
**IT4363/TS4483 Information System Security and Auditing**

**Department of Information Technology**

**Vincent School Mary of Science and Technology**

# Airport Security

**By**


| | | |
|---|---|---|
| **Nattawat** | **Srikornkan** | **5612032** |
| **Thanatcha** | **Premsupha** | **5714270** |
| **Surawat** | **Pothong** | **5726804** |
| **Zhe** | **Zhou** | **5748101** |


**Submitted to**

**Asst.Pro.Dr. Adtha Lawanna**

**1/2016**

# Table of Contents

# Figure

# Table

# **Chapter 1:** Introduction of Suvarnabhumi Airport

Airports are one of the most important places of every country since it is the gateway to go abroad and the first place that tourists can see how our country looks like. The main airport of Thailand is Suvarnabhumi Airport since 2006, which is the largest airport in the country and ranked to be 20th busiest airport in the world.

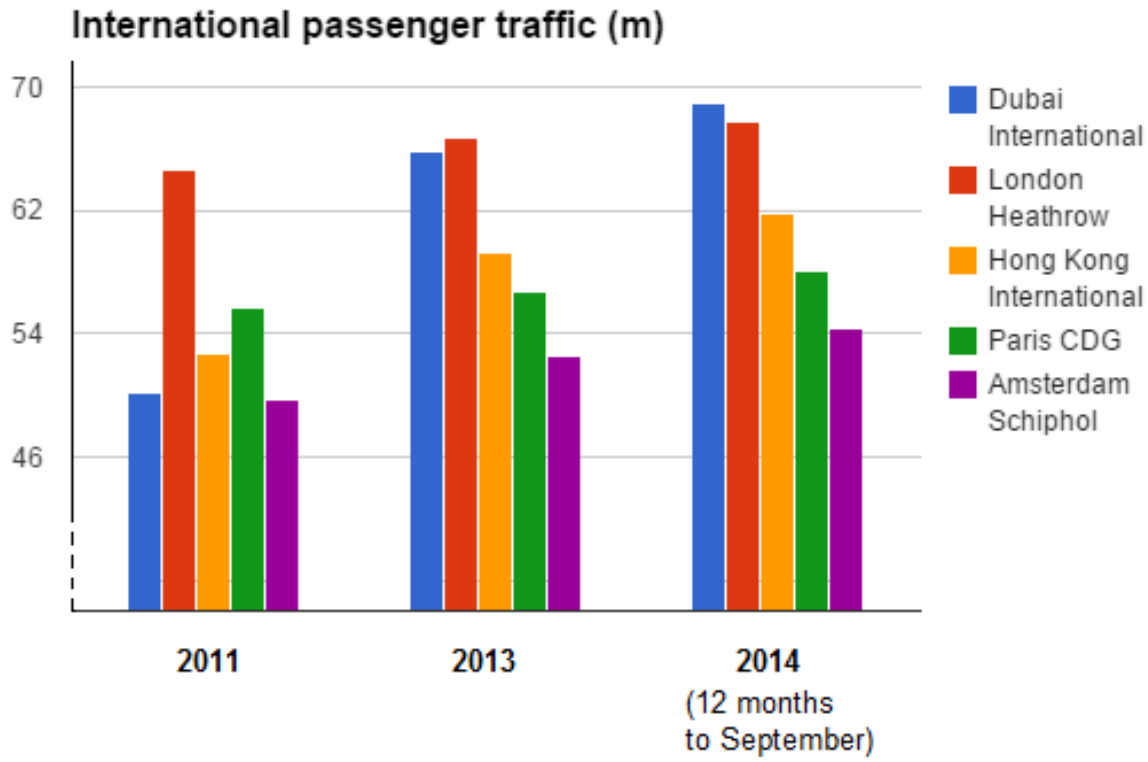


Figure 1.1 International Passenger Traffic

Source: http://www.citymetric.com/transport/charts-dubai-main-airport-just-became-busiest-international-airport-world-631

From figure 1.1, we can see that the number of airports' passengers increases every year, no matter what country it is. So, we can conclude that more people around the world tend to travel oversea as the time goes by. Though Suvarnabhumi Airport is not in this figure, it is currently having more than 50 million passengers in a year. Therefore, security must be concerned at the very first priority in order to protect itself from any bad incidents that can possibly affect the reputation or image of Thailand.

While Suvarnabhumi Airport has never been attacked before, many airports around the world were damaged by the terrorists. For instance, Atatürk Airport in Istanbul, Turkey.

Forty-five people were killed, and more than two-hundred were injured. Of course, all airports have their own security measure, but the question is ‘Is it good enough yet?’ because most of airports focus on checking inside, not outside areas like the terminal or departure hall as the governments do not want tourists to be greeted by an armed presence as their first impression. They actually pay attention to security on an airplane in order to prevent from some critical situations like hijacking. That is why terrorists and criminals take this as an advantage for starting riots or committing crimes by exploding the airport, for example.

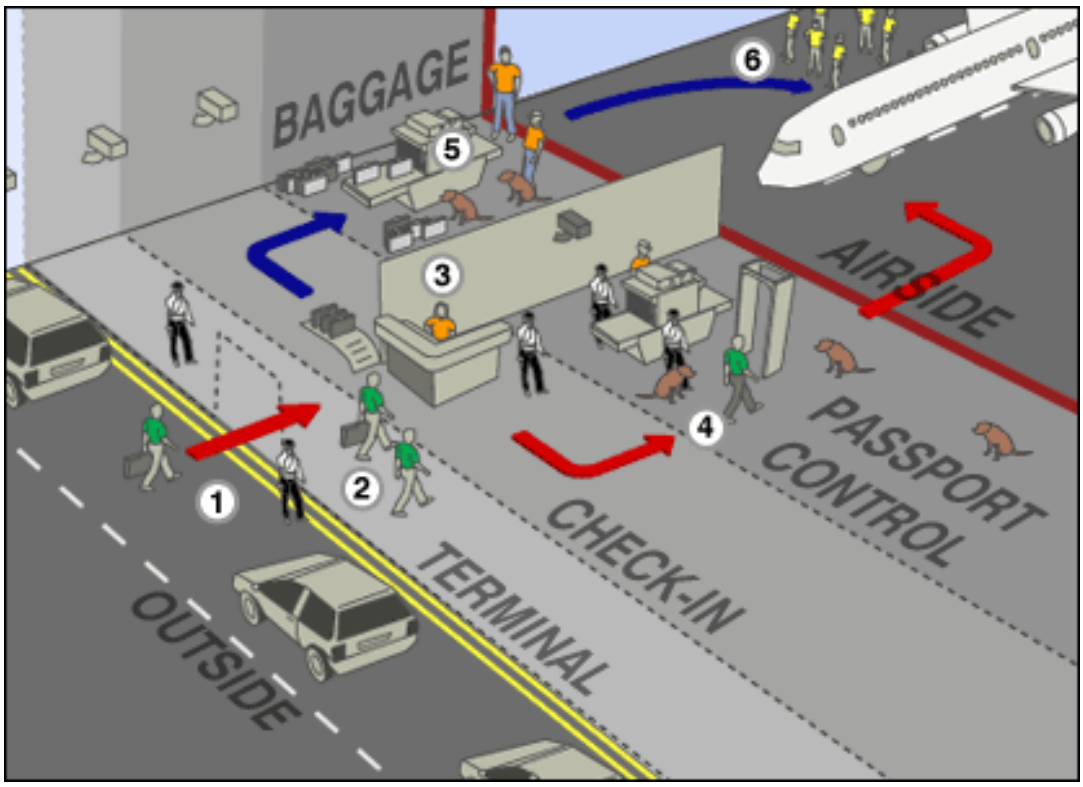


Figure 1.2 Airports Security

Source: http://news.bbc.co.uk/2/hi/in_depth/4780161.stm

Furthermore, In the figure 1.2, it shows you the clearer image about what we are going to provide in this report. Number 3, 4, 5, and 6 are what the current airport security already concerns. But in this report, we will focus on the process at number 1 and 2, outside of the airport and terminal.

