Biometrics

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Lecture No. # 08

So we start biometric system. So the biometric system, I think we started with some ideas but we will go back to those ideas, so that it gets clear at this end. And it is basically an idea for or a system for recognizing the individual beings. Say, if I go or think about the security of a system now, it comes several things in your mind. The security one is that I want to make the infrastructure secured and same thing, I want my country should be secured. At this stage, we are thinking about only the security of the individual beings, human beings I am not thinking about that whether my dog will be secured or not?

So this is human beings for them, I want to think how to make it secured system. Now, while you are thinking about the security of human beings automatically, indirectly you will find that security of infrastructure or some related items also will be coming. For example that I want that only eligible person will be allowed to enter into the nuclear plant. Now, if you do not consider this factor that only the human beings are allowed. So, it may so happen that not only the human beings life will be danger, then infrastructure also will be in the danger so, all those things are hidden in between.

Now, for identification or verifications what we will be using? There will be several words similar type of words you will find. One is, identification another word we will be using recognition, another one is verification, another word is authentication and so on. Depending upon the environment these terms will be used. In our case, recognition means that it is the total thing either identification or verification.

But in the case of verification it is that I have a claim and I want to prove myself that means one to one thinking is verification and identification is that, I do not know his claimed material and you will be searching from a database. So, that is the identification which is known as one to many we will to come that definition later on.

And there is a recognition word that which includes both identification and recognition. Similar terminology we will be using is the authentication, which is equivalent to recognition. Now, in the case of for example Aadhaar card the terminology is different there is a term we will be covering enrollment. Enrollment means that you will be coming here to enroll you data but in the case of Aadhaar card the enrollment is not this is that if you are not available in the other data base, then you will be allowed to enter into the database

So, that identification is being done before enrollment until it is done before enrollment but in our case what we will be doing that if you are not there we will be enrolling you first, later on we do the identification or verification. So, the terminology will be depending upon the environment we will be using. So keep only these two term one term is verification another, one is identification in your mind.

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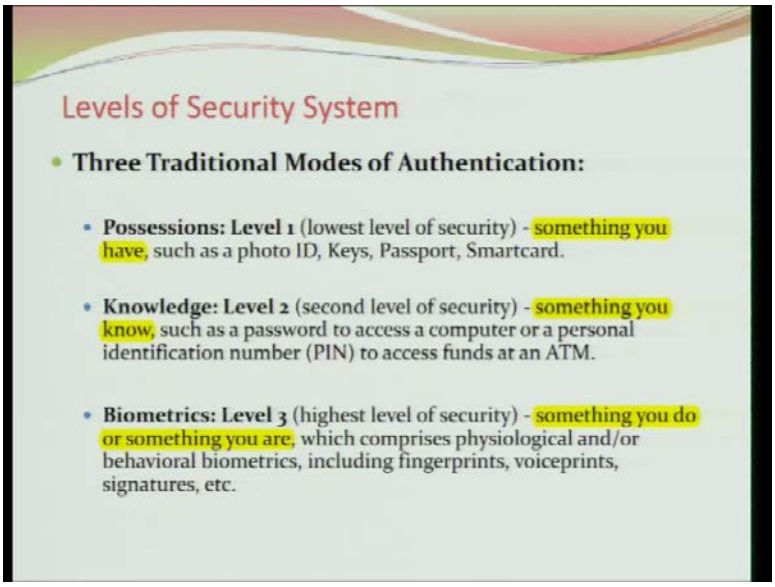

And rest terminology, we will see later on. Now there are three traditional ways you can authenticate. Generally, we will authenticate our self, one is known as the level 1 the simplest one, possessions whatever you are keeping with you, you have for example, that this pen this pen is in my pocket and so it is mine or your passport.

Then there are keys there are car keys with you so car is yours but if the key goes to somebody else then car will be with him provided you do not have any other information

to prove that car is mine. I do not think anybody keeps the chassis number with him or the car details with him; it is always you keep in the car itself.

The next level 2 is the knowledge whatever you can keep in your memory. Simple things is your roll number but roll number is what 5 to 6 digit number or ATM pin, which is 4 digit number, and my payroll number which is a 4 digit number and these numbers the roll number, my P F number you know I can guess because it is serially given.

So, if I know your 2008 batch if I know your name I can estimate what is your roll number or if anybody knows my year of joining and current number of faculty strength you can find out what should be my PF number estimated work. And so, you can make use his or your friends or your friends roll number to use something.

Suppose, I give you a system where only I need the roll number then, I will allow you to do something. So you can guess somebody(s) roll number and you get the money or whatever you want to do. And pin is another number 4 digit number and it is generally, I can guess or anyone can guess because, nobody keeps a pin which is a random number.

Because every card will be asking some pin and if everybody tries to give a random number suppose, you want to give the random number to each pin against each card then what will happen? You have to have another notebook to maintain that, for this card this is the pin, for this card this is the pin which is more difficult then, if you lose your notebook you are in problem.

