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A Revolutionary New Approach to Biometrics: Systematic Study

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Abstract: *Biometrics are a way to identify people using their own personal info. The goal of biometrics is to keep the data safe and secure. There are lots of different types of biometrics, but some are really popular because of how easy they are to use and how secure they are. Biometrics come in two types: physiological and behavioural. Physiological biometrics include things like faces, fingerprints, irises, and signatures. All these systems are covered in this paper. Biometrics work in three main ways: enrolment, verification, and identification. Enrolment is when patterns are taken from people and stored in databases. Verification is when the system checks if the pattern belongs to the user or not. Identification is when the user uses their own biometrics to verify that the data belongs to them. All three levels represent the functional levels of the biometric system. In the early days of biometrics, it was only used at the ground level to provide a basic level of security to the data. Today, it is playing an important role in ensuring the security of our data. Not only is biometrics used in everyday life in the form of phone unlock, phone assistant, attendance system, etc., but it is also being used at the advanced level in the form of airports, border control, cloud computing, etc. This research paper will explore the future scope and scope of biometrics and how it may even transform the future.*

Keywords: Biometrics, Recognition, Security, Identification, Authentication

I. INTRODUCTION

Biometric framework could be a procedure utilized to distinguish a person utilizing its individual recognizable proof strategies. The most concept of biometric frameworks is to supply privacy and security to the client. A number of biometric frameworks are presented but a few frameworks are broadly utilized and are popular since of their utilization and security they give. Physiological and behavioural biometrics are the two sorts of biometric frameworks.

Biometric frameworks incorporate physiological biometrics like confront acknowledgment, unique mark acknowledgment, iris acknowledgment and behavioral biometrics like signature acknowledgment and voice acknowledgment. All these acknowledgment frameworks are examined in this term paper. Biometric frameworks work on three levels: Enrolment, Confirmation, and Recognizable proof.

Enrolment is the method in which designs are captured from the client and put away within the database. Confirmation implies to affirm that the test entered by the client has a place to him or not. When the client needs to get to the information at that point the client must utilize his/her biometrics so that the framework checks that the individual who needs to get to the information is the genuine proprietor of the information or not.

This handle is recognizable proof. All three levels are the working levels of the Biometric Framework. In prior a long time, biometrics were utilized as it were at ground levels to provide basic security to information but presently the tables have turned. It is playing a major part in giving security to our information. Biometrics are not as it were utilized in day-to-day life in phone opening, phone colleagues, participation frameworks but moreover utilized at progressed levels like in air terminals, border security, cloud computing etc. In this term paper, we'll examine end of the scope of biometric frameworks and how it could indeed alter long haul.

The advantages of a biometric system have made it even more important. The first advantage is its reliability and convenience. On the ground level, biometrics are used in everyday life, such as unlocking a phone or entering an office. On the advanced level, they are used in research laboratories or in a defense system to protect confidential data.

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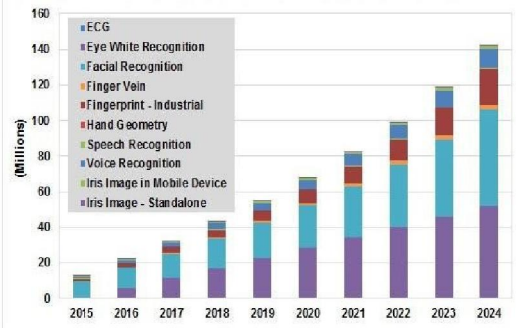

Fig.1 Increase in Biometrics from 2015-2024

It prevents imposters from accessing our data, both personal and professional. If a password is used to secure a data set, it can be broken by hackers or other illegal entities who use it against us. However, if biometric recognition is used instead, there are less chances of data loss, as biometrics work on matrices where passwords are stored as patterns rather than numbers, texts, or special symbols.

It also plays an important role in monitoring the attendance of employees in the workplace. Employees cannot change their time of arrival and cannot mark the attendance of others. In this way, the system helps to maintain discipline in the workplace.