# **Chapter 2:** Security Approaches for Airports

There are few solutions for an airport security because currently they focus on the inside part of the airport. In other words, the airport will only check whether each passenger is harmless or not only when they are in check-in progress before boarding such as checking passengers' belongings and luggage by the metal detector.

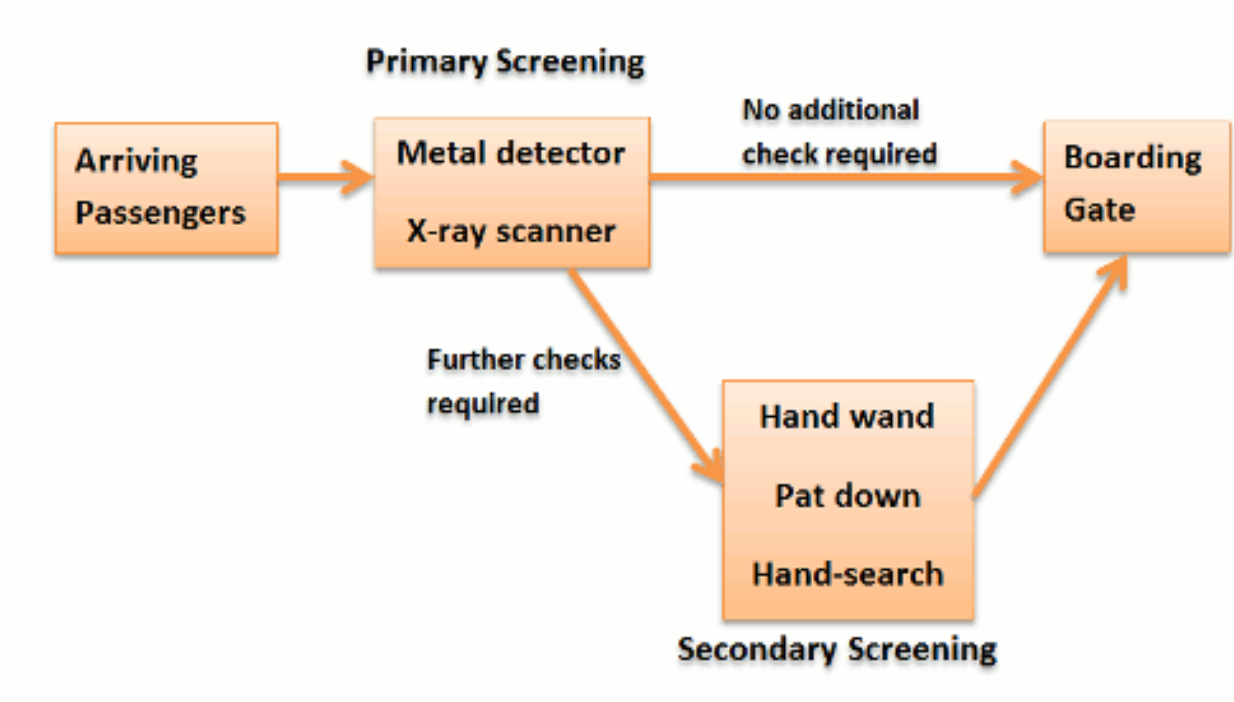


Figure 2.1 The Flow of Security Checking

Source: http://www.lancs.ac.uk/~ludkinm/orinlife/

## **Solution 1** Security Officers

The use of security officers or guards are the simplest and most popular solution for security globally. Many organizations choose this method to protect their assets or any kinds of valuables because it might be the easiest one to think of, and also cheaper than other approaches. Besides, they are able to monitor, detect, and examine suspicious things efficiently.


Figure 2.2 Security Officer at Suvarnabhumi Airport

Source: http://www.vosizneias.com/101188/2012/02/17/bangkok-thailand-raising-security-alert-over-israel-warning-over-new-attacks/

For Suvarnabhumi Airport, these security officers are generally assigned to walk around the airport in order to check and guarantee the safety of every passenger. Some of them are with dogs so that they can detect the addictive drugs. Consequently, their tasks are relevant to the process of decision making since these officers have to ensure that everything is in the way it should be.

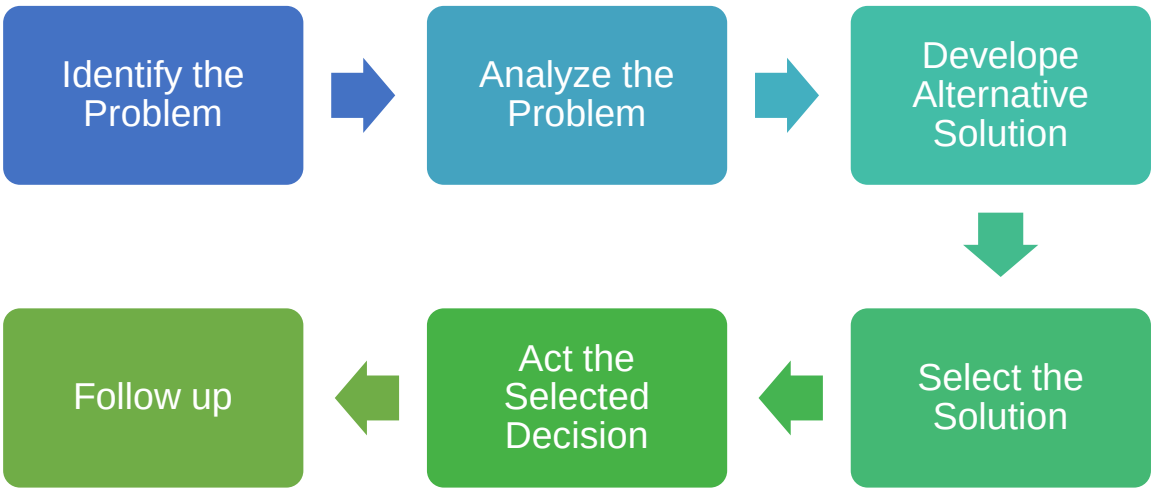

Figure 2.3 Decision Making Process

Step 1: When they notice something peculiar, the officers must figure it out about what is that thing by their own method such as monitoring, investigating, or asking. We call this step as identifying the problem.

