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Biometric Gait Identification for Security

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Abstract: *The Gait biometric is a complementary method used for human identification system. Gait means "a way or pattern of walking". Biometric systems are increasing tremendously in our day-to-day life providing more accurate and reliable identification and verification for secured authentication. For unique human identity, numbers of solutions are invented. According to the Psychological studies, the gait ability for unique identification of a person can be recognized which can be measured by different analysis techniques by visual method including camera from a distance that captures different angles of gait. It is also used in different applications such as in surveillance for security purpose which deals with the existing technology. This paper represents how the Gait Analysis is used in the field of security that can also be used in visual creation. Other fields like medical and biometric identification dealing with betterment for humans can also be included.*
Keywords: *Gait, Biometrics, Authentication, holistic, fingerprint, human recognition.*

I. INTRODUCTION

Many people feel that they can recognize familiar persons by simple way of walking. The recent interest in biometrics has scope of development of the Gait Recognition as unique identification. Biometric can be classified as physiological and behavioral. There are several properties of gait biometric like Finger print as unique identification for authentication in many applications, Face recognition, Voice recognition, Signature recognition, Irises and retina scanning and hand recognition[1]. These are the various approaches for security service that provides unique identification to a individual. There are variations in individuals gait including footwear, injury, terrain and fatigue.

Need of large scale identity management system functionality depends on accuracy recognized through every individuals identity. Previous methods used for person's identification is by characterization knowledge. Examples of knowledge based on the authentication includes PIN, text passwords, etc. and the object based authentication is typically based on traditional methods for bank PIN/ passwords and token based approach. But still there is possibility of the passwords being stolen or lost. Also memorizing such multiple passwords, recalling strong password is a difficult task. Hence, biometrics provides natural and effective solution on certain problems for recognition based on biological features. The effectiveness of the system is based on their robustness and reliability to the various types of attacks. Many attacks are discovered against the authentication system based on PIN/Passwords such as host attack, DDOS (Distributed Denial Of Service) attack, DOS (Denial of Service) attacks and Trojan horse attack[1]. Thus, to overcome the drawbacks and attacks, Biometrics provides certain advantages as non-repudiation, negative recognition cannot be offered by PIN/Password and token based methods which require physical and behavioral features such as Fingerprint, face, signature, hand/palm geometry, iris, retina scanning, voice and DNA information for one's unique authentication.

II. GAIT AND GAIT RECOGNITION APPROACHES

Gait is a manner, a person can walk, move or recognizing any cyclic combination of movements. It is a periodic activity covering two stalks left foot and right foot forward. Biometric gait recognition is used for verifying person by their pattern of walking. Recognition of human by using Gait is a recent approach. The gait can be identified when the movements are coordinated in sense with a particular pattern[2]. By repeating steps in cyclic nature makes a unique gait. Examples included are walking, running, climbing, hopping, picking up the object all are coordinate motion but do not result in making a motion. Skeletal dimensions may be used for recognizing individual person but is cannot be considered as a part of gait. Here, Gait can be considered from two

aspects namely Dynamic and structure. Dynamic refers to the time required for transition between phases and structure represents the configuration of different gait phases of a person. Designing effective algorithm for gait recognition is not an existing method because there are certain challenges of carrying objects and footwear. Biometric research depends on datasets[2]. Biometric gait recognition can be grouped in two categories i.e. Holistic approach called as model free approach and model based approach.

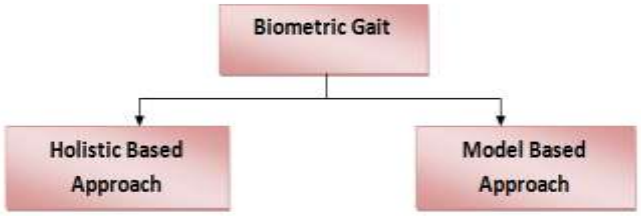

Fig 1: Types of Biometric Gait.

The holistic based approach extracts method and motions depending on statistical features whereas the model based approach use to form 3D gait model that identifies body parts. This paper describes the security features of Gait biometric.