1.1 DIFFERENT TYPES OF BIOMETRIC SYSTEM

A biometric system mainly has two types:

Physiological biometric systems

Behavioral biometric systems

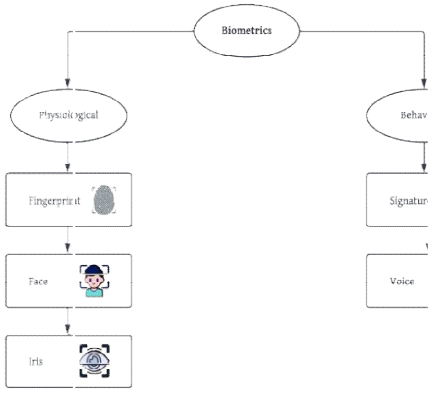

Fig.2 Types of Biometrics

Physiological Biometric Framework: The physiological biometric framework is the framework that incorporates the physical behaviours of the human body. Confront acknowledgment, unique finger impression acknowledgment, and iris acknowledgment are illustrations of physiological biometric frameworks.

In this sort of acknowledgment, any portion of our body is utilized as acknowledgment design, which is utilized as the base or ace design. For occurrence, the phone opening framework has spared our ace unique finger impression or confront design, which it employments a while later to open the phone. It incorporates the taking after strategies:

Fingerprint Acknowledgment: Usually the most seasoned as well as the foremost trustworthy strategy that has been utilized within the industry for an awfully long time. This strategy was found by Sir Francis Galton in 1888 [7]. Everybody includes a one-of-a-kind unique mark design called particulars, which can't be replicated in any way. Keeping in intellect that this strategy was found to check whether the two fingerprints were from the same individual or not, The lines on the fingers are called particulars, and the designs of particulars are one of a kind for everybody.

Both our hands have distinctive fingerprints i.e., no two fingers have the same set of designs. Too, no other individual in this world has the same set of particulars [7]. In this way, it is one of the secure acknowledgment strategies. There

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are numerous unique mark designs like twofold circles, spiral circles, curves, and coincidental designs. Biometric frameworks are actualized concurring to these designs. Each design is filtered and put away in a database, and after that at whatever point a individual tries to open the secret word, he/she checks their unique mark.

Then it is checked whether the design that the client is filtering presently and the spared design of the user match or not. In the event that there's a coordinate, at that point the client is coordinated to their information. Fingerprint recognition method has presently gotten to be a daily practice in the life of humans.

And there's no question that usually a cutting edge thing. It is utilized in:

Smart phone Opening.

Aadhar Confirmation or Distinguishing proof.

UPI Verification.

Bank Servers.

Office/Private Space Opening.

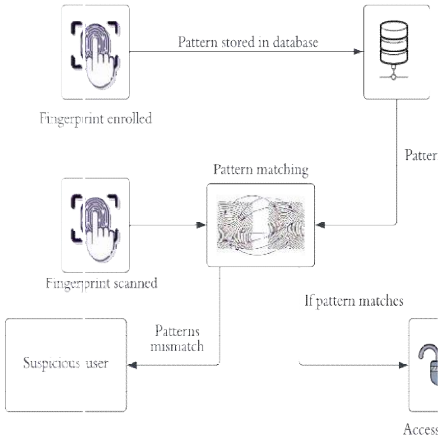

Fig.3 Fingerprint Recognition System

Face Recognition: This is the mathematical representation of a person's face. Woodrow Wilson Bledsoe, an American mathematician, and a great computer scientist, made a great contribution in the field of pattern recognition (commonly known as face recognition). And now it is spread all over the world. Almost every mobile camera has the facility of face recognition. Face Recognition works on the concepts of deep learning where the images are converted into numerical expressions and then these expressions are processed by applying Artificial intelligence and deep learning algorithms which convert it into useful data

Face Recognition has become so advanced that it helps in:

Fraud Reduction

Convenience

Security

Automation

Access Control

Instead, we have a very great future with face recognition as:

There could be 3D recognition, as we currently have 2D sensor recognition, which is less advanced than 3D recognition.