Step 2: Once they know the problem, they have to analyze the problem immediately in a minute. In the problem analysis, the officers need to think about the cause of that particular problem as well as how to deal with it.

Step 3: This step may not be beneficial much because in the real situation, the security officers actually have a little chance to think about the optional decision within a very short time. But if it is possible, it is better for them to have many solutions to choose.

Step 4: The best solution must be selected in this step, however, it depends on each situation for identifying which is 'the best' one. In our opinion, it is better to select the solution that has the least negative impact on the other people while be able to solve the issued problem effectively.

Step 5: Then, the officers must take the selected solution into an action.

Step 6: The last step is to report or share the taken decision/solution with other officers, so they will know what to catch up.

**Example**

Joe, the security officer of Suvarnabhumi Airport, noticed a group of suspicious men wearing a surgical mask walk around the airport as well as carry a large handbag (problem identification). He was afraid that the handbag might have weapons and these guys were some kinds of criminals, but there was also a chance that these men are just ordinary passengers that passing by (problem analysis). So, Joe decided to ask them for a permission to check the bag because if they were totally harmless, they would not hesitate to give Joe a cooperation (solution selection). They acted nervously when Joe walked to them. Let's assume that there are two different reactions from these men:

First case, they listened to Joe and understood his reason. One of the men gave him the bag sincerely and Joe found nothing wrong with it. By the way, Joe had the rights to inquire them about the mask that made them look suspicious, and he used it immediately. It

turned out that these men are celebrities, and they did not want anybody recognize their faces because they could interrupt their vacation time.

Second case, everybody in that group ran away to different directions. Joe decided to chase the one that carried the bag, and called for his friends. Eventually, he could catch only that man, and found out that there were addictive drugs in the bag. Joe had to inform others to let the one that was responsible for this kind of criminal take care of him.

Moreover, not only security officers need to have physical strength, they must have problem-solving skill as well. Sometimes, they can be a receptionist too because passengers are able to ask them for a direction guiding, or also ask them to help carrying heavy objects.

In conclusion, the security officers do not have just only one purpose that is for security matters. They can be like Swiss army knives depending on the situation. However, due to the fact that they are the human being, that is why they are not completely perfect. They are able to make a mistake, not generate a flawless and 100% accurate work like a system. Besides, when we compare the number of passengers with the number of officers, we will see that there are not so many of them. Therefore, it is impossible for the security officers to cover all the work areas.

## **Solution 2** CCTV Camera

CCTV camera stands for closed-circuit television camera that aim to produce images or recordings for surveillance or other purposes such as keeping an eye on children or elderly. Also, it is widely used in various industries because it can act as a very successful deterrent to thieves and burglars in the cost effective ways.

Figure 2.4 Surveillance at Airports

Source: http://www.git-security.com/topstories/security/upgraded-surveillance-izmir-international-airport-turkey

In the airports, there are the rooms only for staff that let them monitoring the airports' CCTV. When they see something goes wrong, they will notify to the security officers in that particular area to take care of it. Nevertheless, if anything happens unexpectedly beyond an eye of staff, all they can do is watching the recorded video to find out about what, when, where, why, who, and how later on.

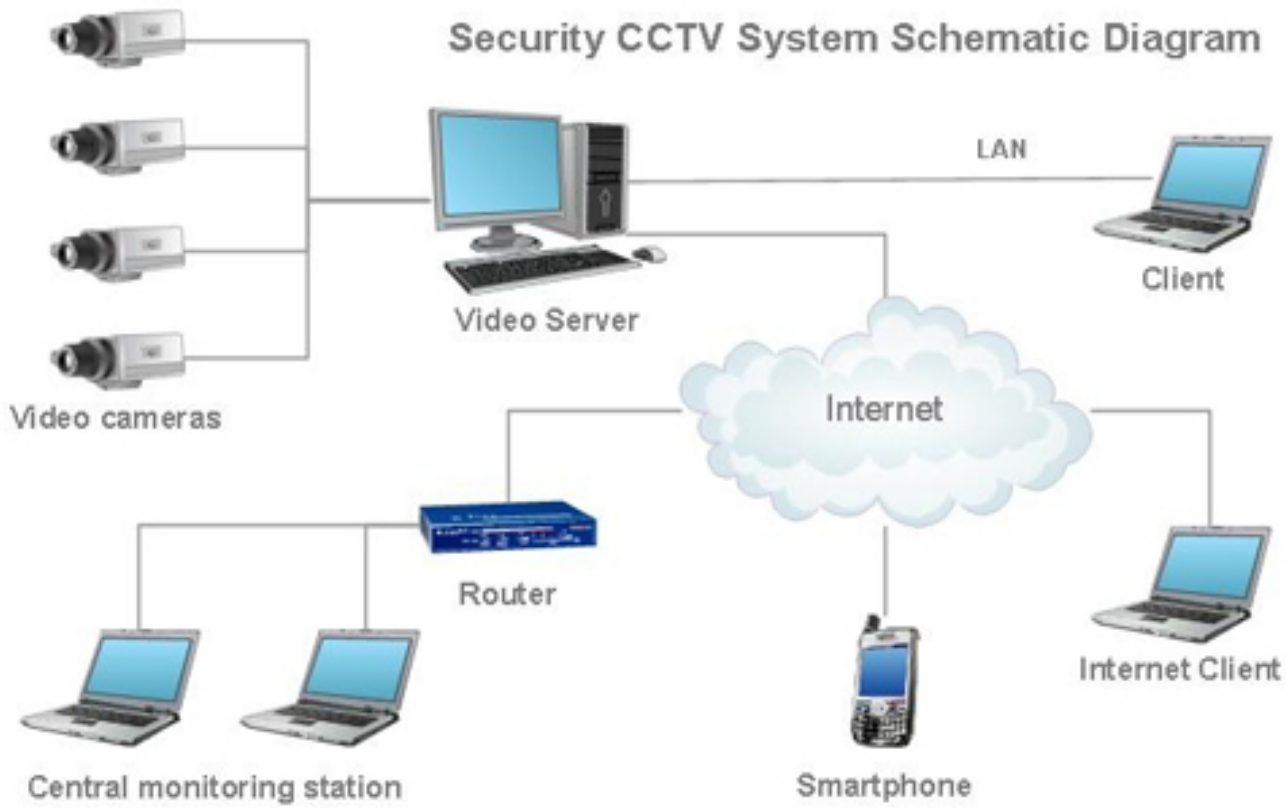


Figure 2.5 How CCTV Camera Works

Source: http://www.mediasearch.co.th/News-CCTV-FUJIKO24.html

The above diagram specifies the way security CCTV system works. The way it transmits data depending on the type of the camera whether it is wired or wireless. Each camera will record the video and send to the central hub. If using wired connection, the video will be sent through LAN (Cat5) to the client monitor. But if using wireless connection, it will be passed to the central monitoring station via a router.

