Design and Implementation of an Iris Biometric Door Access Control System

Etinosa Noma-Osaghae
Department of Electrical and Information Engineering
Covenant University,
Ota, Ogun State, Nigeria.
Etinosa.noma-osaghae@covenantuniversity.edu.com

Robert Okonigene
Department of Electrical and Electronic Engineering
Ambrose Alli University,
Ekpoma, Edo State, Nigeria.
robokonigene@aauekpoma.edu.ng

Chinonso Okereke
Department of electrical and Information Engineering
Covenant University,
Ota, Ogun State, Nigeria.
chinonso.okereke@covenantuniversity.edu.ng

Olatunji J. Okesola
Department of Electrical and Information Engineering
Covenant University,
Ota, Ogun State, Nigeria.
olatunji.okesola@covenantuniversity.edu.ng

Kennedy O. Okokpujie
Dept. of Electrical & Information Engineering
Covenant University,
Ota, Ogun state, Nigeria.
Kennedy.okokpujie@covenantuniversity.edu.ng

Abstract: **Over the years, security has soared in importance as concerned individuals, companies and organizations continue to implement measures to improve the security of lives and properties. Door-access control is a physical security system that secures a room or building by limiting access to specific people and keeping records of such accesses. The significance of iris technology among others, for security and access control applications are numerous. In terms of physical security, iris technology is already making inroads into the access control market because of the reliability of its authentication process. In this paper, the researchers present an aspect of the system relating to the design and construction of an iris biometric door access control. The system was developed as a means of getting into a specified area by securing the door and limiting access. The database created contains the particulars of those allowed access in order to work in tandem with the mandatory iris authentication process. The implemented design worked satisfactorily.**

Keywords—Biometrics, iris, recognition, access control, security.

I. INTRODUCTION

Restriction of access to doors in ancient times was achieved by using knots (made of ropes and related materials to detect when someone tries to open the door). The Greeks and Egyptians developed the use of pin tumbler locks which were made of wood [1]. The romans improved on the Greek and Egyptian locks by using metals as their primary materials. In 1861, Linus Yale patented the pin tumbler lock which is simple and effective and it has been essentially unchanged until the introduction of biometrics in access control [2].

Biometric technology involves using a measureable characteristic or identifier to label an individual [3]. The identifier could be behavioural or physiological. Physiological characteristics describe an individual based on the shape of the body. It includes using the fingerprint pattern, palm veins, face structure, iris image, retina, or scent of persons as identifiers. Behavioural characteristics relates to the pattern of behaviour of a person such as gait, voice and even typing behaviour.

The integration of biometrics into access-control systems has greatly increased the security of such systems. The biometric characteristics used cannot be forgotten or misplaced and thus ensures a safer method of keeping lives and properties safe [4].

One of the door access control's main devices was the iris scanner supported by a database containing the unique iris template and particulars of those authorized access the area behind the door. The door used in the prototype was the electric strike lock/dead bolt lock (an electromagnetic locking mechanism. A microcontroller was used to integrate the actions of the scanner, database and the door's opening and closing mechanism.

II. RELATED WORKS

A. Aspects of Access Control

A well-structured enrolment process, accurate verification and up-to-date logs, form some of the most important aspects of access control. The enrolment process establishes the first stage of the access control process. It acquires the data required by the access control system to expedite its coordination function fluidly. The verification process enables the access control system identify users while the logs keep track of accesses granted.

B. Door Access Control

Jam locks and animals are widely used as physical layers of protection. Many a time, after-hours alarms are placed at entry points to deter intruders from getting access to restricted areas. Identification badges, I-card keys, Tokens and Biometrics can be used to monitor and control the daily flow of individuals in and out of any location [5].

Automated door-access control is an emerging area of security that is used to grant authorized individuals access to restricted places and keep logs of such accesses. Door-access control is a physical security system that assures the security of a room or building by limiting access to specific people and keeping record of all accesses. To limit access to specific people, it utilizes an individual-authentication method [6]. Biometric authentication uses unique physiological or behavioural characteristics to limit access. This makes the issue of loss and impersonation less prevalent. There are several types of biometric authentication methods. The biometric used in this paper is the Iris. This paper describes the features of the iris as a biometric and how it can be used control access to restricted areas.