So, this and moreover you have to keep all those things ready with you because today suppose I want to withdraw money, I go to the bank or ATM counter where I have to press my pin and if you do not remember that, then you are in problem. The level 3 is something you do or something you have with you right. You do not have to carry with you automatically it is being carried. For example, your behavior your physiological characteristics say for example, that the way you walk, the walking style is fixed for everybody. From behind suppose, you are walking ahead and I can see that you are going I can understand he is the man that everybody can detector by even you know there are people by listening the sound of the foot step he can tell who is coming. So this is inherited in our system even sometimes, you know some of us we can know that who is coming even by listening the vehicle sound whether, he is the person coming or not. So, all these are inherited in your brain.

So, something you do and something you are and in the case of physiological characteristics you for example, you have your face. If you do not put mask on your face then anyone can determine that he is the person. Or that your vein patterns this is fixed. Inside your skin, veins are there and their patterns are fixed you cannot change it even if you want. So those characteristics can be considered to identify somebody(s) identifications.

Say, but being a teacher suppose here I am here and I know, whether you are present or I do not know all of your name very few names I know. But I can find out whether you are presence or not because I know where you sit or you will find that your sitting location is fixed. It is plus minus one row or one column not more than that. So, by this I identify yourself so, there are something that does not come under these categories but they are additional information by which one can identify, one can reduce the search zone.

Whether you are absent or present, that can be determined, because you know why you are thinking that only 20 students, there is class of 500 students but one can a teacher can determine whether he is present or not. He may not know his name only by virtue of that principle of locality he reduces the search area and he checks whether he is there or not.

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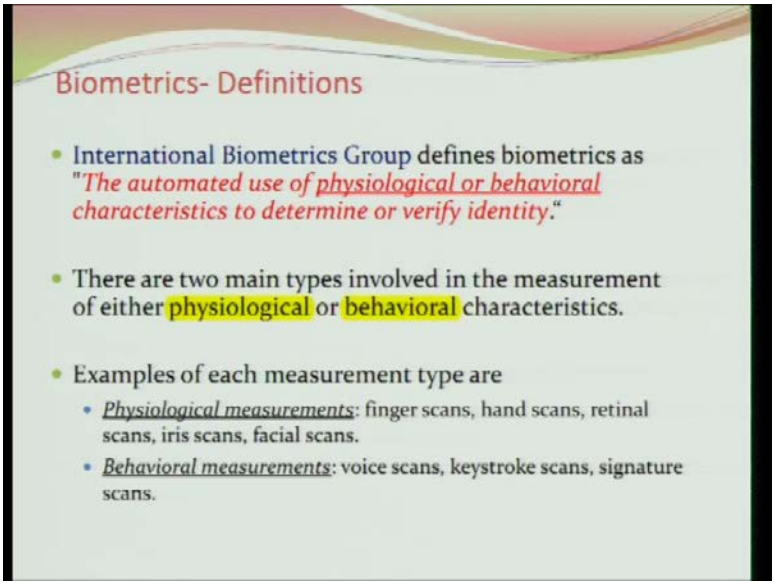

Now, the definition of biometrics: it is the automatic use of physiological or behavioral characteristics of human beings to determine its identity. So the word, we are using physiological and behavioral characteristics is important. Now, the question has come

day before yesterday that a forensic science department was telling that sir DNA is not a physiological characteristic.

But we assume so they told it is a biological characteristics and you should have added there physiological slash biological characteristics. We assume that DNA also belonging to the physiological characteristics. Now, by these two terms physiological characteristics and behavioral characteristics we are defining our biometric systems. So, there are two measurements one is physiological under which you will find finger prints, hand prints, vein prints, retina, iris, face and so on.

Whereas, behavioral characteristics: voice, key note, keystrokes, signature and so on. Now, that you observe these finger prints, hand prints, retina, iris, face and so on they are very difficult to change or ear. Whereas, one can one can mock the copy the voice or one can try to copy the signature the way you sign. There are several people, quite a good number of people they work in the field of signature forgery.

That you have given a signature and there is a competition that who can forge your signature, the way you sign there is no problem but there are people working in this field. Similarly, there exists quite a good number of people like Raju Shrivastav who can copy somebody else voice. And also if you see that, if I am suffering from cold and cough the voice gets changed. So it has been observed, that the behavioral characteristics based biometric system has very large error rates compared to physiological based biometric systems.

Now, our aim is to get a system which will give you the 100 percent accuracy that is the aim. Now, one can think that is 100 percent accuracy means the situation is that where the forgery will be minimum or where I will not make any mistakes to give my biometrics data so that automatically, it gets matched. Say for example, that if I give the vein patterns. One good thing is, that nobody can change his vein patterns because that he has to cut his hand and he has to put additional veins all those things will be coming in between which is very difficult, it is near impossible and by what vein patterns I am thinking about the hand vein patterns.