**Why CCTV is so popular?**

It is important to take security seriously in this era, not only for the business purposes that need good security, but also our homes as well. And CCTV camera is the right choice for us because it is the effective way to prevent the crime since it records everything so why would they want to break the law if they know that they were being recorded, and its video can be a useful piece of evidence to help law enforcement solve crime. Also, with a CCTV system, we can monitor the safety of children and elderly folks while we are away to make sure nothing out of the ordinary is going on.

Though CCTV camera is very popular in these days, it also has some limitations as well. First, it can monitor in a limited area, and in some cases, criminals may be able to change the angle of the camera to another direction. The next is the image quality may be not good enough for identifying the objects because the video is too dark or blur. Additionally, even CCTV enables users to record footage for later viewing, and receive justice from the law. It cannot, however, stop a crime when it is in progress. It does not alert neighbors or the police like an alarm system would. If the criminals wore a mask and sunglasses to cover their face when they committed a crime, having CCTV camera is not help, actually. Nevertheless, there is no system that can completely protect the systems for 100%. It is up to the purposes of usage because everything has its advantages and disadvantages.

Figure 2.6 Thieves from a CCTV Camera

Source: http://www.yashglobal.in/cctv-footage/

# **Chapter 3**: Facial Recognition System

Generally, a facial recognition system is a computing system that being used for identifying or verifying a person from a digital image or a video frame from a camera in security systems areas. It works by comparing facial features of the acquired image to the faces in database.

It is not a new idea at all because many organizations have been developing and using this system for a very long time. In fact, the first facial recognition was developed in 1965. But like we mentioned many times in the previous chapter that they never apply any security methods outside the airport except the security officer and just a normal camera.

Moreover, this is already used in some areas. For example, [2] The U.S. government uses the program called US-VISIT (United States Visitor and Immigrant Status Indicator Technology). When a foreign traveler receives a visa, he has to submit his fingerprints and photograph. These things will be checked against a database of criminals and suspected terrorists. When the traveler arrives, he will be verified with the same fingerprints and photograph to check that the person who received the visa is the same person attempting to gain entry.

Table 3.1 Applications of Facial Recognition System

| **Areas** | **Applications** |
|---|---|
| Information Security | Access Control (OS, Database)<br>Data Privacy (ex. Medical Records)<br>User Authentication (Banking) |
| Access Management | Secure Access Authentication<br>Permission Based Systems<br>Access Logs / Audit Trails |
| Biometrics | Person Identification (IDs, Passports, Driver Licenses) |
| Law Enforcement | Video Surveillance<br>Suspect Identification<br>Suspect Tracking |
| Personal Security | Home Video Surveillance Systems |

| | |
|---|---|
| Entertainment | Home Video Game Systems (XBOX360 - Kinect)<br>Photo Camera Applications |

So, we select the facial recognition system as our solution for Suvarnabhumi Airport security as well. It is not like the one that is used in check-in process. This system will be integrated with the CCTV camera around the airport in order to monitor and detect passengers' face and identity. But the technical process of how it works is actually the same as ordinary one.

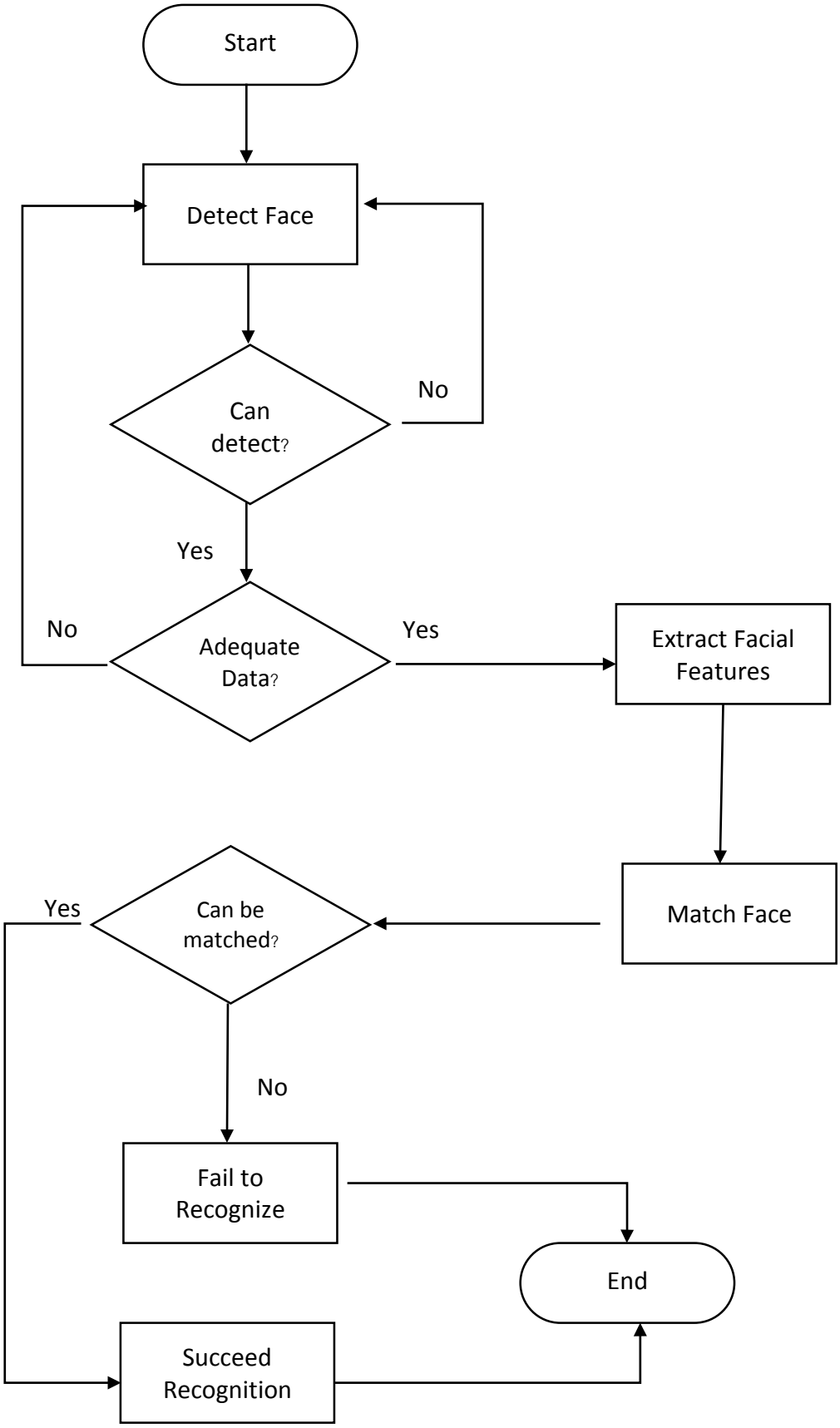


Figure 3.1 Flowchart of Facial Recognition System

The above figure is just a simple flowchart with a very basic idea to explain the facial recognition system. When a camera can detect a face, it will capture that face to identify the facial components such as eyes, mouth, nose, and chin to perform recognition [3]. In case there is no detected face, the camera will continue scanning. Then, the system will match the face to the image or template in the database. If it is matched, then his or her information will be shown on the monitor.

