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Remote Sensing Protocol for Verification and Authentication Management System for Pensioners (RSPVAMSP)

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ABSTRACT

This paper provides a less rigorous pensioner screening exercise by using remote sensing protocol for pensioners screening process. In Nigeria, pensioners are faced with several challenges such as long queue during periodic routing exercise to asserting existing pensioners, long distance traveling to be physically presence at screening centers, identity masquerading, bribery of staff to changing self-information, possible out breaking communicable diseases due to overcrowding among others are regular recurrent pensioners' experiences under the current pension screening process. In solving these challenges, *a* remote sensing protocol for verification and authentication management system for pensioners was developed using Ada Boost, Local Binary Pattern, cascade classifier, Haar-like feature, and Principal Component Analysis and facial image pre-processing. In resolving these challenges, a remote sensing facial biometrics techniques by introducing mobile application facial image capturing methodology for real time feature mapping and secured transferred protocols of pensioners' information sharing, verification and authentication which only accept real time images and information from identified pensioners only, confirm life picture, and generate reports for actions on pensioners' periodic emoluments. These algorithms were used to extract, detect, verify and authenticate individual's facial identity who are alive. The system developed on three tiers architecture, the mobile tier where individuals' facial images are captured and sent to the system gateway in real time using android studio mobile editor. The system gateway was developed within Microsoft dot-net framework to processes such image and report stored at the system database where monthly pension emoluments are generated for payment to only living pensioners.

1.0 INTRODUCTION

Employee benefits are elements of remuneration given in addition to the various forms of cash payment. Pension is one indispensable form of employees' solid benefits which has positive impact on employee discipline, loyalty and willingness to remain in the service of an employer, commitment to the attainment of job goals and concern for the survival of the organization. An occupational pension plan is a policy that allows employers to offer pensions to retirees or deferred payments to departing employees. It is a system designed to provide the employees of an organization with a means of securing on retirement a standard of living reasonably consistent with that which they enjoyed while in service [1].

Over the years, the administration of pension systems in Nigeria has been overwhelmed by a range of issues including insufficient financial support, inadequate allowances and funding, inefficient record-keeping in pension offices, direct allocation of pension funds to insurers, outstanding pension payments, challenges in selecting suitable investment strategies, absence of transparency, and financial mismanagement, including corrupt practices. Others include cumbersome clearance procedures, incompetence and inexperience of pension staff added to poor human relations, lack of etiquette and simple courtesy, among others, these situations often affect employee loyalty and commitment to an organization negatively. The federal government of Nigeria has conducted numerous evaluations of pension schemes, resulting in challenges with their implementation.

In implementation, geographical location of pensioners to the headquarters of their respective place of service coupled with verification exercise to ascertain existing pensioners and eliminate ghost pensioners has been a major challenge. In solving the challenges attached to cumbersome clearance procedures involved in pensioners screening, identification of real pensioners and generation of payment schedule has been the major quest of the government of Nigeria at various levels.

In Nigeria, identifying pensioners has been the major challenge to the nation's pension system which has led to huge crisis in funding the scheme. [2]. listed the challenges facing Nigeria pension system which includes: Pension deficit of about N2.3 trillion in 2004, Pensioners not being paid entitlements regularly, Existence of ghost pensioners in the public service., Pensioners dying on verification queues, Unstructured and unfunded private sector schemes and diversion and mismanagement of existing pension fund by Board of Trustees (BOT) and Fund managers, among others. The biggest of these challenges is the inability of the pension management board to clearly identify the real pensioners. These factors have prompt both the ghost pensioners and fraudulent members of the pension management board to take advantages of such scheme by diverting pensioners fund to self-benefits. In devising clear means of identifying legitimate pensioners, a scientific method such as facial biometrics system should be involved in such processes.

2.0 REVIEW OF EXISTING WORK

Several authors have proposed various models in solving problems related to pension management and pensioners. [3] proposed face recognition algorithms surpass humans by working towards compare the accuracy of computer-based facial recognition systems with humans. Seven different Algorithms were used to compare with human ability to identify images. Their model was able to obtain data and analyzed it using ANOVA methods, the results shows that three different Algorithms were better in image recognition than human ability. The limitation of their research work was inability to choose large data set during sampling, and human sampling was based on a particular geographical location, hence human performance evaluation was not broad.