III. EXISTING SYSTEMS

For the purpose of biometric authentication, there are different already existing systems which are now-a-days more frequently used. Some of them includes:[2]

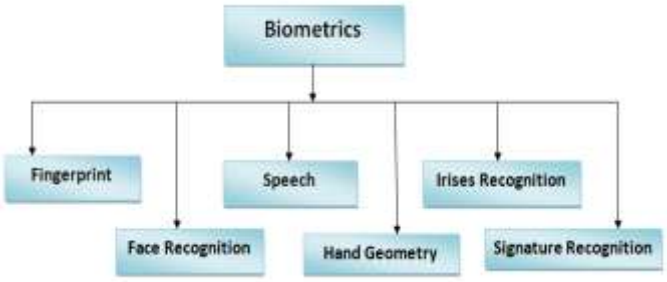

Fig 2: Biometric types

3.1 Biometric Fingerprint

Recently used system by the service providers is using the biometrics which uniquely identifies any person based on their behavioral characteristics using the fingerprint as the password[4]. But, it doesn't guarantee the complete security as the finger due to the following issue: Someone can replicate the biometrics of fingerprint simply by removing out the chip or the glass to make a fake fingerprint. Hence, the researchers are trying to make an alternative to such attacks[5].

3.2 Face Recognition

The most commonly general life used biometric includes the password entry to identify human is through the face recognition. It is cost saving and provides accuracy in authentication. Though it is used very often but it includes tedious task of image size and image in the form of pixels and thus it is difficult to process and to store.

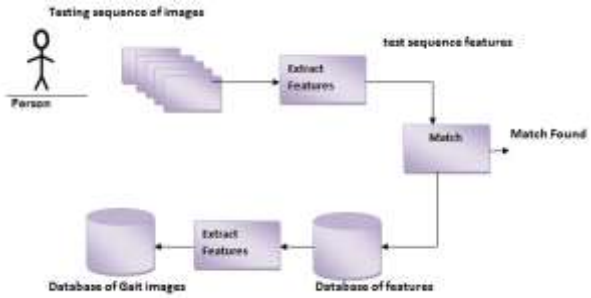

Fig-3: General block diagram of authentication system using Gait Recognition

Fig. 1 represents general block diagram of authentication system by using gait recognition. Gait captures the sequence of video images by different angles and viewpoints and then the critical step of Feature extraction. Extracting features from video sequences to show walking person by frequency domain feature is referred as spatial temporal extraction. Ensuring feature extraction processing and then comparison with existing database gait signals for recognition.

IV. GAIT ANALYSIS FOR EXTRACTING FEATURES

Study of gait analysis requires the feature extraction of a walking person using particular image processing from gait sequence. Thus, for extracting the feature from background image sequences divides the gait analysis in two approaches as holistic based and model based.

In holistic approach its highly extracts tests the reference sequence and gait sequence from same viewpoint that are captured. In model based identification parameters are identified by gait sequences processing. Required gait image sequence in high quality .Here is example take walking human as model this technique converts in binary map in texture colorful information but it extracted by Fourier transform method. By using this pattern matching by distance measuring formula Euclidean distance for gait recognition also finding inner product distance in binary different frames.

V. APPLICATION

1. Security

It is able to provide unique features in the field of security because of its non-invasive nature. Gait recognition technology does not produce any harm for humans[9].

2. Use to guard against

It can be used at high level security protecting against terrorism and domestic crimes by gait recognition that can identify the terrorism before any sort of action.

3. Enhanced security

For enhancement of the security at airports, organizations and shopping malls to identify attackers and criminals, we can store gait data of terrorist so that it can be easily detected. Gait recognition makes unmatched feature for recognition[9]. Also it is used in military and defense area for unique identification of a person.

Real example of a Southampton University in the UK, Gait tunnel is only facility, that can particularly arrange walking people into the multiview image sequences by constructing a real time 3D CV(Computer Vision) images for measuring unique patterns of Gait. It records individual person gait.

Criminals who walks through these tunnel will unknowingly record their data for identification and this data can be shared between countries to find better solution against the global terrorism because of potential capability to identify distrustful behavior before crime is in binding.

