SIMPLIFYING THE USE OF OPTICAL MARK READER (OMR) TECHNOLOGY FOR PHILIPPINE ELECTIONS

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Abstract: The present Automated Election System (AES) uses the Optical Mark Reader (OMR) in a very ambitious but complicated way! This presentation shall address this issue but will focus on that portion of the AES that starts when the voter has already accomplished the election ballot form up to when the ballots have been read and the votes counted by the OMR. Towards simplifying the entire AES, it is proposed that the OMR be limited only to do the following basic functions: (1) At the start of counting of the votes in a given precinct all count registers in the OMR are set to zero; (2) the OMR accepts the ballots fed into it and each ballot is read only once; (3) the OMR determines whether or not a ballot that is read satisfies pre-specified conditions -- if so, the ballot proceeds for further processing; otherwise, it is moved to the tray for rejected ballots; (4) increment by one the number of votes of each candidate on the ballot for which a corresponding valid vote mark is detected; (5) move the counted ballot to the tray for accepted ballots; and, (6) after all the ballots are read, come up with the required electronic output/report of results from the OMR. It is also proposed that the OMR be activated to perform these functions only after the end of the voting period. The benefits and/or advantages of making these changes will be explained and discussed.

Introduction

Republic Act No. 9369, in Section 1 (Declaration of Policy), expresses the intention of ***"...improving on the election process and adopting systems, which shall involve the use of an automated election system..."*** and ***"...recognizes the mandate and authority of the Commission to prescribe the adoption and use of the most suitable technology of demonstrated capability..."*** and, in Section 5 (Authority to Use an Automated Election System), mandates ***"the Commission on Elections, herein referred to as the Commission, is hereby authorized to use an automated election system or systems in the same election..."*** and further specifies a ***"...paper-based or a direct recording electronic election system as it may deem appropriate and practical for the process of voting, counting of votes and canvassing/consolidation and transmittal of results of electoral exercises..."***

Clearly this law compels us to use an Automated Election System (AES) in Philippine elections and for the Commission to consider only two options: a paper-based (which optical mark reader/recognition, or OMR, is) or a direct recording electronic (DRE) election system.

In this same law, Section 6 (Minimum System Capabilities) specifies a minimum of 15 capabilities of the system. This set of capabilities was expanded in great detail in the *Project Specifications posted by the Commission on July 1, 2009 (http://www.comelec.gov.ph/modernization/2010_natl_local/technical_specifications.html#component1b)* wherein the technical specifications just for the PCOS unit numbered 32 items, one of which is Item 4, which is stated as **"The system shall be a fully integrated single device. The printing and transmission functionalities may or may not be integrated with the system."** This gives us the impression that most of these capabilities were concentrated in the OMR system

instead of spread over the entire AES -- the main reason why I believe that the configured OMR system is more complex than what it should be.

T**he** AES may be divided into 4 phases: (1) the registration of voters, which happens during many months long before election day; (2) the actual voting itself, and then (3) the counting of the votes and coming up with the election returns at the close of voting -- at the precinct level on election day; and then, finally, (4) the transmission of the election results from the precincts to the canvassing centers where the election results are aggregated and from where the results disseminated. This paper deals with the 2nd and 3rd phase of the AES and on the use of Optical Mark Reader (OMR) technology to automate the 3rd phase, but I would like to emphasize at the outset that our overarching objective is a better overall AES designed around the OMR technology, although the use of other technologies may also be needed. Moreover, it is important to point out that the various social and technical processes within the AES should be designed such that more attention should be made on the social or human processes that are intertwined with the technical processes.

At this point, very briefly, we describe the automated processes at the precinct that I have in mind, in broad terms. The OMR will operate independently of the computer (which I estimate will take much less than an hour) starting with the feeding of the ballots from a single precinct in a batch and ending with the generation of an electronic output file of the total number of votes per candidate on the ballot. Next, the computer gets the output file from the OMR and then generates the electronic Election Returns file; subsequently, the computer effects the printing of the printed Election Returns.

Note that, as described above, the precinct level AES component is off-line, meaning that there is no need to be connected to the transmission network. The connection of the computer to the network will only be activated when the precinct's Board of Election Inspectors (BEI) is about to transmit the electronic ER file to the canvassing centers and this will be done only after the members of the BEI have signed the printed ER.