[4] presented face recognition: a survey. Their objective was to consider several methods in extracting facial features with lower dimension by classifying various facial recognition algorithms approaches into groups and summarized their pros and cons. In their results, it shows that face recognition in video possess using three-dimensional face image models for low resolution, dimension, poor contrast and non-frontal pose. However, their research was a theoretical exercise that does not go deep into many facts and details of all models focused on.

[5] presented face recognition applications and methods. The purpose of the research work was to expand a facial recognition system to automatically identify a human face in an image. To achieving their objectives, generic methods based on edges, lines, and curves was adopted for features extractions while structural matching methods that take into consideration geometrical constraints on the extracted features was used to consider coordinates points. Their system was able to authenticate faces and images in a controlled environment. However, their research work does not consider 2-Dimensional and 3-Dimensional images in variants of the camera used and can only function in a controlled environment only.

[6] presented a review of face recognition: a literature review. The aim of their research work was to carry out a comprehensive review of different facial recognition methods and point out weakness and possible future research areas where those research works were unable to capture. Their research work was able to present a theoretical review of different facial recognition methods while strengths and weakness of those techniques were outlined for future research. Also, percentage of accuracy of various methods was compared with two different face databases (Yale and AR databases) as their bench mark. However, their research work was based on assumption from the theoretical review information gathering was based solely on secondary data.

[7] presented a facial recognition and detection system for institution-based attendance monitoring system. The purpose of their research work was to recognize and detect individual student's face for class attendance. The researchers used two ways techniques in achieving their purpose by using Hue Saturated Value (HSV) and True colour or Red, Green, Blue (RGB) colour mode algorithm for facial detection and the Principal Component Analysis (PCA) for face recognition due to its simplicity. Their system was able to recognize and detect human faces. The major setback of their system was that their research consideration focused on recognizing and detecting standalone images.

[1] presented Pension System and Retirement Planning in Nigeria. In her publication, she examines the features, prospects and challenges of pension in Nigeria and highlights some feasible solutions to such problems. Her research focuses pension management solutions from the theoretical and legislative point of view in reminding some perceived ideas for reforms. However, the research work never focused on any scientific methods in solving any of her stated challenges.

[8] presented a Real-Time Face Detection and Recognition in Complex Background. Their publication proposed the used of Ada Boost algorithm was implemented in a cascade classifier to train the eyes and face detector; the LBP descriptor was used to extract facial features. Haar-like descriptor was used to detect eyes to be sure it is a living facial image, while the Principal Component Analysis (PCA) algorithm was used to identify faces in teal time. However, their research work implements a standalone system which means users must be physically present at the server base.

The existing research works do not consider the remote sensing of facial images which does not consider the plight of pensioners in Nigeria.

3.0RESEARCH OBJECTIVES

This research work focuses on modelling a mobile driven system for pensioners' verification, authentication and implement such model for facial recognition to consider only living pensioners for pension management and entitlement for Rufus Giwa Polytechnic, Owo (RUGIPO) pensioners.

4.0 METHODS

In solving significates part of challenges facing pension management and pensioners in Nigeria, oral interview was conducted to obtain pre knowledge of conventional methods involved in the process of traditional verification and authentication of the existing pensioners' management system in Rufus Giwa Polytechnics, Owo.The model of [8] was adopted in facial recognition and authentication while [1] proposed model was adopted for screening and verification exercise of pensioners.[8] adopted the use of Local Binary Pattern descriptor algorithm ($PLBP_{8,2}^{u2}$) for facial features extraction, while Haar-like descriptor algorithm was used in extracting eyes features (line features, center surround features and edge features) to allow only living images from faces of the sample sets. The second aspect of their model used Ada Boost algorithm totake out the best features to identify the faces.

$$S(x) = a_1w_1 + a_2w_2 + a_3w_3 \ \ldots \ a_nw_n \qquad (1)$$

Equation (1), $w_1(x)$, $w_2(x)$, $w_3(x)$, ... $w_n(x)$ are n weak classifiers used to construct a strong classifier $S(x)$, while parameters a_1, a_2, a_3, …, a_n are weights associated with the n weak classifiers. The strong classifiers are used to identify faces adopting this equation:

$$S_{th}(x) = \int_{0,}^{1,} \quad \begin{matrix} if\ S\ (x) \geq \frac{1}{2}(a1 + a2 + a3 + \cdots + an) \\ otherwise \end{matrix} \qquad (2)$$

In equation 2, $S_{th}(x)$ is the threshold by the strong classifier to detect faces. While "1" indicates facial detection and "0" stands for no face detected.