And but if you see the vein patterns the pattern looks like this may be like this:

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Now, from this pattern one way could be that I take this pattern and you have another pattern, just you super impose on it and check whether it is matched or not. See, one thing is that every hand is having a similar type of pattern and to identify somebody suppose, I want to identify you. I have to know certain characteristics by which only I will be identifying. One can think I will see the height of the person, weight of the person or whether he is a fat or slim and so on. But there exist several people of the same height or same weight or similar weight and it will not give you the true pictures.

So, there exist certain unique characteristics by which only you will be telling that yes he is this man. Now, suppose my vein pattern is like that and another person vein pattern also will be similar to this. There exist certain characteristics which is different. What are those characteristics may be this junction points characteristic is different, your junction point is having only one cut or one bifurcation may be you have that trifurcation and so on.

Now, issue is here coming that are are they unique? That is very difficult to tell. Another one is that, you could have thought that no the thickness of the vein would have been considered that your vein thickness is may be thinner than mine one. But that is also cannot be considered as the parameters because, depending upon the age or depending upon your physical exercise or physical activity this may get change. But if I assume that

no no they are or if I can prove that they are unique, then this is the best biometric system I can tell nothing to be shown, you just go and give your pattern and match it.

And this is basically problem becomes that given the two forest, you want to change tell these two forests are same or not. If I can think this is a graph, not graph this is basically forest, some collection of trees and these two trees are there you have to tell whether these two trees are same or not. The problem is that, nobody will interfere on your vein and other things so, you can easily do it. But this is not the case because it needs lot many things you need a good scanner to get the images.

How to get that images? You have to pass through IR light, so that or some other light source through which you will be getting the things. And you will observe, that in between your hairs will be coming so, this hairs also will create noise. So, you have to eliminate those hair also. But easier one is your finger print a very simple is as go and give your finger prints, detect the ridges and valleys and from there you can determine.

Sir if there is slight burn on your hand

I will come I will come I will come so, you can give your finger print gives you the ridges and edges, ridges and valleys and these ridges and valleys can be considered as the biometrics characteristics. Now, he has to rise one valid question sir what happens that if there is a cut on my fingers?

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So obviously, say what happens in the case of finger prints you will find like these lines will be there. Now, there may be small gap between the two edges that can be considered as due to some noise the system could not. But there is a chance that there is a cut or due to some reasons that sensor could not detect this one. There is a cut here, you can see that there is a cut straight cut is there but before sometime or there was no cut there is a possibility.

Now we will assume that this is occluded, this region is occluded. And other part of your finger is available and you can determine the characteristics from that part. Now, it may so happen that the whole finger he has burnt intentionally or not intentionally. Then it is unfortunate, manual intervention is required by which you will be determining whether identity is correct or not.

So this, if you think from that angle that in India you will find is a very big number, more than 1 percent people are not having one finger, specially those who are hard laborer hard worker their fingers sometimes are missing and about 15 percent of the people cultivators their finger ridges are not available. The 15 percent of the cultivator they do not have the ridges nothing is there plain. So, those issues will be coming in between while we will be considering the finger print biometrics. But assume that finger prints are there, then that can be considered as a valid biometrics characteristics.

Then comes palm, this is another one this portion can be considered as valid pattern. You know that the lines are fixed you have the principle lines and heart line and all those lines are there they are fixed everybody has some line. Besides that, there are small small lines are there. These patterns also can be thought as a bias biometric characteristics; Iris I do not know how many of you has seen the iris scan data. You will find, the eye ball looks like that, this is a white area and this is the darkest area very small part.

And this dark area, this area, if you see carefully there are beautiful designs are there, but the smaller part smaller dots that is nothing is there that is a very dark area at night that smaller area becomes very if it is a dark area that, smaller part becomes very large. You can see this example, is the dog or cat if you see cat you can see very easily that this smaller part becomes very large and this area becomes smaller and this design I found unique.

Now, how to get that iris images that will be coming in between, because if I just take your photograph just like that then this photo I will see this black area but I cannot distinguish between this small black and this black and moreover this design will not be visible.

So, one way is that you have to use the IR light infra red light source to get this one and obviously, that I will prefer my camera should be at a distance of 10 inch, 9 inch, 8 inch, 1 feet or something like that, because so that I can directly get that area and so that I can get my features. Now, there is a constraint that once you are using the IR light, there is a IR frequency will be coming out and which may spoil your eye. So, people may ask you that how safe is your camera?

So, generally there are very few company they produce this IR based camera or iris camera so, that you know they are safe moderately. But these features are very, very unique in nature and not small in the case of vein pattern, the pattern is very small but here the pattern is very large.

Now, the another one is the retina. Retina comes here some design you will find, it is a red red color they are also very powerful because they are also unique in nature. But getting data will be a challenge. So, nobody keeps the data of retina or data of iris with him. Face is the very, very easy way to get the data. The data is available and generally we identify person by seeing the face, this is a general.