Here is the diagram showing how the facial recognition works and how it interacts with the database.

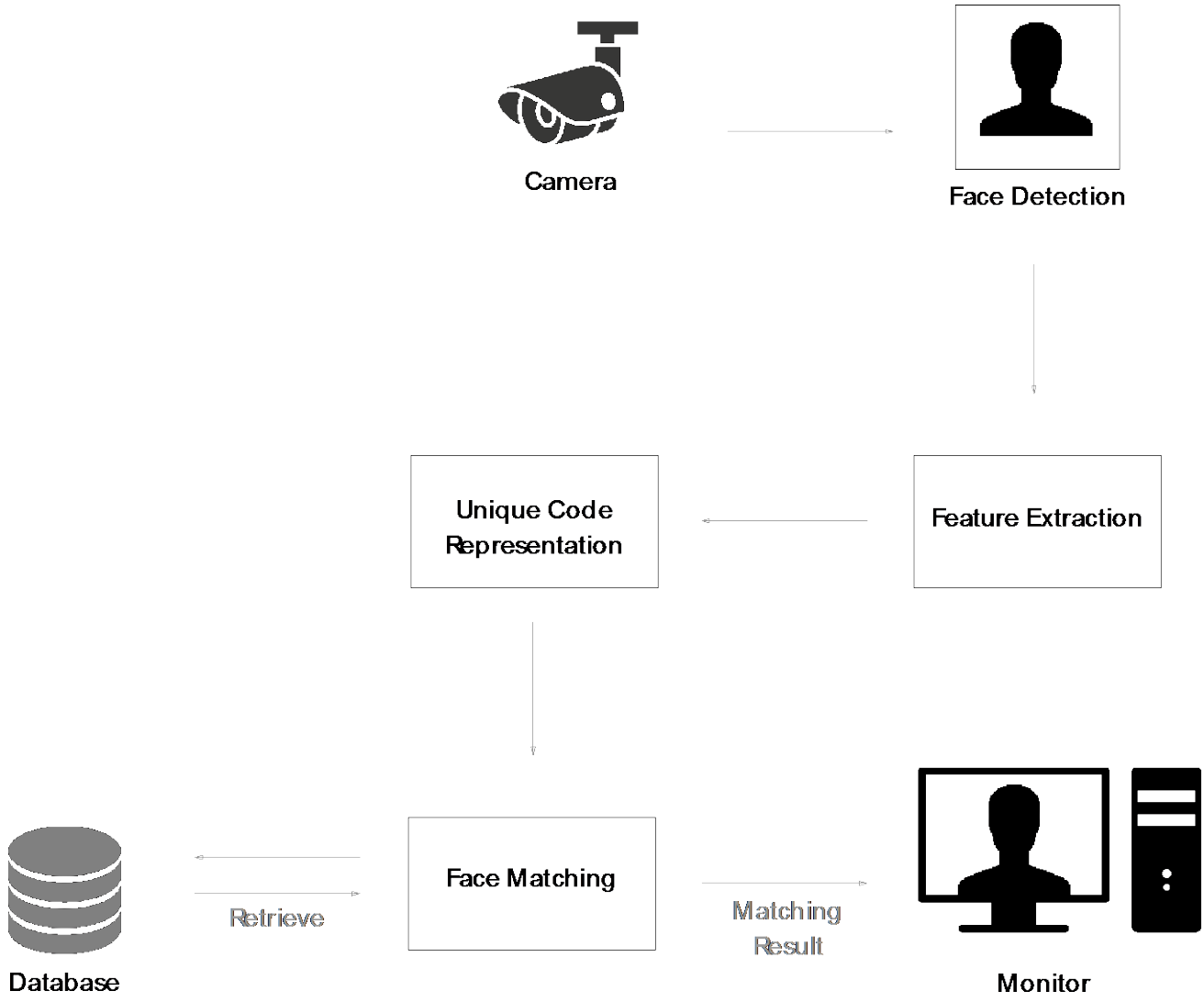


Figure 3.2 Facial Recognition Diagram

The input of the facial recognition system must always be an image or video, and the output or result is an identification or verification of that person. The CCTV camera will keep scanning for finding a face in the area. In a face detection process, it also has 3 sub-processes, which are face detection itself, face location, and face tracking – see Figure 3.2.

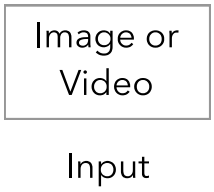


Figure 3.3 Face Detection Process

Once the face can be detected, the system has to identify the face location and track it because the subject may walk around. If the system does not track the subject's face, it may lose that one into a crowd and has to find another instead. The basic face tracking process

has to compute the differences between frames to update the location of the face. However, the head can be tracked as the whole entity or certain features separately depending on the system design. There are many issues that must be faced: partial occlusions, illumination changes, computational speed and facial deformations.

Though there are four methods for face recognition [4]: knowledge-based methods; rule-based methods that translate the human knowledge of face into a set of rules, feature-invariant methods; using algorithms to find invariant features of a face without the problem of angle or position, template matching methods; algorithms for comparing a face and stored faces, and appearance-based methods; similar to the previous one but using a set of training image. However, we select the third method, template matching.

Template matching methods is about to define a face as a function. Different features can be defined independently into eyes, face shape, nose, and mouth. Also, a face model can be built by edges based on geometry of human face.

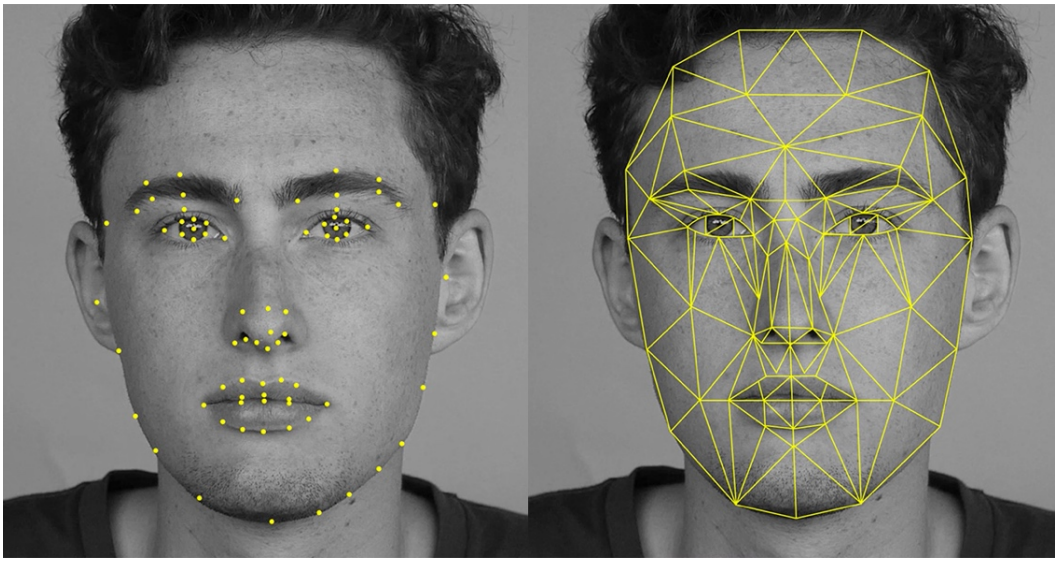

Figure 3.4 Geometry of Human Face

Source: petapixel.com/2016/06/30/snapchats-powerful-facial-recognition-technology-works/

The system will automatically extract a set of geometrical features from the picture of a face such as nose width and length, mouth position, and chin shape. This process uses a tool called ***Active Appearance Models***, which helps minimizing the difference between an input image (detected face) and a template.

