# A Database for Identifying the Missed Pilgrims in Hajj and Umrah

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*Abstract*— **Based on three main advantages of an iris; there is no previous knowledge is required about the iris, the iris stability and the iris contactless, a new Hajj database for identifying and recognizing the missed pilgrims in both hajj and umrah based on iris recognition is proposed in this paper. This Hajj database will be used in any biometric recognition systems based on iris recognition used by officers in the Kingdome of Saudi Arabia (KSA). Actually, the iris model and its unique pattern are considered as the most robust and accurate methods in any biometric recognition or authentication system. In order to do research on large-scale and long-range iris recognition systems, a new framework for constructing an iris recognition Hajj database is proposed**.

***Keywords*- biometric recognition, iris database, Hajj, Umrah, QR**

## I. INTRODUCTION

Mainly, in the daily life security is very important issue. Here, there are many security systems where the biometric recognition systems based on iris is the most commonly used by system designers and engineers. Both government and private sectors are encouraging the use of biometric security systems instead of using the traditional systems. By definition, biometric recognition is known as the automatic recognition system for recognizing and identifying individuals according to their biological characteristics or according to their own behavior. Furthermore, there is a rapid increase of using the biometric recognition systems for recognizing and identifying the individuals automatically. The recognition is conducting according for a regular access to the physical spaces, services, and information. This regular access can be expanded to an extra access to the international borders with some legal rights and benefits [1, 2, 3]. By nature, the iris is considered as an ideal identifier. So, designing and developing a recognition systems based on the iris is a challenging task.

Technically, iris recognition has the best accuracy recognition rate among other biometric systems currently available. Actually, the amount of light received to the human eyes is being regulated and its size is being controlled by the iris which is the colored ring around the human pupil. Figure 1 shows the human eye structure, while figure 2 shows the iris structure.

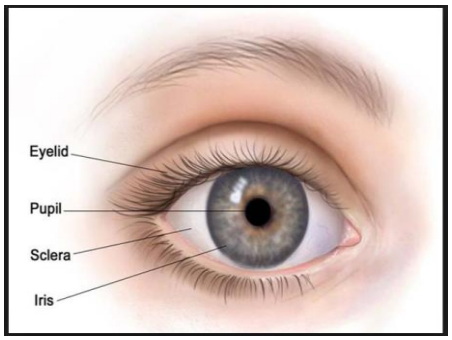

Figure 1. Human eye structure

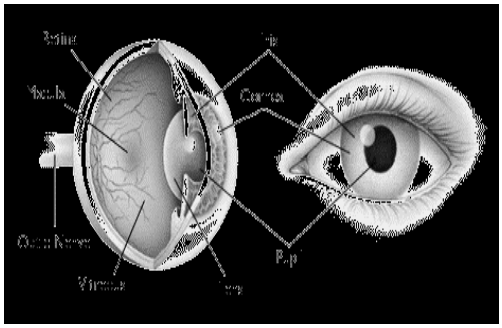
Figure 2. Iris structure

Iris recognition needs a digital camera for capturing iris images in specific details. The specific details can be the iris unique structure, where this unique structure can be compared later on by an encrypted data. The encrypted data is extracted from the iris images from a specific database.

Iris recognition has many benefits and advantages. The benefits and advantages can be summarized as follows [5, 6, 7,8, ]:

1. Accuracy: Iris recognition is considered as the most accurate biometric recognition systems available.
2. Stability: Basically, the iris pattern does not affect or change throughout human life time.
3. Speed: Due to the iris small template size, the iris computation and matching is so fast.
4. Popularity: The iris recognition systems are the most popular identification and recognition biometric systems all over the world where it has a strong satisfaction and acceptance from people.

Basically, any recognition system needs to imitate the human vision system. The human vision system is a probabilistic system where the error is low. On the other hand, the imitated recognition systems designed or developed by systems designers and engineers should be designed and developed for having a low recognition rate [2, 3]. In order to achieve a high recognition rate, the recognition systems need to have a large database for training and testing [2, 3, 4, 5].

A block diagram of any recognition system is shown in figure 3. All the recognition systems have three main phases: the pre-processing phase, the feature extraction phase, and the classification and the identification phase. Those three phases take place after the main phase which is image acquisition phase.