But it is the most difficult way to. If I use system through which I want to define or identify a person based on the face biometrics you will find that it is a most difficult one. Because even though we can visualize you, your face is fixed. But determining some unique characteristics from the face is the problem.

Now, few things you can think one is that every face has 2 eyes, 1 nose, 1 mouth these are fixed. Further thing is that distance between the 2 eyeballs along with the centre of the lips that triangle is also almost fixed. So, all those anthropometry system is our system is such that the ratio is maintained properly. So, nothing extra information you will be getting from the face but by seeing you I can tell you are this person. What is that? That is the thing only you have to identify.

There exist say; we covered already principle component analysis. Now, in the principle component analysis what we get? Suppose, if I take your photographs and I get the eigenvectors so, highest eigenvectors will give you the most common features you have. Second eigenvector, will give you the features which are having the less common and the smallest one will give you the very rarely available on your face that you are retaining and so on. Sum of all these eigen features if I combine, then I should get your face.

So, can I use those eigen features to identify you. Similarly, another way could be that you have the face now this face from there can I have a model? can I have a model? By which I can define your face. By model, I mean that you have, I assume that so these, these points are there like that all some points will be here and there. If I can define these points, these points are fixed for individually.

Now, someone face is oval shape, someone is having the rectangle shape these features will help you these points will help you. Through this face, you can have say I can say I have the triangles. These triangles can be considered as mentioned or I can have the rectangle some geometric property you can define or I can define a graph. Can I use this graph for your face matching and so on.

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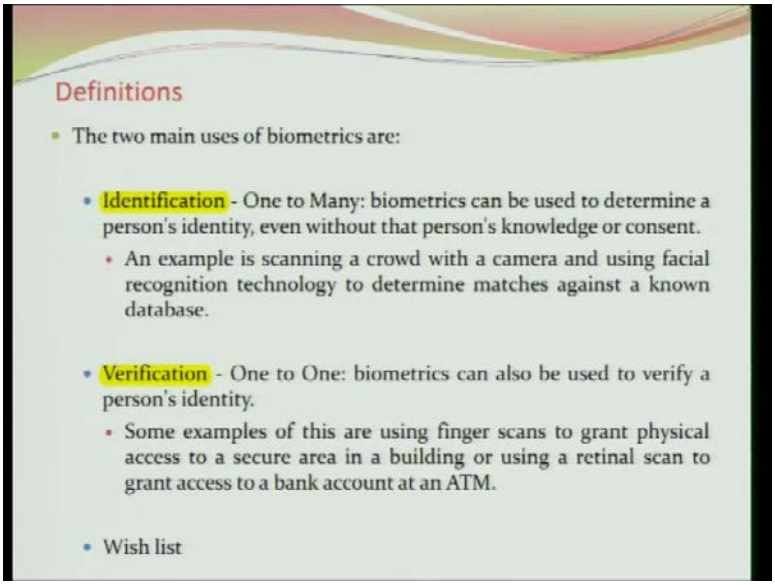

So, there are three uses of biometrics, where these two are the most commonly used. Third one we use for the negative identifications. First one is, the identification which is known as one to many, search here I have a face or I have a finger prints or something

like that and I do not have any other information I have to identify who is that person. Now once you want to have this idea, that I want to identify a person from some biometrics characteristics without knowing his identity or claimed identity so, you need a database of those feature points.

Suppose I have the face, one face and you want to identify then I need a database of face. Now, once you have the database of face with the understanding that the database must be closed enough. What it means? That face, photograph whatever you are giving to identify his face should be in my list, in my database.

See, what happens in our country sometimes you will find that I got a face can you find out who is that person? But the database is not complete, it is not closed. He may be somebody else so it is very difficult to identify some person if the database is not closed. Here, we assume that database is closed. Now, once you get the database closed given a biometric characteristic, you can find out who is the person that is our problem. Now, directly it may not be possible for us to tell that he is the person. Because, of the other reasons which we will be discussing later on. But what we can tell we can reduce my search space. Suppose, I have a 10 million people and from there you have to search. I might be able to give you that 100 persons information that they are probably candidate who can be matched with him.

After that, there may be other circumstantial evidences which one can take into account to see whether he is the man or not. So, this is your identification these are very simple problem compared to identification is known as verification. Here, what happens that I come and I tell that I want to draw money from my bank, my bank personnel will ask what is your passbook number? I give the passbook number. Then he tells that can you sign on this paper? I sign on his paper he checks whether my signature is matched or not and if it is matched he gives you money.

Now, I am sure it is they do not check my signature properly because, you know the way they see just like they gives you money. But there exists lot many forgers who can copy your signatures and your pass book. It is openly, it is publicly available your passbook he can generate a pass book and there is a small chit where, you have to fill the form, you can withdraw the money.