It could be a real-time personalized experience. Think of when you go to the market and, based on your facial expression, the AI robots or machines show ads and show products.

For instance, it could be an automated experience where, for instance, you are scrolling on Facebook or Instagram and the application shows you different things of your choice and which you like based on the recognition of your face.

Face Recognition: This is often the numerical representation of a person's confront. Woodrow Wilson Bledsoe, an American mathematician, and a great computer researcher, made a extraordinary commitment within the field of design acknowledgment (commonly known as confront acknowledgment). And presently it is spread all over the world. Nearly

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each versatile camera has the office of confront acknowledgment. Confront Acknowledgment works on the concepts of deep learning where the pictures are changed over into numerical expressions and after that these expressions are handled by applying Counterfeit insights and profound learning calculations which change over it into valuable information

Face Acknowledgment has ended up so advanced that it makes a difference in:

Fraud Diminishment

Convenience

Security

Automation

Access Control

Instead, we have a really awesome future with confront acknowledgment as:

There may be 3D acknowledgment, as we as of now have 2D sensor acknowledgment, which is less progressed than 3D acknowledgment.

It might be a real-time personalized experience. Think of once you go to the advertise and, based on your facial expression, the AI robots or machines appear advertisements and appear items.

For occurrence, it may be robotized involvement where, for occasion, you're looking over on Facebook or Instagram and the application appears you distinctive things of your choice and which you like based on the acknowledgment of your confront.

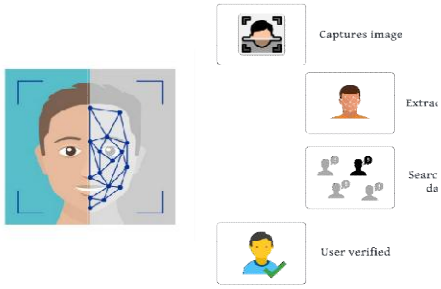

Fig.4 Face Recognition System

Iris Acknowledgment: Iris acknowledgment is one of the foremost exact among all other sorts of biometrics. Any other biometrics can be replicated or can be deleted but this will remain until the end of time with us and cannot be copied. So, it is the foremost secure confirmation strategy.

This strategy is based on the concept of profound learning. Firstly, our eyeballs or iris is checked by the scanner and the picture of the iris is partitioned into little pieces which at that point are changed over to double codes and matched with the design of codes as of now put away within the database [8]. Iris Acknowledgment is such a cutting edge concept that it can be utilized in numerous ways:

Iris scanners can be introduced at the entrance of any individual property.

It can be utilized as a security framework in historical centers or at places which require tall security.

Can be utilized in military workplaces to confine entrance of unauthorized people.

Behavioral Biometric Framework: This framework is based on human behaviour. Fundamentally, it works on the concept of human behaviour like how a individual talk, in which tone he is talking, his writing speed and his signature. This framework controls the pitch of voice, keystrokes, and the way in which a individual sign.

This framework incorporates signature recognition, voice acknowledgment and numerous more.

Advancement from Physical to Advanced signature: As the time has changed, presently there are exceptionally few places where these physical marks are utilized. Instep, these are replaced by the Advanced Marks which are done by a few software's. These are more dependable than the ancient conventional ones. In this way, presently a part of certificates and other reports are Carefully Marked and are reliable. It moreover diminishes paper wastage and time utilization.

Signature Acknowledgment: Signature Acknowledgment is additionally an ancient strategy of biometric acknowledgment. Prior when individuals were not so taught, at that time they utilized to sign by fair engraving their

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thumb impression on the piece of paper but at that point it changed into signature. This method isn't the foremost secure one as one can duplicate it and can abuse it as well. There are exceptionally few places where this sort of acknowledgment is done. For occurrence, in banks we sign on the reports, checks, and at other places. Typically too done on wills, property papers, exams, etc.