C. Biometrics

Biometrics uses unique behavioural and physical traits in humans to identify individuals [7]. This usually involves acquiring an image of the individual's unique physical trait and comparing it with the previously stored templates in a database. This has made it possible to use biometrics in a wide range of applications and the field keeps evolving [8, 9]. The face, voice, fingerprints and many other physical traits have found use in a diverse range of applications. The reliability in terms of usability and security are depicted in Figure 1.

The iris is surrounded by the pupil and sclera. It is one of the most reliable physical traits that can be used for individual identification. The stable, invariant and unique nature of the iris is in a special class of its own. It is a more stable biometric trait in comparison to others. The iris is so unique that it is different for the left and right of the same individual (even twins). Daugman wrote an efficient algorithm for iris recognition developed a very efficient method for iris recognition in 1992 [10]. Daugman used the integro-differential method to detect the boundaries of the iris and 2D Gabor filter, was used for feature extraction.
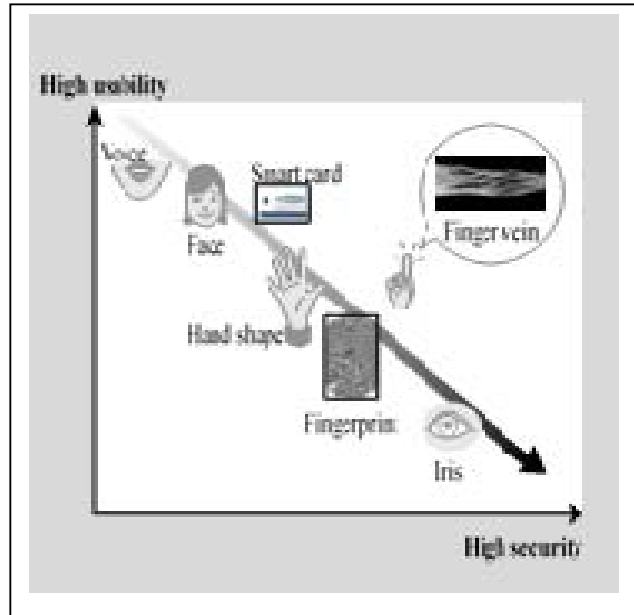

Fig. 1. Categorization of biometrics in terms of usability and security

III. METHODOLOGY

A. Design Consideration Specification

The embedded door access control system was centered on iris recognition for verification. One of the aims was to improve security and avoid impersonation. The proposed system makes use of the ATmega128 chip as the core of the embedded system and an iris scanner. These were used to control access via a door by ensuring that access was granted only to verified persons [11].

The embedded chip was programmed using the C language. The compiler used during development of the system was the GNU Compiler. The integrated development platform used was Eclipse which has a fully functional C and C++ Platform.

B. Operational Principle of the Designed System

The proposed design involves two phases, the enrolment phase and verification phase. Each phase is depicted in Figure 3.

Once an individual has been enrolled into the system, the user is given access to the door. Identification implies a one-to-many match requiring the iris of the user to be provided as a means of identification. The iris sample provided is compared to the previously stored information in the database. If there is a match with the iris pattern enrolled, access is allowed. Otherwise, access is denied.