Now, that bank also understand this problem that is why for a small chit where you sign that is known as withdrawal slip there is a limit to it may be 5000, 3000, 2000 and also he has to told that if you want to use your withdrawal slip you have to come to my bank, you cannot withdraw this money from other place.

So, you have to go to your own bank and submit your withdrawal slip, he will give you the small amount of money he is ready to take the risk of that much. Now, suppose I increase the limit and I put only this information the signature and account number. Obviously, it is not possible for you because, he will file, open a file, check the signature and he check those signature yes, it looks alike, give the money. So but this is the one even though I am telling that this is a simpler problem to this. But it is not simple there exist several good identification problems but those algorithm you will find may not work well in case of verification.

Similarly, there exist several verification algorithms which are not working well on identification problems. So, even though you feel that verification is a subset of identification but with reference to the error rates or with reference to the performance sometimes it is not the case. So, it has also physical importance to design a verification and system itself is also a good challenge.

Third category is the wish list and here it is basically, we use it for negative identifications. The wish list comes under the negative thinking, why negative thinking? That say in some country I will decide that I do not want to allow this people to enter in my country. But at the same time every country wants that visitor should visit my country because this is with reference to several thing cultural exchange, tourism is a big industry nowadays or a health and so many things. And what happens we are not allowing some people in this list is not very big number.

Suppose, I tell that I do not want to accept that Maharashtra I do not want that these people should not enter into my province. You will find that specially suppose I consider UP how many people you will be telling that they should not enter in my. You will find that UP is the zone where everybody is allowed to enter.

But in Assam it is a big problem that if I tell everybody should enter into this then this is a chaos condition as it is going on. So, and in Maharashtra also you will find the similar type of problem is coming out. Maharashtra condition is different, Assam condition is

different Assam is telling only foreign nationals should not be allowed so, you have to prove that you are not foreign nationals.

But in Maharashtra, what is happening he is telling no no only Maharashtrian will be staying specially Bihari and UP people will not be allowed, something like that. I do not know exactly but I know in my case I while, I am from Assam so, I was working in Indian space research institute Ahmedabad and to join in ISRO you need security clearance. It is not anybody cannot join in ISRO they have I B clearance [FL] clearance all those things are there.

So, I got job there I was working there and one summer I visited Assam and incidentally actually my father called me that you have to come, to prove your nationality. And I thought that if this is important thing in Assam at that time it was burning I went there and then incidentally, in a college there is a camp where you have to prove your identity that you are Indian. I saw that my friend, he was at that time D M and he was checking all those things. Then I waited and meet him personally and he is telling that Phalguni you have to give me this four one of this four to prove that you are Indian and what are those four?

The first thing is that you have to show your birth certificate I told I do not have birth certificate. Then there is a national registration certificate NRC. I told, I do not have that because national registration certificate was given to the people who before before 1947 who entered in Assam from Bangladesh or from neighboring or from Punjab to Indian west Punjab they got a certificate, registration certificate. Another one is the national refugee certificate that is 1947, during that time, the people came they got the refugee certificate that also I did not have.

Then is the land record, I told “I am not the owner of any land” I do not have anything. Well, then you are foreigner. See what I have, I told that I have one certificate for that passport and another one is [FL] no no passport is not valid thing, passport does not prove your citizenship. Then he is telling that, I told him that I am working in ISRO [FL] then he said you are working in government of India not in Assam. So, I have been told that in your name there cannot be any land transaction that was the implication. I told what was the implication that you cannot have the land in Assam no problem, I do not need a land.

But those are coming under these you should have the wish list is telling you that I do not want this type of people. It is a negative one and here in US embassy or some other you will find that there they have the list of people name wise. In India, that area is having the country wise that we do not want this people should enter into that. But the idea is that I do not care whether you are but negative one I am thinking here. In shopping mall, I do not want these five [FL] should be allowed to enter this is fixed one. Now, their photographs are there or these these are fixed that attitude, that is the wish list group.

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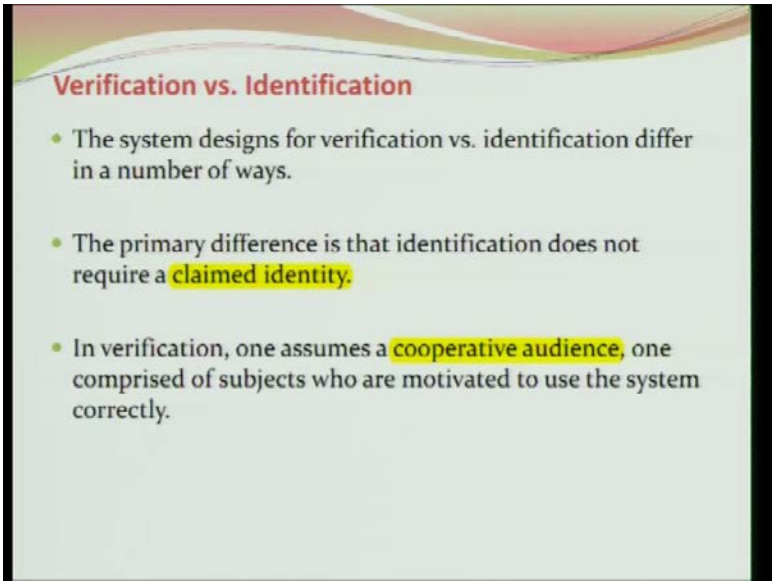