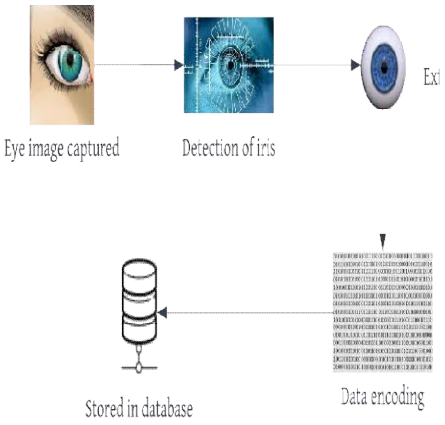

Fig. 5 Iris Recognition System

Voice Recognition: Voice Recognition is an AI Based identification method used at many places. This is an advanced method used in many places, for instance, we have voice assistants like Siri, Google Assistant, Bibxy which recognize our voice when we ask them to do something by giving some voice commands. In voice recognition, firstly our voice is saved in the database and transformed into many commands which can be asked by us at various stages in our life with the help of AI. After this, when any voice command is given, the voice is compared with the voice already saved in the database and if it matched, it would give the desired output. It gives lots of benefits like:

It has improved the customer's experience.

It takes very less time.

It can be used widely and remotely.

These biometrics systems are quite popular as they are growing widely in the IT market as well as among different people in the world. These biometrics popularity is illustrated in below table:

TABLE 1: POPULARITY INDEX

RANK	BIOMETRICS	POPULARITY
1	Fingerprint	53%
2	Signature	41%
3	Iris	33%
4	Face	30%
5	Voice	27%

Largest number of popularity as it is the oldest recognition method followed by signature and other methods in the market.

II. PHASE OF BIOMETRIC SYSTEM:

To use a biometric system there are 3 methods that are mandatory to follow: enrollment, verification, and authentication. In other words, we can say that the user must submit its pattern so that it can be stored in a database and

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can be used as future reference and then the user verifies their pattern. After this, whenever a user is using its biometrics then its pattern must be matched with the pattern that is stored by itself in the database.

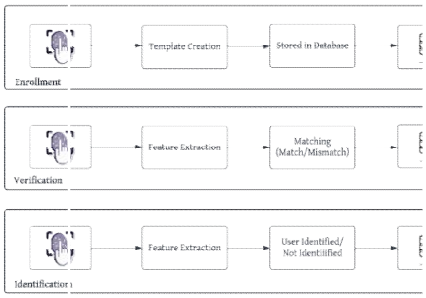

Fig. 6 Different phases of Biometric system

Enrollment: It is the process that is responsible for registering individuals to the biometric system. The user's biometric samples like fingerprint, face or signature etc. are captured by a biometric scanner. The quality of the provided samples should be clear to ensure the reliability of the samples. The samples are stored in the form of some matrices like in number, alphabets, and special characters. The biometric samples are stored in the database with its demographic information like user's name, gender, height etc. [8].

Verification: This process is responsible to ensure that the user's claim to his identity is true. It is a "oneto-one comparison. The user provides a pin or username as an identifier of the sample. It is checked that the sample provided by the user is right or not by comparing the data entered by the user in this process and the sample template provided during the enrollment process. The verification process produces a match/mismatch decision. Match decision is declared when the data entered by the user and the data stored in the database matches. Mismatch decision is produced when the data entered by the user and the data in the database do not match due to wrong username, or pin or wrong sample etc. [8].

Identification: This process is "one to N" comparison. In other words, in this process when the user tries to unlock/get the secured data with his provided biometrics then the pattern or matrix of numbers provided by the user biometrics matched with the user's original patterns stored in the database [3]. If the user is identified, then he can access their data and if the user is not identified then it can lead to disapproval of the access and there could be a chance that any hacker or imposter is trying to hack some data.