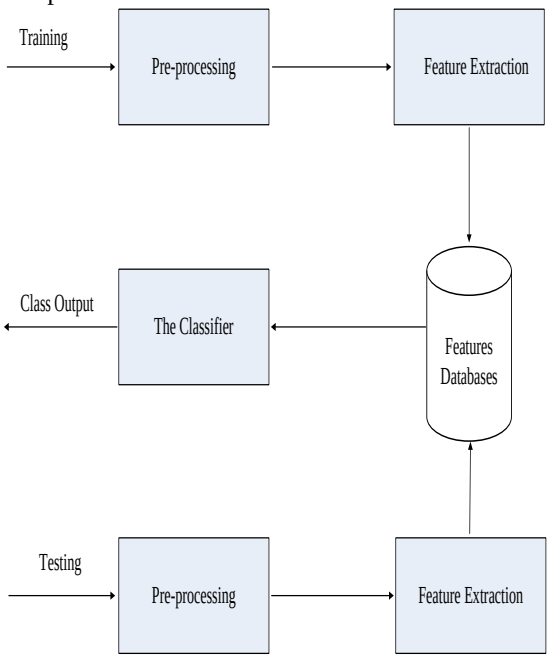


Figure 3. Recognition System block Diagram

Biometric systems based on the iris recognition are mainly used in all the societies all over the world to be more robust, reliable for identifying and recognizing people. According to the fast grow in acquiring iris images technology, the biometric iris recognition system are expected to be the main fundamental factor recognition components of all societies all over the world. Basically, there is variety in biometric recognition system applications such as banking systems, forensics systems; Electronic (E) services systems, biometric passport identification systems, and national identification card systems, etc [7].

There are millions of Muslim believers arriving to the Kingdome of Saudi Arabia (KSA) to conduct Hajj and Umrah yearly. Conducting this kind of worship is having a place in Mecca which is the first holy city in KSA for all Muslims all over the world. While conducting Hajj or Umrah, there is a main challenge which is identifying and recognizing a missed person over there in the huge crowd. The people who are conducting Hajj and Umrah are known as pilgrims where hajj is known as the annual Islamic pilgrimage. Muslims can conduct Umrah any time during the year, however, conducting Hajj is done on a specific time on the year [6, 7].

There is no standard Hajj database all pilgrims as yearly basis. Since conduction Hajj is required for Mulslim believer once in his/her life time, the pilgrims are changing every year for both Hajj and Umrah. Therefore, a huge Hajj database for all pilgrims is required. For example, the pilgrims in 2016 are different from pilgrims in 2017. Thus, a special kind of image are required to be designed and collected every year. Training and testing any recognition system needs a large database in order to evaluate the system performance [2, 3, 6, 7]. .

In this paper, a Hajj database for identifying the missed pilgrims in both hajj and umrah is proposed based on iris recognition. Also, the images in the Hajj database will be linked to a quick response (QR) code. The QR code is a special version of the barcode where it is considered as two dimensional barcode. There are two main types of the QR codes: The static QR codes and the dynamic QR codes. The static QR codes are used for spreading and disseminating the information to the public. The dynamic codes are editable by the owner at any time for targeting personal information. Various file formats are used while creating a QR code. The file formats are summarizes as: HTML code, TIFF file, PNG file. The PNG file works excellent due to its flexibility in changing its size and scaling it. Ideally, the QR code is a square grid with a white background. The foreground of the grid square consists of black squares. Reading the QR code requires a special tool of imaging devices such as camera. Moreover, there are various software capable generating the QR code. The one used in this paper is the QR Stuff which allows a user to generate two types of QR code either static or dynamic QR code. Both static and dynamic QR code can be fast downloaded for further processing (https://www.qrstuff.com). Figure 4 shows a QR sample.

Figure 4. QR Sample

In this paper, the following contribution is done:

- A new Hajj database for identifying and recognizing the missed pilgrims has been proposed.
- The images are linked to QR) code

Section 2 describes the related work done on constructing and building databases for Hajj. Section 3 summaries the proposed system. In Section 4, data acquisition and pre-processing are discussed. The conclusion of this paper is summarized in section 5.

## II. RELATED WORK

As mentioned earlier, any recognition phase consists of four main stages, the image acquisition phase, the pre-processing phase, the feature extraction phase, and the identification phase which is the feature comparison phase. The pre-processing phase is mainly used for iris image segmentation.