Table 3.2 Feature Extraction Algorithms

| **Methods** | **Notes** |
|---|---|
| Principal Component Analysis (PCA) | Eigenvector-based, linear map |
| Kernel PCA | Eigenvector-based, non-linear map |
| Weighted PCA | PCA using weighted coefficients |
| Linear Discriminant Analysis (LDA) | Eigenvector-based, supervised linear map |
| Kernel LDA | LDA-based, kernel methods |
| Semi-supervised Discriminant Analysis (SDA) | Semi-supervised adaptation of LDA |

| | |
|---|---|
| Independent Component Analysis (ICA) | Linear map, separate non-Gaussian distributed features |
| Neural Network based methods | Diverse neural networks using PCA |
| Multidimensional Scaling (MDS) | Nonlinear map, sample size limited, noise sensitive |
| Self-organizing map (SOM) | Nonlinear, based on grid of neurons in the feature space |
| Active Shape Models (ASM) | Mathematic and Statistical method, searches boundaries |
| Active Appearance Models (AAM) | Evolution of ASM, using shape and texture |
| Gavor wavelet transforms | Biologically motivated, linear filter |
| Discrete Cosine Transform (DCT) | Linear function, Fourier-related transform |
| MMSD, SMSD | Methods using maximum scatter difference criterion |

There is a parameter controlling shape, $x = \bar{x} + Q_s c$, where $\bar{x}$ is the mean shape and $Q_s$ is the matrix defining the variation possibilities. The transformation function $S_t$ is typically described by a scaling, $(s\,cos\theta - 1, s\,sin\theta)$, an in-plane rotation $\theta$ and a translation $(tx, t_y)$. The pose parameter vector $t = (s\,cos\theta - 1, s\,sin\theta, tx, t_y)^T$ is then zero for an identity transformation and $S_t + S_t(x) \approx S_t(S_t(x))$. There is a texture parameter $g = \bar{g} + Q_g c$ as well, where $\bar{g}$ is the mean texture in a mean shaped path and $Q_s$ is the matrix describing the modes of variation. The texture in the image is defined as $g_{im} = T_u(g) = (u_1 + 1)g_{im} + u_2$, where u is the transformation parameter vector. It is zero for an identity transformation and $T_{u+gu}(x) \approx T_u(T_{gu}(x))$.

The parameters c and t define the position of the model points. During matching we sample the pixels and project into the texture model frame. The current difference between the model and the image (measured in the normalized texture frame) is $r(p) = T^{-1}(g_{im}) - (\bar{g} + Q_g c)$, where p is from $p^T = (c^T|t^T|u^T)$. We can perform expansions and derivation so that to minimize the differences between models and input images. It is better to precompute all the parameters available, so that the following searches can be fast and faster.

Then, the acquired template will be transformed into a unique code. This code specifies each template a set of numbers to represent the features on the detected face.


Figure 3.5 Code Representation

Source: http://www.myinttelix.com/FRSWorks.aspx

After conversion, the system will compare the face with the images in the database to see whether it matches with any images or not. If an image of the face is matched, the system will retrieve personal information from the database, and send to the monitor to show the result. In addition, if the purpose of using the facial recognition is verification, then the image will match to the only one image in the database (1:1). But if identification is the goal, the image will be compared to all images in the database resulting in a score for each potential match (1:N).

Anyway, the facial recognition system is mostly used for security purposes in a big enterprise or institute to restrict the internal area to those who are not working there by checking from the Human Resources database only. Therefore, the next is about our idea for improving the system.

**Added Idea of the Facial Recognition System**

Normally, once the camera detects a face on a monitor, the system will perform the process of matching the face and retrieve his or her information from the database. The government database of each country generally stores information of every citizen by ID number like what FBI does, so we can use this to apply with our system in Suvarnabhumi Airport.