When faces are discovered, the Haar-like descriptor algorithm is used to identify both eyes of the face in order to improve the face detection accuracy and eliminate the use of static images. In the recognition of human faces, Principal Component Analysis was used as the principal algorithm as described by [8]. In the implementation stage, LUXDAN facial recognition software development kits were adopted for system gateway development.

4.1 RSPVAMSP flowchart

The proposed flowchart for this system was modeled from facial recognition technique with PCA algorithm by [8] as shown below in figure 1. The model contains three tiers which comprises of: -

- **Client tier**: - The client tier system includes the following, mobile phones with pensioners' mobile application, pensioner's registration point on organization personal computer, other mobile application enabled device with camera. The client-side subsystem interface provides the platform for registering eligible pensioners, and to send personal real life information to system gateway. At the pensioner's tier application level, pensioner's life images are streamed to the system gateway and the client subsystem discard all information on such device after sending.

- **System gateway tier: -** The system gateway server is a software dedicated to the efficient execution of methods, class, routines and procedures for supporting the construction of clients and applications. The system gateway server processes the information from client tier level to verify and authenticate sender's information. An Auto Swapping Mechanism (ASM) authenticated facial image captured by the system is then activated if the system integrity test is passed by the sender. The ASM will automatically replace the old images location by the new facial image recognized. This will allow the standard deviation of the values acceptable as a result of the effect of ageing.

- **Database server tier: -** The database server tier allows regular I/O operations to keep data integrity and data consistency. The real time up to date activities of all verification and authentication processes are captured for report generation, payment schedule printing, auditing logs, etc

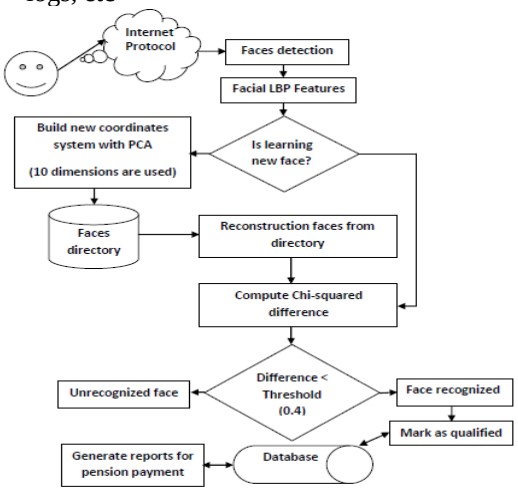

Figure (1): System flowchart

5 RESULTS

The system was tested using 50 sample set of human having deployed the mobile application on their android enabled phones. Their information and facial images were captured. They were all made to use the system for verification and authentication of individual over a period of 14-months. The system recorded 100-percent accuracy

with reports of such as qualified individual entitle for pension monthly emolument.

6.0 CONCLUSION

In solving the challenges attached to cumbersome clearance procedures involved in pensioners screening, identification of true beneficiaries, generation of payment schedule has been a challenging task over the decades in Rufus Giwa Polytechnic Owo (RUGIPO) and other government owned institutions. The adoption and usage of remote sensing protocol for verification and authentication management system for pensioners (RSPVAMSP) in managing the affairs of pensioners and pension system of RUGIPO and other government institutions will remove the harsh conditions subjecting pensioners to during verification to enable them received their emoluments. The system made provisions to impose the collection of only live facial images from pension beneficiaries while non registered persons' information or images which failed authentication processes are moved into the trash bin. The system is capable of proving almost one hundred percent of needed platform to drive pension management system in RUGIPO.

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APPRECIATION

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