A dataset for recognizing the pilgrims face was proposed by Aly [7]. This dataset presented different pilgrim's face image. All the images were taken in Mecca during the 2012 Hajj year. The face images were taken in both Hajj and Umrah seasons that year. The main goal for that dataset is to propose a facial recognition and detection system. Zawbaa and Aly presented a new data set for Hajj and Umrah recognition [8]. Basically, Hajj and Umrah has specific rituals to be conducted. Based on the rituals of hajj and Umtah different images and videos were taken to build a dataset. This data set contains images and videos while pilgrims were conducting umrah or hajj. It contains a collection of all umrah and hajj ritual events. The main goal for this dataset is to develop a recognition system which is capable of recognizing a wide range of human actions during the Hajj and Umrah rituals

## III. PROPOSED SYSTEM

Basically, the first step in constructing a database is to find the suitable source of data. Here, this source is done by capturing and scanning the iris of all the pilgrims who are conducting Hajj or Umrah every year. Ideally, designing and developing robust recognition systems requires a huge dataset to be used in both training and testing such systems. Based on this fact, there is no real online dataset for all the pilgrims in such a specific year. Every year, the pilgrims are different. For example, the pilgrims on 2015 are different from the 2016 ones and so on. Based on this, a novel framework for constructing a yearly base Hajj database for identifying the missed pilgrims in hajj and Umrah is proposed in this paper.

There is a rapid increase in using large image databases which needs an efficient solution for using data management with powerful data processing steps. Generally, in ideal recognition systems, there is no link among image databases and relational databases to be used together in web portals. Here, a web portal to SQL image databases is proposed to construct a Hajj database for all pilgrims every year.

By definition, the web portal is defined as a website page which is specially developed and designed to pass information from different variety of sources such as emails, different search engines, forums, etc.

Basically, the pilgrims are categorized into two main categories either local or foreign. The iris images will be captured for both local and foreign pilgrims. The local pilgrims cannot conduct hajj without having a hajj permit. The iris images will be scanned for the local Hajj while applying for the hajj permit. The foreign pilgrims must enter KSA from its various borders. The iris images will be scanned for the foreign Hajj while entering the KSA borders. Ideally, all the iris images will be saved and updated in the computer server of the Ministry of Hajj via web portal.

All the pilgrims Hajj Identification card (ID). All the personal information of the pilgrims is shown on the hajj ID. The information contains the pilgrim name, all the needed contact numbers for the case of lost or death. The hajj ID card will be scanned for both local and foreign pilgrims along with iris scanning. The scanned Hajj ID will be converted to a QR code which will be saved and updated in the computer server of the Ministry of Hajj via web portal. Figure 5 shows a hajj ID sample.


Figure 5. Hajj ID Sample

The Hajj database contains the iris images for all pilgrims with their personal information as well. The first step in any biometric iris recognition is the image acquisition step, which is complicated due to the variation in color and the size of iris for each person. Technically, scanning the iris image for a person is difficult. The acquisition distance for average of capturing an iris images is 2 to 3 feet while the average time is 1 to 2 seconds. Due to the effect of different lighting, different distance, and different positioning, different results will be produced for the same person [9]. Figure 6 illustrates the mechanism of iris image acquisition and scanning for all pilgrims.

Figure 6. Iris Scan

## IV. DATA ACQUISITION AND PREPROCESSING

The main goal of this paper is to develop a new framework for constructing an iris Hajj database for all the pilgrims who will conduct Hajj or Umrah every year. Constructing this kind of Hajj database will be done every year due to the fact that the pilgrims are not the same every year. The database contains twenty images for each individual pilgrim.

The pre-processing phase deals with the pilgrim's original scanned images. The scanned images for each individual pilgrim are the iris and the hajj ID card. The database is divided into two sets: training samples and testing samples [10, 11, 12].

The iris will be scanned for all pilgrims either local or foreign as shown in figure 4. A special pre-processing tool is performed for the pilgrim's scanned iris. Firstly, the original pilgrim's scanned iris will be saved and presented in the computer server of the Ministry of Hajj as shown in Figure 7(a). Secondly, a circular contour is formed around the original pilgrim's scanned iris as shown in Figure 7(b). Thirdly, the *concentrically* concept is applied with the circular contour in order to obtain the concentric with the circular pupil as shown in Figure 7(c). Finally, all the iris portions occluded by the eyelids will be removed as shown in Figure 7(d).