But the size of the wish list is very small in nature. If it is a large one, then it is not a negative database does not have any meaning. So, in the case of what is the difference between verification and identification? In the case of verification what do we want? That I am giving you my claim identity my payroll number is 2321 and I am so, so he will look into the database whose record number is 2321, and check and tell yes you are the person that is the thing. In the case of identification, nothing is given except your biometric characteristics and from using these characteristics you have to tell, who is the person?

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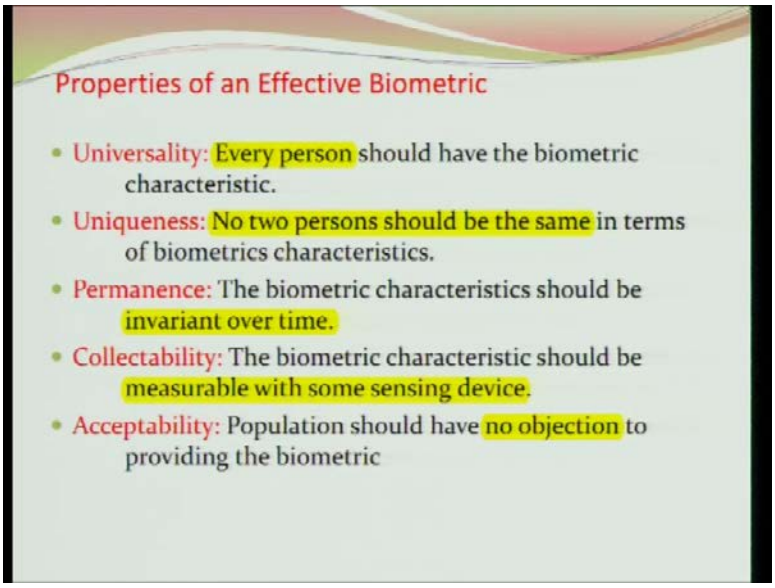

Now, what are the characteristics which part of your body or what behavior or what physical characteristics you can consider as the possible biometric characteristics? See can I consider from here to here as the biometric characteristics? Possibly yes. Provided, you prove that it satisfies these properties. So, first one is universality. Universality means that characteristics that this from here to here exists for everybody exists in your body. So, every person should have the biometric characteristics. Now, if somebody tells us there is no hand that part leave aside. If he is a complete person then this hand will be there so you can consider.

Next one is the uniqueness no two persons should have the same characteristics whatever you are considering. So, if I just see from here to here from here to here and I consider this is the only part I want to consider for my biometrics characteristics, it is not unique. Because this measurement from here to here, you will that there are several people having the same measure or if I consider the diameter of this or the circumference of this part you will find there exist several people will have the similar characteristics. So, that is you cannot consider unique.

So, uniqueness is one important parameters through which you will separate them out. Permanence: That characteristic must be available throughout your lifespan. But it is not it is not clear whether there exist such types of biometrics which you can claim. That it is available throughout your lifespan fixed but for a short duration it is yes. For example,

your face biometrics if I consider for 5 years it looks almost same provided, your there is a start age is 18 year onwards. So, it should be permanent.

Then collectability; there must exist some sensor something some media through which I will be able to collect your data. Otherwise, it will be difficult I need your digital data form how to get it? So there must exist some media through which I will be able to collect it. And acceptability, the society must allow us to collect the data. Society should not feel no no this is not to be given and you are in problem.

So, these are the 5 characteristics and you will find that does not exist any biometrics character which satisfies fully all of them. Say for example, the face biometrics. Let us understand what happens? Everybody has face, without face there does not exist any human being. Universality exists, uniqueness almost exists may be twin case is the only part where you can think. Otherwise, except that Hindi movie things do not put those movie anything but otherwise uniqueness exist.

Permanence in the case of faces is difficult one. It is a very, very short duration during that time they are fixed. See, I can give you an example very straight way Amitabh Bachchan's today's photograph and you see that well earlier days [FL] you check you will find there is lot of difference is there in the face photograph. So, this is difficult problem in the case of face biometrics. Actually, the uniqueness or permanent part of the face maintain for 5 years, 6 years, 7 years beyond that one should not consider.

Collectability yes, there exist enough number of ways you can collect the photograph and society accept the idea. There is no problem I can take your photograph only thing is that I may ask you can I take your photograph? Worst case scenario, you can tell not a distance you can take from 500 meter not beyond that you will not tell no no no do not take my photograph. That is generally we do not do if somebody ask that can I take your photograph you tell yes take do not worry. So, these are the characteristics.