Why OMR Technology?

OMR is a mature technology and, if set up properly, can be simple to use – simple enough so that it will not require an IT expert to operate.

The envisioned system architecture for the precinct level automated processes basically consists of a desktop or laptop computer, the OMR and a printer. In addition to this simple ICT infrastructure, it is also proposed that there be a specially-designed ballot box (more on this later) into which the voter feeds his/her accomplished ballot. Thus, note that, insofar as the voters are concerned, this step does not require them to interact with the computer or with the OMR – it is quite simple indeed!

In *"Voting Systems Used in U.S. Presidential Elections Since 1980" (http:// votingmachines.procon.org/view.resourcer.php?resourceID=000274),* the use of the OMR voting system (similar term to "Optical Scan voting system" that used in the report) has grown steadily from 2% in 1980 to 35% in 2004 (measured in terms electoral jurisdictions that use the system, but excludes jurisdictions that used mixed systems). Over the same period, a close competitor, the Direct Recording Electronic Voting Machine (DRE), also grew from nothing to 29.5% and the three others voting systems (Lever Machine, Punch Card

and Paper) have all declined in usage (43% to 14%, 31% to 13%, and 10.5% to 1%, respectively).

In *"America's Voting Systems in 2010" (http://www.verifiedvoting.org),* for 67% of American voters, voter-marked paper ballots are the standard voting system while 25% use paperless electronic voting machines. The report also indicates that OMR is the preponderant technology used.

I would like to include below, verbatim, an excerpt at the end of a written testimony by Dr. Aviel D. Rubin, Professor of Computer Science, to a US Government body on March 7, 2007. If you read the testimony in its entirety *(http://avirubin.com/Rubin.testimony.House.appropriations.3-7-07.pdf),* you will find that it is backed by serious research studies done not just by Dr. Rubin but together with other equally qualified scientists and engineers. (Note that the testimony highlights the two leading voting systems, OMR and DRE, which were used by more than 90% of American voters in the 2010 US Presidential Elections.)

> "A paperless DRE cannot be properly audited. Period. There are no records external to the system, and electronic data cannot be publicly observable. Furthermore, a DRE with a voter verified paper record (VVPR) is not as good as a paper ballot system with precinct-level op-scan counting. Here are the properties of optically scanned paper ballots that make them superior to any form of DRE voting.
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> - Faster voting eliminates or minimizes long lines because voters do not have to wait for machines to fill out their ballots. Scanning paper ballots takes seconds, whereas voting on a DRE takes minutes.
> - Even if the equipment fails, voters can keep voting. This is not true of DREs.
> - The technology is cheaper, with only one scanner and one ballot marker needed per polling place.
> - Audits are do-able, and much easier to perform than with commercial VVPR systems.
> - Redundant tally issues (paper vs. electronic) are simpler than in VVPR systems.
> - Ballot marking systems and external verification systems make paper ballot systems as accessible as DREs, and potentially more accessible that DREs with VVPR.
> - It is easier to preserve privacy than with VVPR, because most VVPR solutions store the paper records sequentially.
> - It is easier to use paper that is durable.
> - The operation is simpler and more transparent to voters.
> - Less software is required.
> - The system is simpler to administer."

In view of the above experiences and observations, in addition to our own exposure to the technology options, I am convinced that OMR technology is our best choice for developing the Philippine AES. Our challenge is in selecting what ICT resources to acquire and what to develop ourselves. I strongly believe that the Filipino can meet this challenge.

On the Ballots and the Ballot Box

It is proposed that all ballots be made of durable paper and be of standard size (say, A4) but that the color of the ballots for national candidates be different from that of the ballots for

local candidates. The main reason for this position has to do with the size of the ballot box and to make it easy to sort out the ballots for national and local candidates.

It is suggested that the ballot box be made of translucent material with an open top and a cover that can be locked onto the box. I think that we can design and fabricate a mechanism that can handle the following function: When the voter inserts his/her unfolded ballot (face down) into the box, through a horizontal slit on one side of the box, the ballot would drop to the bottom of the box and then a thin opaque piece of material would sit on top of the ballots that are stacked at the bottom of the box.