4. Medical And Clinical

It is used to identify person medical condition that is affected by Parkinson's diseases where muscular control is weak. Early identification can allow treatment to be prescribed earlier because many diseases are incurable[9]. In clinics, the gait data of patients should be collected at the time of checkup which will provide previous planning for treatment by using Gait.

5. Sports

Gait recognition can help to prevent from sports injuries. For example an incorrect posture, etc.

VI. Advantages

1. Unique Authentication

The biometric authentication by gait saves human memorization task of remembering PIN/ password. Gait recognition can identify person by considering and matching walking pattern at crowd place, airport, fashion mall, etc[10].

2. Overcome problems with CCTV

CCTV stands for Closed Circuit Television. A huge amount of people passes through shopping malls, airport every day. Also faces may be observed and recorded from places at a long distance. It may also be difficult to capture doubtful character from crowd. So in gait recognition, it captures more detailed recording by image processing and also process low image quality data when required.

3. Easy to use

As per the recorded gait data, systems are allowed to access by matching one's identity associated with the databases. Only visual information can be stored here and hence there is o need to remember any pass code/PIN instead only pattern will match with different set of sequence of images[10].

4. Can be used as a biometric

In physiological biometric, it can be used as person's identification as compared to other system approach[10].

5. Works in Poor Brightness

In can also work well in poor light condition. When light effect is less then identification based movement is not possible for us because it is not easy to detect any person or object in crowd because of poor light effects.

6. Cost effective

In medical sciences, use of gait method reduces the cost of care by pre and post operative hospital visits and also affects the surgical inventions. Also it helps individuals by early detection of disease and one can take treatment in an affordable cost[11].

VII. DISADVANTAGES

1. Affected by different clothing

These may get affected by different types of cloths. So recognition at such times may be difficult[11].

2. Carrying bulky items

Carrying bulky item may have an adverse effect on floor sensor and it makes critical for identification[11].

VIII. LITERATURE REVIEW

Table1: Findings of Biometric Gait from some research papers.

Sr no.	Title	Authors	Their Findings	Our findings
1.	Biometric Gait Recognition.	Jeffrey E. Boyd,James J. Little.	Factors affecting both human and machine recognition of gaits, data used in gait and motion analysis, evaluation methods, existing gait and quasi gait recognition systems.	Acquisition of images portraying an individual's gait can be done easily in public areas not requiring the cooperation or individuals awareness under observation.
2.	An Efficient Gait Recognition System for Human Identification Using Modified ICA.	M. Pushpa Rani,G.Arumugam	It is used to address this problem by recognizing people based on the way they walk. The development of computer vision techniques has also assured that vision based automatic gait analysis can be gradually achieved.	They are tracking humans through video sequencing and then it identify the humans whether it is a male or female.
3.	Human Gait Recognition And Classification Using Similarity Index for various conditions.	Nahid A Makhdoomi, Teddy S Gunawan, Mohamed H Habebi	It is used to implement the traditional gait recognition algorithm by show the variation in gait recognition when subject is observed parallel to camera under the conditions of walking normal, carrying a bag and wearing a coat.	It will search for the similar index which matches the gait and then study for the human classification
4.	A Survey Paper on Human Gait Recognition Techniques	Kalpana Soni, Amrita Singh.	identity of the person by using unique physiological or	It will survey on the various methods of gait recognition and then study for the

			behavioral characteristics. Since these properties are unique for individual person so it can be used for recognizing the person.	human identification.
5.	Gait Recognition Based-on Silhouettes and Neural Networks for Human Identification.	Molhema Mohualdeen, Magdi Baker.	The different side of view movement increase reliability of the key extracted feature and improve the neural network performance which opens a scope for further development.	It will study the neurons of the humans and then identify them based on it.

IX. Conclusion

This paper represents overview research of Gait Analysis and recognition in field of authentication and human unique identification. Future scope and concept is introduced in some movies but not commenced in reality. 3D model allows face and Gait recognized at the same time. Also maintaining security benefits for authentication. To create effectiveness in future of gait recognition has additional parameters for unique identification. Like face recognition and Gait recognition make strong authentication for person. In future, security service can be collaborated with the cloud computing based frameworks.

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