In the case of finger print, let us understand now. Everybody has the finger, can I draw this one? No, I told you that there are people, you will find that 1 percent or less than 1 percent people they do not have the fingers. That finger is not there. But if there finger is there then the characteristic exist.

Uniqueness: small data sets of around 10 to 15000 we have seen that they are unique. But no one has told or has seen that what happens that if it is go for 12 crore people or 125 crore people, whether this finger prints are unique or not? That is not known. But in the lab environment whatever study we have made we have observed that it is almost unique. Permanence: it retains the features accept that as he raised, if there is a cut or there is some accident of course, those things are not considered here.

Collectability; yes there exist a very good amount of number of scanners through which you can collect the data. Acceptability is an issue here. See, once I tell you that give me your finger print, there are people in the society they feel that only illiterate people can give the finger prints literate people can give the signature. So, they will tell you that see I know how to sign I will not give my finger prints. So, the social stigma is there. But more or less society accepts that. If you want finger print I am ready to give.

Now but one thing you remember these are all whatever criteria we are telling this is for the general request mode. But if I tell you that if you give this data I will give you 500 rupees I will not mind to give my data several times. So, because every time, I will get 500 rupees; so I am not considering those cases. Now in the case, let us consider vein patterns, hand vein patterns what happens that if my hand exist then vein pattern must be there otherwise, blood flow will not be there.

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Uniqueness, is the questionable thing, because we do not have enough data we have only 1000 data at IIT Kanpur, we have checked that they are unique. Similarly, very small small data exists and based on that we are telling they are unique. But if you observe that my forest is like that, there may be similar type of forest similar type of forest may exist because, not too many bifurcation or trifurcation you will find in the vein.

Permanence is fixed, these vein patterns are fixed you cannot change it. Even, from your childhood to up to the old age it will maintain the same pattern. Collectability: it is a little difficult problem; it is a costly problem because you need the costliest sensor to collect the data. Acceptability: society does not mind to give you. Because you now still today nobody can withdraw money by giving their veins pattern or transact the land using the vein patterns.

Now what about the signature? Suppose, I consider a signature can it be a biometric strait? Yes or no?

No

Why no? No no the first one is that universality. So, that itself is a problematic that there are quite good number of people they do not know how to sign. This is a big problem and second thing is uniqueness. If I tell you to sign 20 times on a plain paper, you will find that first signature and last signature there is a vast difference.

If I tell you the sign today one, tomorrow another one you will find that there exists similarity. But if I tell you no no sign now 50 signatures itself you will find that there is a lot of variability between the first signature and the last signature. There are people they do not sign regularly, very less number of signatures in a month he signs or she signs. Specially, house wives; say they want to withdraw money and they do not need the money every day, today they have withdrawn and may be after 15 months they want to withdraw again.

Now, these house wives they have to think which type of signatures they make. Whether small signature or like that they are very serious about they have forget because, occasionally they are signing. Now, there are people they sign too many papers in a day is that there other cases also exists. And, there are some papers are official, some papers are semi official, some of the papers are for keeping in office file.

Specially, these army people they have certain formula. They use the different color of ink. Red ink, green ink they have the different meaning. And what we do for for example, my my case in my bank account I have signed full. But when I use my office letters I signed P Gupta and when I write to some I write p g that everybody does some other way because of short form. But can you identify based on that? It is a difficult problem.

So, this uniqueness not only that same signature, there exists the variability of your signature pattern based on the environment. So, those issues are there. Permanence: At certain age it is permanent. But beyond that some period it is permanent, the reason is suppose, 18 years, 19 years at that time early age, everybody wants to modify his

signature. He wants to see how is my signature? But as he becomes the stable in life you will find that signature also gets stable.

By that time he has decided what signature is; because today if I take your signature you write full name or some name. But while you will be in the field but really you are working in some environment then you will find that your signature style is completely different, because that has become stable with you. So, during that period it is more or less permanent.

Collectability is very easy. You put a white paper you sign and I scan it I get it. More or less, the society accepts the signature only except those people who are afraid of land transactions they may feel something. Otherwise, society accepts this one; so signature that is the reason why signatures is not well accepted by the biometrics society.

