

E – Voting via Face Recognition

An Automated Election System Technique

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Abstract — In the new era of advanced technology where online system boosts work speed, reduces mistakes and promotes the generation of accurate results, having manual election system becomes a misfortune. A public election system constitutes the backbone of a democracy where the person has to elect their state's leader. Pakistan currently uses a manual election system, which causes several kinds of problems. Due to this paper ballot based election system, some problems are faced by voters before or during elections and others are faced by the administration before and after the voting.

An online system, which involves procedures like registration of voters, vote casting, vote counting, and declaring results etc. would constitute a good solution to replace current system. The system proposed in this proposal will be helpful for the voters by using any resources like their own system, android devices or system arranged by Government. Moreover, the proposed system will also decrease the risk for corruption.

In a democracy, the electorate expresses its will through the election of representatives. These elected representatives operate the country, on behalf of the political body. In order for the representatives to appropriately represent and implement the demands of the people, the elections in which they are elected must be held fairly and results computed accurately.

Observing the history we deduce that Polling Systems based on hand rising had just a problem with security (elections were not anonymous). Instead a Paper based Polling System has at least three problems (discussed below). The paradigm shift from Hand based Polling System to Paper based Polling System is caused due to population growth whereas, now, time and safety are so important that it has driven a new paradigm shift from Paper to Electronic. There is no defensible reason to stick with Paper Polling System, but there are many security reasons to encourage the use of a new Electronic Polling System in order to draw up polling systems to digital era.

In Pakistan's current Paper Polling System, there are some other troubles as well apart from low turnout of votes, by looking at those problems, it is necessary to build a system which could solve those problems and speed up the election system.

Speed: Hand counting votes is time consuming especially in most populated countries like Pakistan, where many candidates are for same position and voter has to cast vote for many races.

Intelligibility: When a system based on pens, stamps, punch cards or ballot papers is used for voting in a Paper based Polling System, the result can be ambiguous.

Accessibility: Disabled or duty bound people do not have an easy access to the poll booth, but an easily Touchable system will help them to cast their vote.

Transparency: Chances of manipulation of the results from influencing authorities will almost be finished.

Keywords — PHP: Hypertext Preprocessor; MySQL: My Structured Query Language; HTML: Hypertext Markup Language; CSS: Cascading Style Sheets.

General Constraint — Each requirement in this section is: Correct; Consistent; Complete; Unambiguous; Verifiable; (i.e., testable); Prioritized (with respect to importance and/or stability); Traceable (both forward and backward to prior/future artifacts); Uniquely identifiable.

I. INTRODUCTION

Democracy is an important matter in most modern societies. One of the most important activities within a democracy is the election of representatives. It is also a very delicate process that is the subject of various disturbances, such as inactive citizens, attempts of fraud etc.

In this project we will discuss some of these problems, starting from the current democratic situation in Pakistan. We will at the end bring a software solution to the problem in terms of a product that will handle the most important aspects of this problem.

The main purpose of this study is to boost the turnout of votes. For this purpose we have to view all the aspects responsible for low turnout. Some people hesitate to vote due to weather conditions in different areas during the election, youngsters of age group 18 – 24 having no charm to cast the vote. People who are outside of their town/city/country don't want to come to their area for just casting the votes due to the expenses and trouble of transportation. Same situation is also for those who are on duty during the election, they don't have any interest to cast their vote during job or they don't have facility to submit their vote. A second purpose is to make it more difficult to commit fraud and cheating during an election.

People in Pakistan are well aware of available online services and, from the last few years the use of internet has increased. Youngsters have developed interest in using internet for various purposes. After looking above factors, the decision for online voting is more natural than before. The expenditure of an election will be decreased and it will cover people of all ages. It will be a facility for the people who have different problems such as mentioned earlier. And all those who cover the area of 67.5% of total population of Islamic republic of Pakistan lives in urban areas will be aware about the use of the system through media awareness programs.

In a manual system, sometimes people are registered in more than one area and can thus cast the vote multiple times. By creating an online database covering the country it will be possible to eliminate the bogus casting of votes. In some areas, officials of the Election Commission themselves cast votes and after the end of election they adjust these votes from the voter's list. Hence, they manipulate the result of the election. There is clearly a need of a system that could reduce the authority of officials and could sustain the true nature of voting. It would also give people options to cast an empty vote if they don't like to give the vote to any of the candidates.

II. SCOPE

This is purely user friendly application and users can utilize this by ease through their mobile phones and personal computers at anywhere. They do not require any software to get registered as a national voter, to cast vote as a registered voter and to check election status as an herby citizen of Islamic republic of Pakistan, they can just do that through an android application.