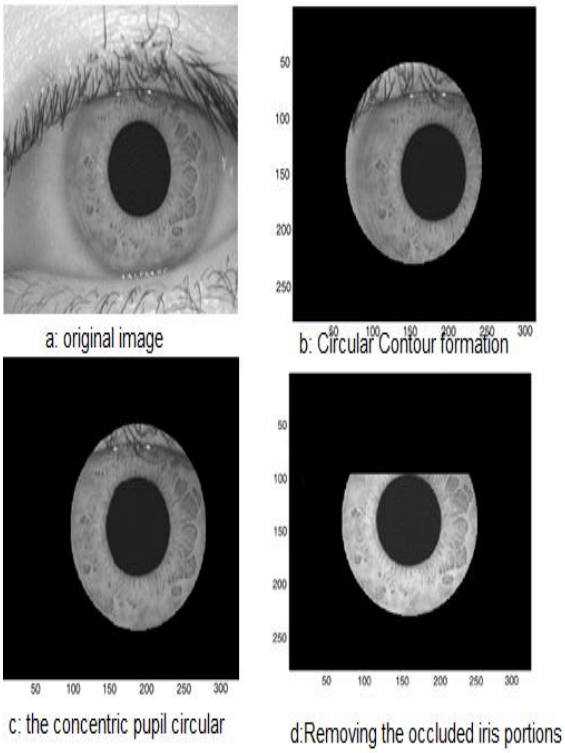


Figure 7. Iris Pre-processing Example

Actually, there are many pre-processing algorithms in the literature for iris localization and normalization. Systems designers and engineers may use any algorithm or create his/her new algorithm and apply it to the hajj database if required while designing and developing their iris recognition and identification systems.

For pre-processing the iris images, first the iris concentric outer boundaries was identified so extracting the region of interest in done by isolating noise regions initially. This is known as localization which consists of two main parts. Firstly, Detecting the eye lids and boundary detection. Secondly, the regions have to be segmented. Later on, the iris boundaries have to be recognized in terms of internal or external boundaries. This mechanism is done using canny edge detection in both directions horizontal and vertical. The Hough transform is applied later. Hence iris normalization is done to all iris images. Normalization is needed since the dimensions of the iris images are different due to several factors such as camera rotation, different viewing distance, eye rotation, etc. These factors plat an important role in changing the image resolution, thus it is very important to produce the iris images in constant dimensions. So, iris image normalization is done using Daugmans rubber sheet model to all images after localization. Later on, iris images were enhanced by Local histogram equalization technique due to the low contrast due to non-uniform illumination for the light positions based on its position. The pre-processing techniques are illustrated in figure 8 [13].

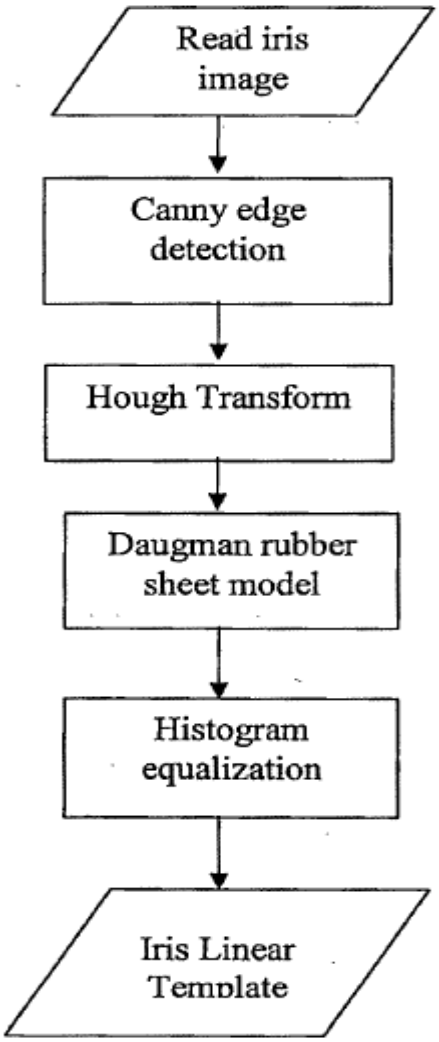


Figure 8. The pre-processing techniques

For the matching and comparing two irises, a special ratio will be computed to be the first comparison criterion. The special ratio is computed as the diameter of the limbus to the diameter of the pupil. This ratio is considered as an important criterion ratio in comparing or identifying the irises. This ratio is illustrated in Figure 9.