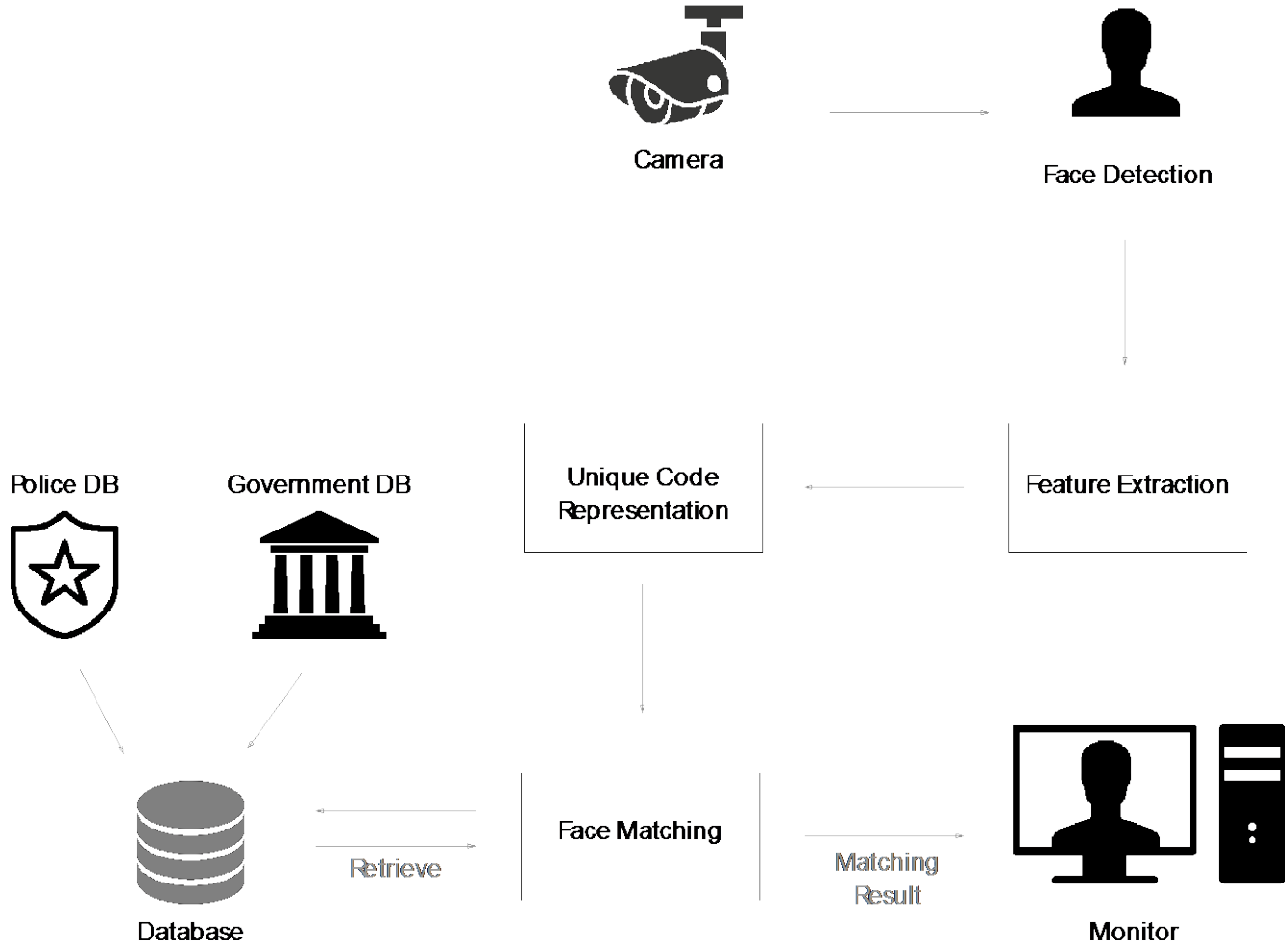


Figure 3.6 Enhanced Version of Facial Recognition Diagram

The system must connect to the database of the government and the police so as to get all citizens' ID and mugshots. Then, when any faces are detected, it will be processed to check whether it is matched with any mugshots or not.

In the initial phase, the system should be able to scan the database of criminal records looking for a likely match. When the criminal is found, the officer will be able to arrest him

or keep an eye on him in case that he was once in the prison before. Therefore, it will be very useful in the administrative way because everyone will be under an eye of an authorized controller making it harder to commit a crime twice since the officer who take control of the monitor will know immediately about the criminal.

Additionally, beside from preventing an incident from the hazardous problem like terrorists or criminals, the facial recognition system also can facilitate airport officers' works. We have to think as a passenger about what they will be afraid when they are at the airport. Most of travelers usually buy travel insurance in order to secure their assets while traveling especially their baggage. Many passengers face the problem of losing the baggage at the baggage claim owing to these only two reasons. First, it is because the airlines' fault. The tags may be damaged or lost, so it stops that luggage from moving to the destination or even load to others instead. Second, it is just being stolen. Most of this kind of cases, the baggage is lost forever.


Figure 3.7 Baggage Claim at Suvarnabhumi Airport
Source: http://www.annastravelsph.com/blog/2014/1/22/bangkok-suvarnabhumi-airport-guide

Consequently, with the use of the facial recognition system integrated with CCTV cameras around the airports can help. If the baggage is picked by other people, the owner is able to ask staff for help to see who is the theft from the monitor.

**Limitations**

The issue of low quality images will not be discussed here as it is beyond our facial recognition system's scope. So, the first weakness of the system is that it may not be that smart to separate too much look alike faces such as the two women in figure 3.5 or even a twin, of course. Also, it can waste the time if the system found out that one passenger was the criminal whom was being wanted by the police. Then the staff assumed immediately that he was using the fake passport. They arrested him, but realized that it was totally a different person whom just being look so alike.

Figure 3.8 Keira Knightley and Natalie Portman
Source:reddit.com/r/todayilearned/comments/3lnqmh/til_that_keira_knightley_played_the_role_of_sabé/

The second drawback is the stored images. Normally, there should be the set that contain a very large number of images of each subject taken from many poses, under many lighting conditions, and with many facial expressions. But our system aims to match the face with the image from the database that has only from the mugshots that are in identity card and passport. Ironically, both of them are also straight face photos. So, this is probably having an effect on the effectiveness of the system.

Another thing to concern is about the privacy. Since the system needs to have everybody's information, which are from the ID or Passport number including the picture of facial images. It is truly difficult to make people understand about how their images are being used and whether their right to privacy is being respected. Also, it makes things easier for hackers or terrorists gaining an access to the database via the network since they are able to simply hack the CCTV cameras. This large information can be in harm.

Finally, this system eventually is just a camera. The area of its observation is limited. There is still a chance for those criminals to do bad things such as stealing at Suvarnabhumi Airport where the CCTV cameras are unavailable. Hence, the airport has to increase the number of the cameras to cover all the areas as well as make sure that the security measures satisfy every passenger.

# **Chapter 4**: Existing Systems VS. Facial Recognition System

At the present, airport security is about CCTV and security officers in order to monitor an entire Suvarnabhumi Airport. The airport has a policy that protect the citizen first to prevent the situation that can occur in the airport so that is the reason, the airport has security officers and CCTV to record and monitor a suspicion person that can be danger to airport or people, but a face recognition system can do it too. With three of them we have to compare that which one is better by finding the advantages and disadvantages of security officers, CCTV and the face recognition system.

Table 4.1 The Advantages and Disadvantages of Security Officers

| **Security Officer** | |
|---|---|
| Advantages | Disadvantages |
| - Security officers can guide or service the tourist like another reception for them.<br>- The officers can take a dog to look for the bag that contain an illegal thing.<br>- The officers always prepared any situations that can happen in the future. | - The airport has to hire more officers to monitor making it costlier to pay.<br>- The officers can make a human error.<br>- The officers cannot do any action until the situation is climax.<br>- The officers cannot remember all of the terrorists.<br>- The officers have to train more to prepare from the terrorists or criminals |

We can say that the big part of security officers is the cost because with a lot of officers we have to pay more. The officers are a human so they can make a human error too, and have to train before being the officer to prepare any situations that can happen in the future.

Table 4.2 The Advantages and Disadvantages of CCTV Camera

| **CCTV** | |
|---|---|
| Advantages | Disadvantages |

| | |
|---|---|
| - CCTV monitors 24 hours.<br>- CCTV can record everything that can happen in the airport and it can help the tourist to find their lost luggage. | - CCTV has a high cost if we compare with security officer<br>- CCTV can have a problem with the electronic problem or anything else that can invade without permission to control them example hacker.<br>- CCTV cannot explain which one is criminal or terrorist to officer. |

CCTV is a good electronic device that can monitor the airport 24 hours and can record so that the staff can take a look at it later when they want to find a suspicious person. Also, it has to be an expensive one for a good performance and good resolution to record the video and it can be a problem if someone can invade into the server and use it.

Table 4.3 The Advantages and Disadvantages of Face Recognition

| **Face Recognition System** | |
|---|---|
| Advantages | Disadvantages |
| - Face recognition system can find the suspicious person or criminal or terrorist by detecting on their face and matching them with the data that we store in database.<br>- The system can integrate with a CCTV.<br>- The system is detecting faster than officer because the CCTVs are around the airport.<br>- The system can detect separated between staff and suspicious person. | - The system needs a large storage to record a lot of citizen data.<br>- The system can be hacked by hacker.<br>- The CCTV must be a high performance to record a high quality of video. |

The face recognition system is a system that can detect terrorists and staff by using the database that record the terrorists and the criminals face that we retrieve from the police record. With the large population, face recognition system has to use the large storage to record the face of the terrorists, security officers and staffs in the Suvarnabhumi airport to ensure that outsider cannot come into the inside of Suvarnabhumi to leak or control the data of airport without permission. We can integrate the system software to CCTV and the officer don't have to monitor 24 hours and 7 days, and the system can detect separated between staff and suspicious person by using the HR database.

