered in the visual space of the brain, then it can fully take notice your presence (the sense of self). It is thalamus that connects sensation and motion. The thalamus acts to connect the movements and the interior and exterior sense to cerebral cortex. Hundreds of thousands of areas of thalamus and cerebral cortex vibrated at 40 Hz, and Gerald Maurice Edelman named it the dynamic core and then called it as the core factor of human consciousness (mind). The technology that utilizes the balance sensory theory in central nervous system, is Vibraimage system [1, 3, 8]. Only when information that we receive from the body –2.5. Detection point and process according to “Dynamic” or “Static” or “Mixed” mode.

2.3. Features of VIBRASYSTEM applied security solution

VIBRASYSTEM Technology can be seen in four broad perspectives [1, 3, 6, 7, 8]. First, the vestibular system of the brain-body performs the various roles by adjusting and modulating the balance organs of the human body through the vestibular cortex of the brain. It means that it perform the cognitive functions, for example, such as posture control, self-movement, cognitive ability, and space moving objects.

Second, through the autonomic nerves of the heart-body, when heart information such as heart rate variability, tension/anxiety, awakening/relaxation is transmitted to the brain is transferred to brain, at this time, the vestibular system is stimulated

through the rotating stimulation and temperature stimulation using blood flow. This information is used to determine and grasp the effect of human body. Third, the brain's commands and heart responses are expressed in balance or in fine tremors through the equilibrium organ of vestibular system, and then it is represented by micro-movement (energy conversion).

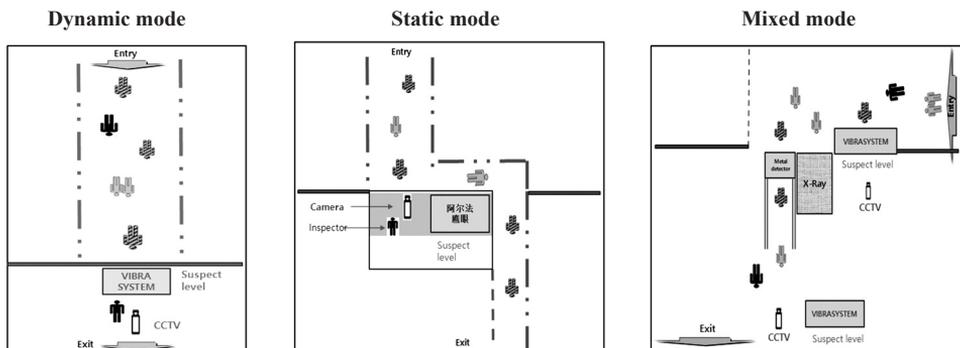
Four, it is a very unique technology that can recognize the physiological response by mapping the real video information (frequency, amplitude, symmetry) using the camera with the electrical physiological signals (EEG-HRV).

2.4. 3 kinds of operation programs for security

There are three kinds of operation program in security solution. According to the testing environment and the required target and purpose at checkpoint, the most appropriate testing program can be applied and operated. VIBRASYSTEM at some checkpoints need to sense the passing crowd on walkway. It requires to sense the standing person at passport or identification card at other checkpoints. In addition, it should sense the waiting person at the back of X-ray baggage inspection machine. According to the required purpose and condition, the best operating program should be selected and applied for the reliable examination. The first program in security solution is "Dynamic mode", which can be applied to the unspecified crowd flowing through the given guiding walkway. This is a very general operation process in security at the various checkpoints [10].

The second program is for checking sensing the standing passengers or person while he should stand for a moment at the front of inspector. This one should be different from the flowing conditions. It can be applied and operated to all check points to inspect passport or ID card or credit card or the standing mode at the front of inspector. It is called as "Static mode" [10]. The third program is for sensing and detecting under the mixed condition and environment by combining "Dynamic mode" and "Static mode". This one can be limited to apply actually. But in case that passenger or person stands for a moment and walks way at a short distance.

2.5. Detection point and process according to "Dynamic" or "Static" or "Mixed" mode



3. Detected cases for Proof of Operational Concept in China

3.1. Sample of the suspect level analysis captured to the actual criminal by VIBRASYSTEM

The signs of behavior are indicated by suspect level through VIBRASYSTEM.

After getting the recorded video image that captured the real criminal who was arrested by criminal investigation, VIBRASYSTEM examined to analyze this video image. The dynamic mode program was used for evaluation. This case was occurred at the big shopping mall and the criminal stealed some jewelry and gold from a store. VIBRASYSTEM could detected the high suspect level from its video image. By this kind of analysis and evaluation contributed to find out the very potential suspect in criminal investigation. VIBRASYSTEM made some contribution by examining and analyze some video files. The following picture (Figure 1) is one of the evaluation evidences.



Fig. 1. Case of Theft at Jewelry store, Recorded video by CCTV

3.2. Detection lists for POOC in China's major sites

In China, anti-terrorism caused by the independence and religious problems of ethnic minorities such as Tibet and Inner Mongolia has become an important national policy issue. Recently, the Ministry of Public Security of China has organized and operated the counter-terrorist department independently, and is taking an active approach to the issue of counter-terrorists. Therefore, we designated the demonstration area in China and conducted the testing operation using VIBRASYSTEM. The demonstration areas are in Beijing Sudo International airport, Guangzhou Bakwoon International airport, Shenzhen Baohan International Airport, Inner Mongolia border immigration office, Zhejiang Province Yiwu City train station and so on. The Figure 2 shows the case of the testing environment that requires “Dynamic mode” program in airport and terminal. The mark with red rectangular box indicates the high suspect person.