This product has eliminate the chances of bogus voting up-to 99% and try to allow overseas citizens to cast vote without any doubt of corruption as no un-registered voter can be allowed to vote and not only this but registered voters are also restricted to cast vote only once.

Product will take paradigm as input tool that will be their face texture along with their CNIC.

To complete the product we had implement three algorithms for feature extraction, feature distribution and comparison process.

For face features extraction we used Local Binary Pattern, for face feature distribution we will implemented Chi-Square distribution and for face comparison we preferred threshold technique.

III. FACE AS BIOMETRIC

Face recognition is one of the most difficult problems in the research area of image recognition. A human face is not only a 3-D object; it is also a non-rigid body. Moreover, facial images are often taken under natural environment. That is, the image background could be very complex and the illumination condition could be drastic

The importance of face recognition is highlighted with the widely deployed video surveillance systems. Surveillance cameras capturing images can be used to monitor abnormal activities in sensitive areas. The face recognition problem can be defined as the process of identifying an individual from his/her face image. This face image can be captured by a camera or can be extracted from a video. Face recognition is a challenging task in pattern recognition. This is mainly due to the fact that the image of a face is prone to change due to a number of factors like noise, illumination, viewpoint, age, facial expressions, occlusion etc. In the past 40 years, we have witnessed a major development in the field of face recognition. The main reason for such expansion is the need of such systems for various commercial security applications. In spite of this advancement, recognition systems have faced certain limitations due to the above mentioned robustness issues. In particular, the issues of contiguous occlusion and illumination variation are considered as the most challenging problems in the paradigm of face recognition.

There are two predominant approaches to the face recognition problem that are geometric and photometric. Geometric is feature based whereas photometric is view based. After a long period of research many different algorithms were designed, developed and tested, among which Principal Component Analysis (PCA), Local Binary pattern (LBP), Elastic Bunch Graph Matching (EBGM) & Linear Discriminant Analysis (LDA) are four of the well-studied face recognition literature.

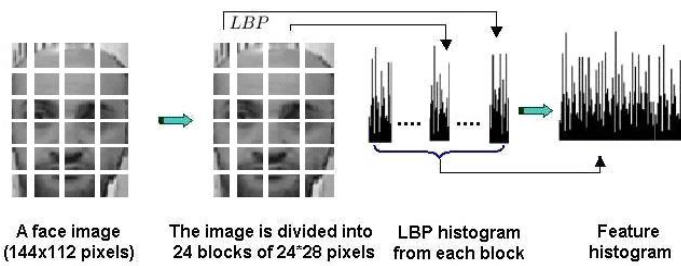
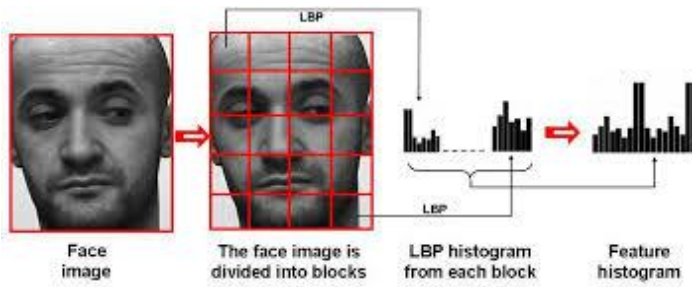
IV. LBP – LOCAL BINARY PATTERN

The LBP operator is one of the best performing texture descriptors and it has been widely used in various applications. It has proven to be highly discriminative and its key advantages, namely, its invariance to monotonic gray-level changes and computational efficiency, make it suitable for demanding image analysis tasks.

The idea of using LBP for face description is motivated by the fact that faces can be seen as a composition of micro patterns which are well described by such operator.

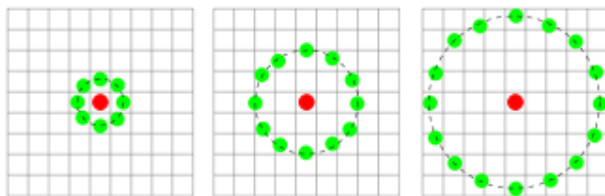
The LBP operator was originally designed for texture description. The operator assigns a label to every pixel of an

image by thresholding the 3×3 - neighborhood of each pixel with the center pixel value and considering the result as a binary number. Then, the histogram of the labels can be used as a texture descriptor.