Figure 2 shows the block diagram of the designed system while Figure 4 is a depiction of the algorithm used to implement the iris biometric door access system.
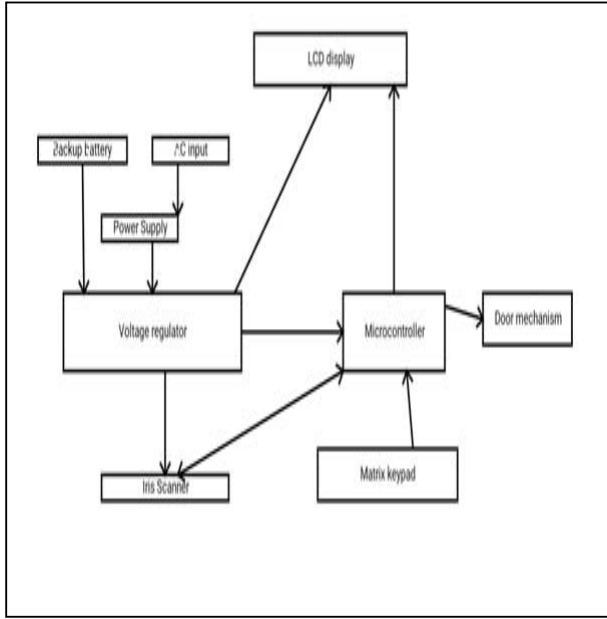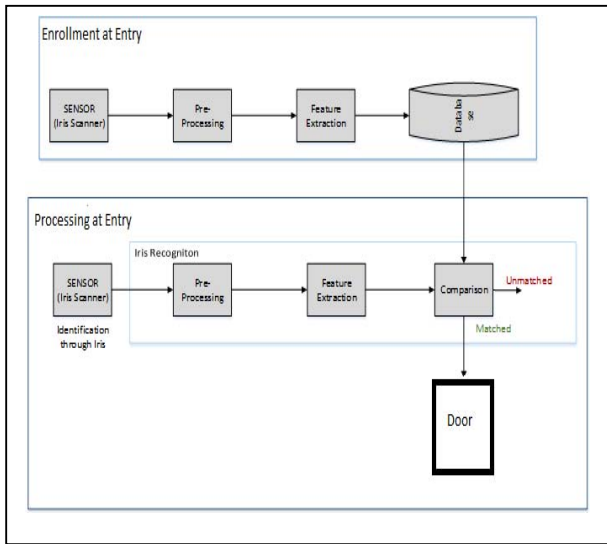
Fig. 2.   Block diagram of the designed system

Fig. 3.   The Enrolment and Authentication Algorithm

C.   Circuit

The circuit design was accomplished using PROTEUS®. This made it possible to design and test-run the simulated system before it was implemented. The circuit diagram is shown in Figure 5.
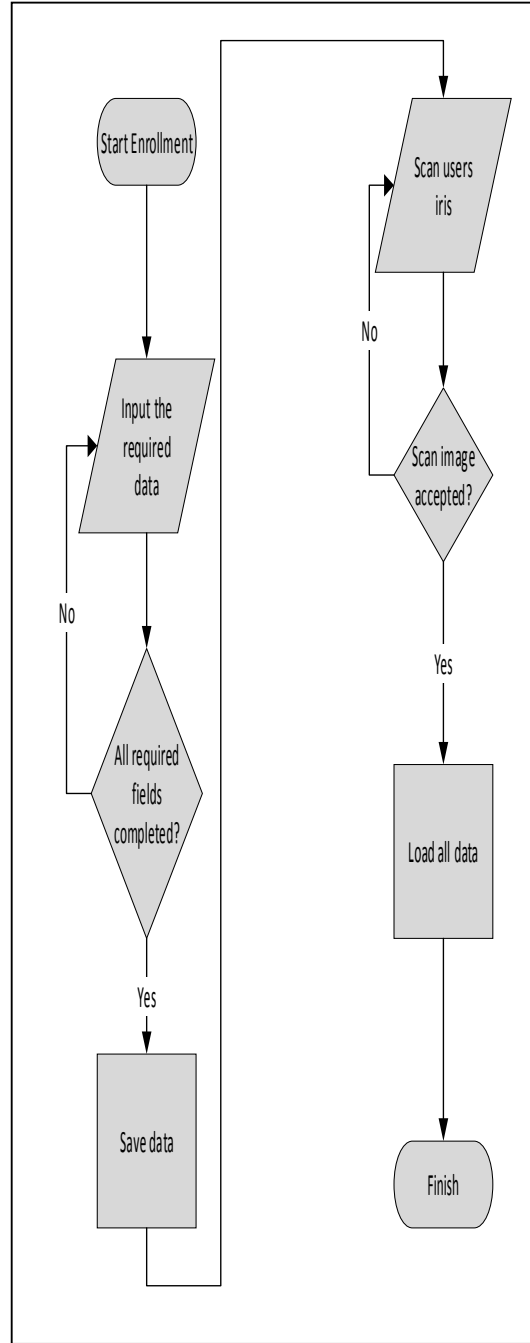

Fig. 4.   Algorithm used to implement the designed iris biometric door access system.

CONCLUSION

The performance of the designed biometric door-access control was satisfactory.

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