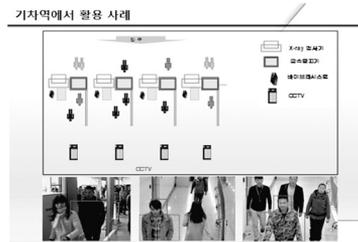


Fig. 2. Case of high suspect person by dynamic mode

The testing for Proof of Operational Concept (POOC) was conducted for about 2 year from March 2016 to November 2107. The representative testing results are shown on the below table. Some cases are very surprising and remarkable evidences and results in China's testing.

1) Undeclared case to hide and bring US\$100,000 in baggage (Illegal entry of US\$100,000)

Suspect Level	Conditions
69.3	<ul style="list-style-type: none"> – Captured and detected to hide and carry US\$100,000 in baggage Arrested immediately by police team (Syrian people, Man) * Must declaim when carrying over US\$10,000
	

2) Undeclared case to hide and bring plant with drug ingredient in baggage

Suspect Level	Conditions
65	<ul style="list-style-type: none"> – Captured and detected to hide and carry a specific plant with drug ingredient in baggage (Kenya, Men) – Chatercho (kind of Arabia tea) – Prohibited to import since 2013 (Prohibited items for national importation)
	

3) Undeclared case to hide and bring fruits in baggage

Suspect Level	Conditions
66.3	<ul style="list-style-type: none"> – Captured and detected to hide and carry a lot of Mango – Employee (Crew) in International Airplane company
	

4) Declared case to carry 1 Million China money

* He declared 1 million China money before embarkation [Legal entry case]

Suspect Level	Conditions
67.3	<ul style="list-style-type: none"> — Captured and detected to carry 1 million China money (RMB) (Legal case, He declared it before embarkation) * He was captured and detected because he was so nervous and state of tension to bring a big money
	

5) Evidence to detect Drug Injector

Suspect Level	Conditions
65.5	<ul style="list-style-type: none"> — Captured and detected by drug injection — Arrested immediately on site after urine examination * She was revealed as Drug ex-convict. * Impossible to detect at any inspection machines
	

6) Evidence to arrest the on-site pickpocket crime

Suspect Level	Conditions
70.5	<ul style="list-style-type: none"> — Captured and detected as pickpocket crime * He was arrested on site immediately by the close examination due to the high suspect level in VIBRASYSTEM
	

7) Evidence to detect lamb-carried smuggler

Suspect Level	Conditions
65.3	<ul style="list-style-type: none"> – Captured and detected to hide 20 kilograms of lamb meat (raw meat) being taped to body * Impossible to detect it by metal detector
	

8) Evidence to detect a very nervous passenger

Suspect Level	Conditions
65.2	<ul style="list-style-type: none"> – Captured and detected to bring the temporary passport due to losing the real passport * He was in the state of tension and anxiety just before departure inspection due to that he possessed the temporary passport
	

And there are lots of evidences to capture and detect during POOC in China except the above introduction. They will be so much helpful to operate and setting VI security product.

3.3. China Certification by China police and officially certified test report samples

After POOC testing, we could get the officially certificated test reports. By accumulating some test reports in China. They will be so much meaningful and helpful to distribute VI security products because they can make it be reliable and confident as the most appropriate security solution. As the results of the successful POOC testing, at the end, VIBRASYSTEM (named as "ALPHA EYE" brand in China) could be certified by China Police on October 2017 year, which he issued the official certification as figure 3.

the most important point is which technology can be the most feasible and applicable solution to detect and screen the possibly high suspect or criminal in security system. VIBRASYSTEM's security solution by the non-contact method through CCTV video image can be most reliable among the current technologies comparing to SPOT(Screening of Passengers by Observation Techniques) in security profiling system [9].

5. Conclusion

VIBRASYSTEM was conducted in China for Proof Of Operation Concept (POOC) test. A few of suggestions are taken as below.

First, why is the Vibraimage technology to capture and detect the high-risk criminal, based on the real video image required? It is no exaggeration to say that modern times are the age of video. The utilization of CCTV equipment is one of the key factors. However, the technology for improving the video image quality is developing, but it is known that there is no technology to evaluate emotions or physiology using the real video image.

VIBRASYSTEM is for a practically artificial intelligence system with the scientific fusion that can greatly increase the security function of the existing CCTV.

Second, is there a scientific investigation system that analyzes the lie probability for statements by simply recording the video image by mobile phone and detects the high suspect person from the public? The usefulness and simplicity of mobile phones are continuously evolving, so VIBRASYSTEM can provide an extension of the field where mobile phone or CCTV can use the real video image.

Third, is there a non-contact detector that can reduce the controversy of human rights by using the physical contact of the equipment? Everyone is exposed to the unpredictable terrorism and constant threat defenselessly. There is no reason to hesitate if there are equipment and technology that can measure the signs with the scientific numerical evaluation. The development of modern science has come to predict the real situation. However, the fear of terrorism, which is represented by a lonely wolf, is a reality that can not be easily escaped. How can humans respond to disasters that have not been experienced with these crimes? Can the crime be prevented for reasons that are not the reason?

In this study, it has been proven that VIBRASYSTEM using CCTV video image can grow and develop into a state-of-the-art security system that detects potentially dangerous person among crowd.

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