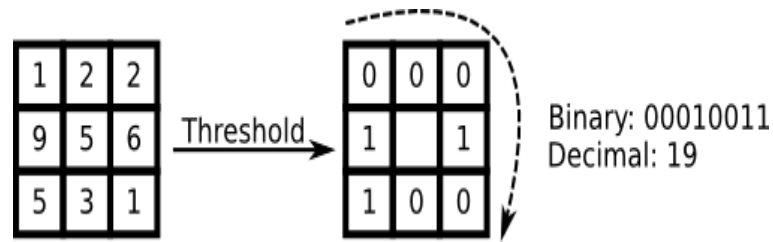
To be able to deal with textures at different scales, the LBP operator was extended to use neighborhoods of different sizes. Defining the local neighborhood as a set of sampling points evenly spaced on a circle centered at the pixel to be labeled allows any radius and number of sampling points.

Another reason for selecting the local feature-based approach is that trying to build a holistic description of a face using texture methods is not reasonable since texture descriptors tend to average over the image area. This is a desirable property for ordinary textures, because texture description should usually be invariant to translation or even rotation of the texture and, especially, for small repetitive textures, the small-scale relationships determine the appearance of the texture and, thus, the large scale relations do not contain useful information. For faces, however, the situation is different: retaining the information about spatial relations is important.



Finding good descriptors for the appearance of local facial regions is an open issue. Ideally, these descriptors should be easy to compute and have high extra-class variance (i.e.,

between different persons in the case of face recognition) and low interclass variance, which means that the descriptor should be robust with respect to aging of the subjects, alternating illumination and other factors.



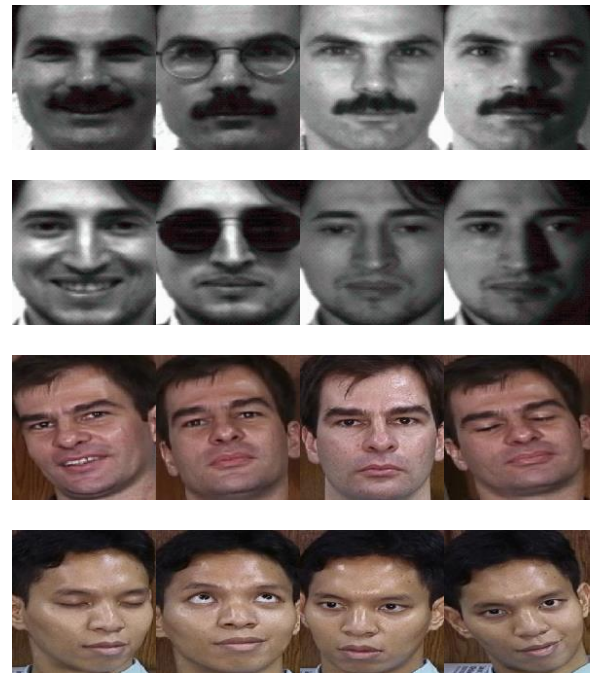
V. TESTED DATABASES

After implementing LBP we had tested it in to 3 renowned databases & 1 local database that we our self, created and their results are given below.

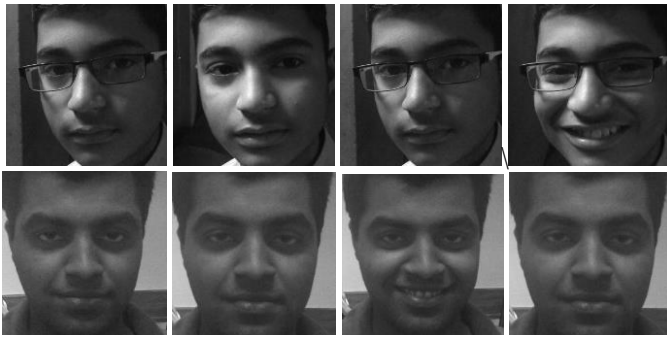
That renowned database has different number of images for each subject but we choose 4 for training and only 1 for testing because that is what the criteria our system is designed on. Each imaged used for testing the algorithm is of grey scale and has size 240*240 pixels in jpg format.

<i>Database</i>	used subjects	Train samples	Tested samples	Result (accuracy)
AR database	20	4	1	84.2%
GT database	50	4	1	96.7%
Yale database	10	4	1	93%
Local Database	50	4	1	96%

Datasets from known databases



Datasets from locally created database



VI. PRODUCT PERSPECTIVE

The software product is a standalone system and not a part of a larger system. The system will be made up of four parts, one running visible directly to the administrator on the server machine and the other visible to the end users, in this case the voters, through web pages. The two main users of the system, namely the voters and the Election Authority (EA) interact with the system in different ways. The election authority configures the whole system according to its needs on the server where the system is running. The voters cast their votes using the android interface provided. These votes are accepted by the system on the server.