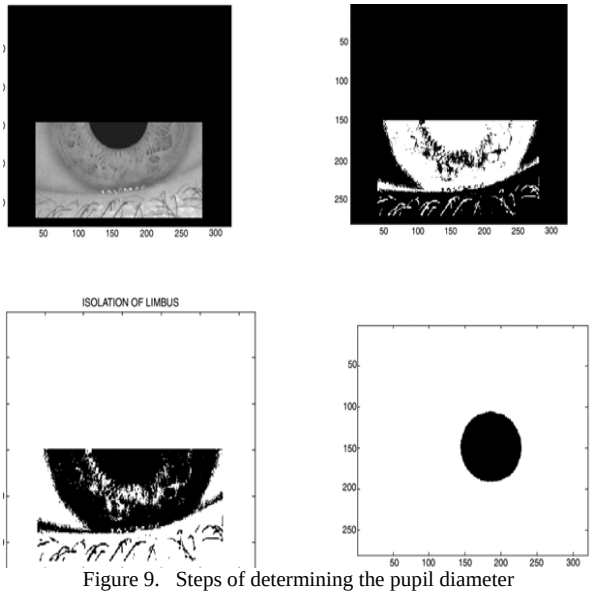


Figure 9. Steps of determining the pupil diameter

Furthermore, a QR code will be generated to all hajj ID cards. The QR code will be saved along with pilgrim iris for further designing and developing image recognition and identification systems. By using the QR stuff software, the pilgrim's hajj ID be browsed to the software and the QR code will be generated automatically and saved in the server of the Ministry of Hajj. A snap shot of the QR stuff is shown in Figure 10.

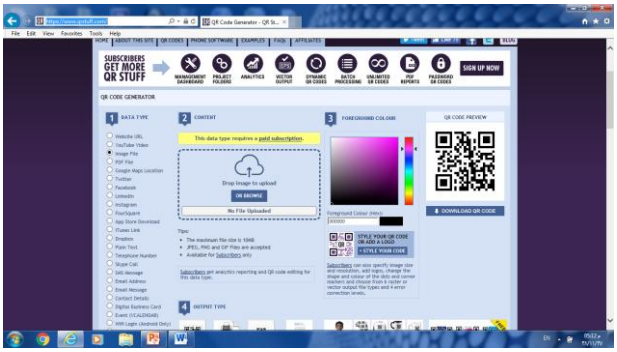

Figure 10. QR Stuff Snap Shot

In summary, the above steps are considered as a novel framework for constructing a Hajj database for Identifying Pilgrims in Hajj and Umrah. Figure 11 illustrates general structure for a recognition system using iris verification and identification. It is worth mention that while constructing the Hajj database, all the pre-processing steps were done in order to make the iris images ready for extraction features for verification and recognition. System designers and engineers may extract their own unique features from the Hajj database to be mapped into a classifier for verification and recognition. The features are one dimensional vector for each two dimensional iris image.

By using this novel iris Hajj database framework, designers can design and construct their own system by using this Hajj

database. Any system requires two sets of Hajj database for training and testing.

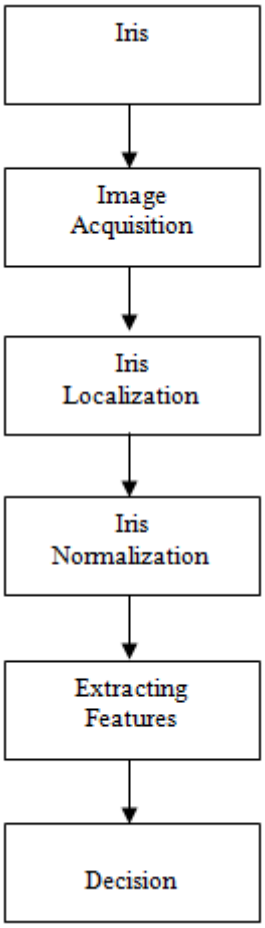


Figure 11. General Structure for a recognition system using iris verification and identification

## V. CONCLUSION

In our community and society, the biometric iris recognition has become an important technology factor for identifying the people. This paper illustrates a new framework for constructing the iris Hajj databases for identifying the missed pilgrims. A new framework for constructing an iris Hajj database for all pilgrims who conduct hajj or umrah is proposed. The new framework for the iris Hajj database basically consists of the iris images collected from the pilgrims. Twenty images are collected for each individual pilgrim along with a QR for his/her hajj ID card. The proposed Hajj database is possible to develop and test any biometric recognition system and it can be used to evaluate the performance of any biometric recognition system.

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