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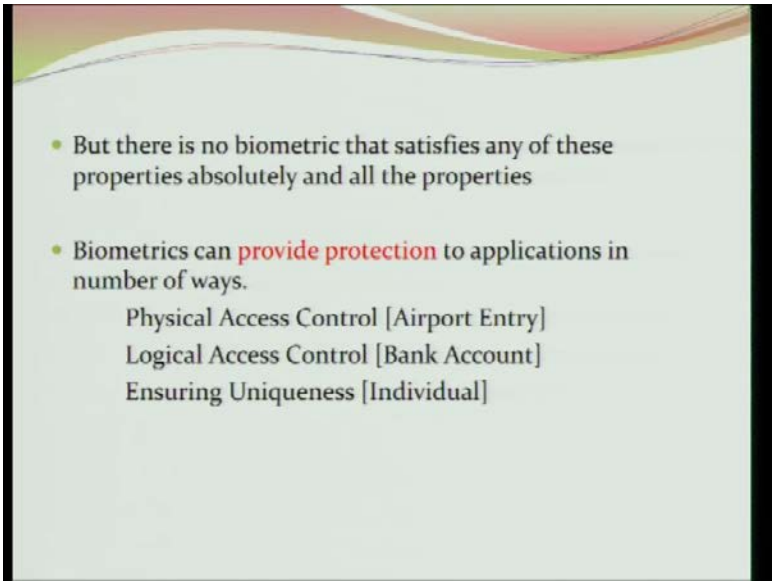

So, I mentioned that there is no biometric that satisfy all the properties absolutely. And, generally it provides the protection in several applications. The physical access control that is the airport security; example is here say, I do not want to allow somebody to enter into my my airport.

The logical access control that is you want and you want to withdraw the money. I do not want to allow you to withdraw the money or I will allow you to withdraw the money so,

this is not physical thing that is logically I may allowing it and you want to prove that I am the concerned person.

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There are several applications, some of them I have enlisted. Time and attendance; I do not know how many of you seen that there is a punch card system. In working environment a person comes and he punches his card, where a time and date will be entered, then he goes inside the room. And while coming out again he entered punched the card then that time will be recorded.

Now, here there is no biometric concept. Just there is a card you insert and get the time enter into that. So, the cards are stacked. I can tell you that I am coming late why do not you enter my card? So, you go there along with your card you can put my card also and enter into that. So, that is one way. Say, for example I have taken your signature on your paper but I do not know who he has come and how many people are there I do not know. And, the number is suppose 17 and I have found here 16. Then number this this number paper number may be may be less than the physical, may cannot be less than the physical one. This may be more than the physical one.

Because there may be some partner who has written twice two names. So, that may be possible. So, there is a punch card problem. Same thing is the signature problem. But if I take your face photographs and enter a data into that then, it is not possible. The time and

attendance is that one. But here you can tell sir can we introduce in the class room attendance. The people are telling that people are not attending my class.

So, the concerned faculty member has been advised that take biometrics data. Now, assume that, that is introduced. How can you introduce this? Suppose, I use the finger print scanner; so one way they move the finger print scanner from one corner to another corner and while it goes to you, you will try to play with that you will try to scratch it or put some pen ink on it something you will do so that the next person face problem he will not be able to give his data.

So, this is human being or from moving one corner to another corner if I take 5 seconds to move from a to b. Now, suppose a class size of 200 so, how much time it takes? 200 into 5 seconds, that means 1000 seconds. How many minutes? It is a big number. So, does not meant anything that what for I am doing this class attendance things? I am sure that in my class that there will not be false attendance. Somebody else will come and sit in my class does not mean anything if he wants to sit fine he sits. At the same time, there is a possibility there are some students who will not come to my class that is possible. That possibility what we can do I can introduce some penalty on it if you are absent or I can tell okay, I will take quiz, but I do not want to put a finger print scanner in my class.

Now the question is coming suppose after that he failed in the exam and he has appealed then he is telling that I attended all the classes. Now, authority wants to know from us whether he attended the class or not? That is the big problem. And, I use only this information for this purpose whether he attended or not? Based on this I will lose some of the pages it is not that I will retain all these. But I will tell on the average he was attending my class (( )).

So, this time and attendance is one problem where one can think about for you 5 percent mark is there. Then competitive examinations; this is a big problem now a days in the Railway board exam for example, or staff selection or that Home guards selection you will find that huge people are attending. And who is joining there nobody knows whether those persons who joined or not.

So impersonation is another big issue for this one. Banking sector that I told several example, airport also I discussed, physical access I told you. Forensic lab so remember, one thing the term forensic lab comes you know there is a difference between the

biometrics. Biometrics is that apriori I am getting it then, I give my finger print then I have been told yes you are the person.

But in the case of forensic science, it occurs after the event happened that no forensic scientist will come to a place to see something. They will come after the event happened, then they will start thinking whether it is identifiable or not. So, a crime occur forensic type people will reach there after occurrence, not before occurrence. Then, they will find out or trace certain informations through which they will try to identify some people. So, the idea is that they can use our biometric systems.

Land record, is another place where you can use the biometric system. Say, if you register your land you have to give the 10 finger prints. And, that is ink based finger prints. Ink pad I do not know how many of you seen and if you you know the quality of the finger print is such bad nothing no ridges and valleys are visible. But that is this British government had told us that to take 10 finger prints just like that we are giving that one and register general using them properly properly or improperly I do not know. But those issues are there.