On the EA side, the system can be used to create/update/delete the election details (posts, candidates, electoral rolls etc.). The EA should be able to specify the different attributes it wants for posts/candidates of a particular election instance and voters. For example, one EA may want the candidate's photograph as an attribute, where as another EA may not find it necessary. Similarly, they may want one set of attributes for voters in one setting and a different one in another. For Example, in a university, the EA might be happy with just the roll numbers of each voter while an election in an association may require voters' name, phone number, address etc. After the election is set up, passwords must be generated and mailed to voters on request. The system should also be able to run separate election instances at the same time. From the voters perspective, the system is used to help them cast their votes and after the elections are over, allow them to view the results, which are automatically posted on the same site after the election duration is over.

VII. PRODUCT PAST COMPARISION

A. Past Survey

Manual Candidate Registration Process
Manual Voter's Registration Process
Manual Vote Casting Process
Manual Vote Counting Process
Vote Verification through CNIC only
No-voting process for overseas Pakistani
No run-time result display

B. Proposed Attributes

Automated Candidate Registration Process
Automated Voter's Registration Process
Automated Vote Casting Process
Automated Vote Counting Process
Vote Verification through Face along with <i>CNIC</i>
An Android and Web application to provide platform for overseas Pakistani to cast vote
Feature of run-time display in app.

VIII. SYSTEM FLOW MECHANISM

This is a generic automated system which can be deploy in any organization, institute or for any nation. It has ability to adjust for any working place and can perform accordingly their requirements.

The system used two platforms to get develop that are PHP and Android, where php is used to design an admin panel and a dashboard for election authority and android developed application is for users that can be a voter or a candidate.

The system is sub classified in to 4 modules that are;

- Election Authority
- Admin
- Voter
- Candidate

A. Election Authority

Election Authority has right to create and election and to create a specific admin for that election with specifying its log in identification. That created election can have sub elections as well which would be created as per the requirement of the customer.

B. Admin Panel

Admin has right to create more admins, create candidates as much as require, create elections (start election & end election), start registration, set authentication criteria that can be "Access only through ID credentials", "Access through face biometric " or "Access through both ID & face". Admin can manage party, set party for candidate, set candidates status. Even he has rights to set the tag lines, titles, sub-titles, place holders and even has right to delete an election.

C. Voter Module

Voter can access the system through android application in three different phases; registration phase, vote casting phase and result view phase.

If the voter is logged in for the first time he can only have access to get registered by verifying his/her basic details and by submitting 4 images for training process.

If one the voter get registered successfully and try to access the application for second time he can only see his details if election time is out reached and if elections are open he can cast the vote by giving his ID, 1 image for testing process and if he get verified he will be provided with the ballot paper having candidates he can cast the vote and then the/she can select one candidate and will automatically get logged out.

Lastly if voter is registered and he already casted the vote he can only see the result of his specific area he casted vote for.

D. Candidate Module

Candidate has the same rights as a voter have as every candidate is itself a voter but in this application candidate is separated from voter because voter don't need to get registered and secondly he/she can see the result in broader view.

IX. EXTERNAL INTERFACE REQUIREMENT

There are no hardware interfaces to the web part of this software system. The only interfaces are through a computer system that must be at least Pentium 4 and must comprise.

- At least 1 GB Ram
- 3.0 GHz processor
- 2.0 Mega Pixel Camera

There must be Windows XP, Windows 7 or Windows 8, Windows 8.1, Windows 10, and Linux environment in the systems where this information system would be deployed.

Whereas, mobile application is concerned it needs an android device either phone or tab with having at least 4.0 android version that is Ice-Cream Sandwich.

The poll server runs on http server that is enabled to handle server pages. It uses a relational database to keep track of the polls, which it connects through standard database connectivity interfaces. In order to run the setup software, the environment needs to have a JVM running on it.

- Operating System: Windows XP/7/8/10
- Android at least Jellybean.

X. SECURITY PERSPECTIVE

Any user either admin or candidate can only be logged in after being declared authenticate.

The system provides basic security features like password authentication that is declared CNIC. All the passwords generated and communicated to the users stored in the database for login management to prevent misuse. For secondary authentication there is Image recognition. System does not cause any harm to human users.

In case of any failure for example in database failure there would be backup or alternative solution. System uses secured database where password will be stored using md5 encryption technique. Normal users can just read information but they cannot edit or modify anything including their personal and any of the other information, system has different types of users and but only admin can look at the details.

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ACKNOWLEDGMENT

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