III. APPLICATIONS:

Biometrics has a lot of scope and is widely used at various places for security purposes. When we talk about biometrics, the word itself gives satisfaction that our work is secure enough. It has a lot of advanced applications which are there and are used at different departments. A few of them are listed in detail:

Judicial Documents: Biometrics in official judicial documents were there from quite a long time and still it is there, and we trust it with our full respect. Fingerprint and Signature Recognition are used in these documents. It helps the officials to recognize the exact person when in need. It helps in improving the safety of public documents.

Airports and Borders: Biometrics technology is used in borders and airports for the smooth travel of the passengers. It includes the safety and health of the travelling person. If a person is travelling to another country, then taking biometrics will authorize the government to say that the person belongs to their country and travelling to the country. It will help them to act if they get in trouble while travelling. Similarly, during airport flight, it gives passengers a smooth travelling experience.

Security: It is wrong to doubt the security that biometrics give to us. It gives an extra layer of security to the old security systems like in our phone we have biometrics with the old PIN.

Whether it is door lock or any phone lock, we all have a secured system with biometrics. Large industries where data is everything to them used to install the high security biometric locks which helps them to allow only the trustworthy persons to enter the particular area.

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Access Entry: Nowadays biometrics are commonly used in large MNCs as an entry identity. Earlier the entry of the employees was accessed either by Keys, Id-cards or by any kind of smart card. Those traditional methods were not so secured as these keys or cards can easily be stolen or can be replicated easily. So, replacing these with biometrics is the best option chosen by the MNCs

Fig. 7 Biometrics helping in attendance

Attendance: Taking a record of one's participation could be a troublesome assignment once you have a number of around thousands of people at one put. Biometrics has made it simple and helpful for both, the participation taker and for whose participation is being taken. It moreover settle the issue of "Buddy Punching" [5] which suggests clock in or clock out for any other person with his title. Basically, it is like a intermediary in college. i.e., the fake participation within the addresses for completing participation criteria. Unique mark and confront acknowledgment strategies are utilized for taking participation [6].

Criminal Recognizable proof: Most imperatively biometrics are too a great source for criminal distinguishing proof. The as it were way to distinguish the precise criminal is to coordinate his biometrics with the biometrics within the database of the government criminal records. The gigantic database is known as "Automated Unique finger impression Recognizable proof System". Parcels of hoodlums are being distinguished by this handle of biometrics recognizable proof and coordinating [6].

Cloud computation: Cloud computing is exceptionally celebrated for its comfort, mass capacity and security. In this, modern user's biometrics are rapidly included to the database and sent to the cloud to decrease complexity and fetched. It is accommodating in different ways. Like it can be utilized in Elections to match voter's character by its biometrics. Too, banks can utilize this framework to avoid fakes and delicacy mistakes.

All these applications as a rule develop and ended up more progressed as time passes. There must be a few more applications of biometrics frameworks which may not be identified till presently but doubtlessly be there in future a long time.

IV. CONCLUSION

Biometrics is completely dependent on the person because it is a method of personal identification that cannot be duplicated in any way. Biometric information helps in many ways, such as protecting users' personal information, professional life or financial information.

All biometrics, ie. psychological or behavioural data, perform different tasks in different places. They are used everywhere, such as schools, offices, large multinational companies, etc. Even we use it daily in our smartphones. Who would have imagined that one day all our expenses will be managed by the biometrics of our phone, be it Apple Pay or Samsung Pay? Even this is not enough, a lot of research is being done to make biometrics user friendly and thus provide the best technology ever.

Biometric technologies are reaching levels you may or may not imagine. Biometric system is so advanced and used almost everywhere, so it seems clear that it has a bright future with many technologies and use cases. We have created some points that give an idea of how the biometric system will create a big future dimension.

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For example, some big companies like Microsoft, Google provide their employees with food that they can easily use, but they can make sure that there is no waste by installing Computer Vision cameras in the campus so that these cameras can identify the person who wastes food. With the help of ML [1].

These are futuristic things that will change the whole world and increase the productivity of every person. There is no doubt that more such biometric uses will be discovered and soon we will be using them in our daily lives.

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