# **Chapter 5**: Facial Recognition Analysis

In our opinion, we believe that in the future, Face Recognition System will play as an important role in the security field much more than nowadays. It can work in many other locations beyond just an airport or organization's building.

What if every country has a very large database that store both citizens' and immigrants' information? Once they walk pass the CCTV camera that using facial recognition, the system will show their brief information such as name and nationality on the monitor. Actually, not only for the airports, but also in many popular places or landmarks such as Siam Paragon and BTS Station.

Once a foreigner comes to Thailand, his information should be retrieved from the home country's database when he is at the checkpoint at immigration. It will be beneficial because he will be indicated on the monitor of the particular CCTV camera that he is the foreigner, and this will prevent him from staying longer than the allowance of his visa. Besides, when he departs from Thailand, his information also will be removed from the Thailand's database as well.

Figure 5.1 Bombing at Ratchaprasong Intersection

Source: http://www.tnamcot.com/content/tag/เหตุระเบิดแยกราชประสงค/page/2

From the incident at Ratchaprasong Intersection case, it took the police for a month to catch the bomber. All they had was only the footage from CCTV camera around the area, so they had to investigate and track for the suspicious person. The police searched for the clue by asking the motorcycle taxi driver until they could finally arrest the bomber. However, if those CCTV cameras around the intersection had used the facial recognition system, the case would have finished much earliest.

Also, as there are many missing children in Thailand, the relevant organizations such as UNICEF or Mirror Foundation can make use of the facial recognition to help parents finding their children. Some of children beggars around the flyover, footpath, and BTS Station are possibly the missing children captured by the criminal gangs making them to find them money. This will need a cooperation from the government as well for increasing the number of CCTV cameras in Thailand so that the system can compare these beggars' faces with the image of missing children. Furthermore, our system interacts with the database that contain everybody's information. If the beggar's face cannot be detected, then the system is able to check the parents' face instead to get his or her information. The officer then should see the ID number of that person on the monitor. We can use this number to gain the census information in order to see whether he is living with the children or not. If not, it will become suspicious and be better to have someone checking that person.

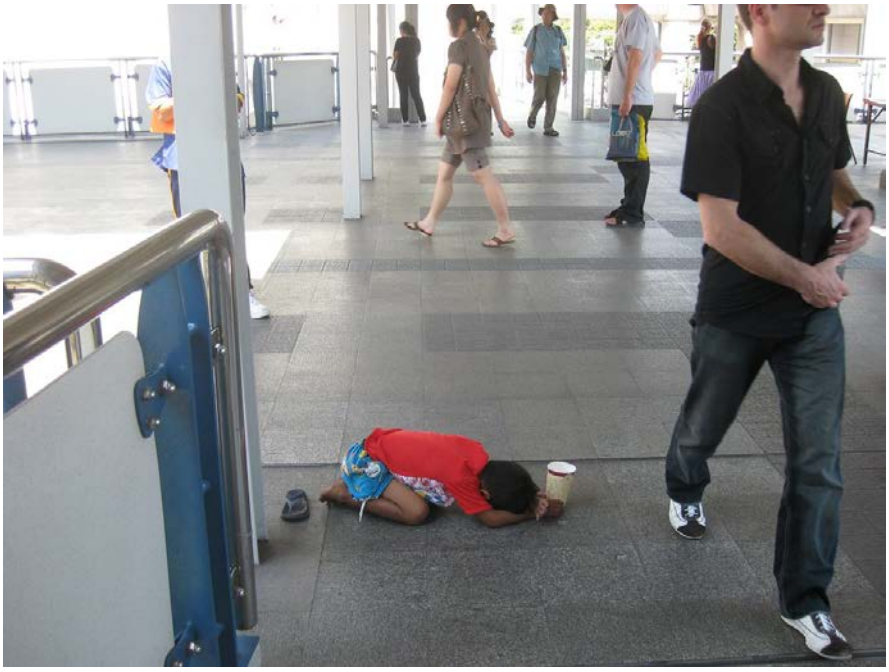

Figure 5.2 Child Beggar in Thailand

Source: http://opportunityfoundation.org/work/photo-essays/child-begging.html

Like we have mentioned, this system is like a double-edged sword. Some may get the benefits from it, some may be interfered by the privacy issues from it. Still, it totally depends on how it is going to work in what kinds of situation. If bad guys have this system and also be able to access to the central database, more than millions of people can be negatively affected from this as we do not know what they will do with such a valuable information. It is not difficult to get an access since they all connect to the internet, so what will happen if they just hack it. Therefore, the network security and some other security approaches are still needed to be used together for the best.

# **Chapter 6:** Conclusion

As security becomes the major concern of every organization, only physical defense is not enough. We have to make use of technologies, which become one of the important factors in our daily life, to assist our tasks.

As this report provides information about the security of Suvarnabhumi Airport both existing systems and the new one, we think the facial recognition system is able to facilitate the security progress at the airport. In fact, our facial recognition system will help the airport's work more than just 'security'. It is not necessary to focus only terminal and outside area of the airport as we stated before because it can be adapted to use in the current security process as well. Since it is able to provide speedy security screening at the airport for passengers who already had been travelled in the country before. Also, there should be specific lines for them to go through that will move more quickly, verifying the traveler by their facial features. Especially on the holiday, the airports are usually crowded, and this may help to fasten their works.

Nonetheless, this kind of system absolutely comes with the challenges waiting to be overcome. For example, what if the person has some plastic surgery and looks totally different from their mugshots. Or there is not enough light for detecting any faces and so on. Consequently, this is why our objectives are not just completely changing from the existing systems to the new one. We must admit that though the current technology is keeping developed unstoppably, it still needs an electricity and a server as they are its weak points. That is why if this facial recognition system exists, we want both of the existing systems and ours working together as the security officers are still being useful, and able to do many things that only a human can or even be prepared for dealing with the physical attack from terrorists.

# References

[1] Animetrics.com: Facial Recognition Applications. 2008

http://www.animetrics.com/technology/frapplications.html

[2] howstuffworks.com: Facial Recognition. 2016

http://electronics.howstuffworks.com/gadgets/high-tech-gadgets/facial-recognition4.htm

[3] F, I. , F., A. , & G, U., “Face Recognition Using Line Edge Mapping Approach”, *American Journal of Electrical and Electronic Engineering*, 2013

[4] Ion Marqu´es, “Face Recognition Algorithms”, *Universidad del País Vasco*, 2010

[5] Michael J. Black, “An Adaptive Appearance Model Approach for Model-based Articulated Object Tracking”, *Brown University*, 2012