Note the transparency -- the voter could always see his/her ballot as it is inserted into the ballot box and the public could see that the ballots are inside the box but could not see the marks on the ballot. Moreover, as expected, the processes undertaken by the BEI, of removing the ballots from the ballot box, sorting them out, and feeding them into the OMR will be in full view of the public.

On the Electronic ER and the Printed ER

The electronic ER is processed by the computer from the OMR output file. Then the computer comes up with the printed ER in the required number of copies. Next, the BEI will review and then sign the printed ERs after which they will then trigger the automatic transmission of the electronic ER to the canvassing centers.

Note that the BEI is expected to perform the very simple function of triggering -- by just clicking on banners on the computer screen -- (1) the transfer of the OMR output file from the OMR to the computer, (2) the printing of the electronic ER, and then, finally, (3) the transmission of the electronic ER to the canvassing centers.

On the Software for the Computer and the OMR

The software for the Computer and the OMR are separate and thus would be simpler for examination by independent third parties before and also even after they are deployed in the field. Certainly, for programmers, these uncoupled software would be easier to deal with in designing, developing, installing, and, when necessary and properly authorized, revising the election system/applications software.

Because we are using standard computer and OMR hardware (with their respective operating systems, of course), we can acquire the best equipment through bidding in the open market; also, inasmuch as we are able to deal with the election system/applications software separately, we can greatly reduce our costs by having the bidding of the computers, OMRs, and printers done early.

Incidentally, on the legal issue of making the source code public upon deciding which technology to adopt for the AES, it is important to note that this issue becomes easier to deal with because the source code concerned will only be limited to the operating system of the OMR (and of the computer, separately, if this is still necessary). By the way, additional features or capabilities of the OMR to read other marks on the ballot (e.g., timing and framing marks and barcodes) in order to check on the validity and integrity of the ballot, are

expected to be an integral part of its operating system.

Additional Advantages/Benefits of the OMR-based AES

In addition to what has already been indicated above, I would like to state/amplify on other advantages/benefits.

- The electric power requirements are greatly reduced because the OMR-based system will need to operate only for a much shorter time. For the same reason, the use of direct-current power, such as that coming from a car battery, can be considered.

- Voting becomes easy and quick for the voters and can be managed better by those concerned inasmuch as the insertion of the accomplished ballot into the ballot box is quite simple and fast. Voting is uninterrupted even when there is power failure.

- The orientation of the voters on how to vote is limited to only filling the ballot and inserting this into the ballot box.

- The separation of the national ballot from the local ballot allows for better attention on the preparations and printing of the ballot by those concerned. I believe that we should not be too stingy in regard to having ballots of the best quality.

- To be able to accommodate the long list of party list candidates on the national ballot, I propose a different scheme of voting (just putting marks in the right places on the ballot) for party list candidates, as follows: From a printed list, which is separate from the ballot, wherein a 3-digit number (from 001, 002,..., up the total number of party list candidates) is placed opposite the party list candidate, the voter selects the number of the party list candidate of his/her choice, and enters the three marks that correspond to the selected number within the designated area in the ballot. This designated area, with a caption of "Party List" at the top portion, has three columns of 10 ovals with appropriately printed numbers within them, starting with "0" at the top of the column down to "9" at the bottom of the column, for every column. For example, if the number "047" is chosen, the voter darkens the oval with "0" on the 1st column, the oval with a "4" on the 2nd column, and the oval with a "7" on the 3rd column. Note that only a small area on the ballot needs to be allocated for this purpose; also, I believe the voter will find it easy to do this with the proper orientation.

- I believe that by simplifying the way we integrate the technologies and the social processes into a system that is transparent to and understandable by the general public, easy to operate by the concerned personnel, easy to use by the voters, and easy to deploy and manage, makes us more confident and trusting of the entire AES.

- Finally, I'd like point out a major national benefit/advantage for the country and that is the fact that this ICT infrastructure for the AES can also be used for many other purposes between elections. In general, we can enable the fast gathering of field data from all the barangays all over the country, that supports the timely analysis of nationwide data/information (in agriculture, education, health, environment, government services, etc.) and responsive decision-making and actions by the

concerned national government agencies. If we deploy this community-level ICT infrastructures in public schools and empower some teachers to operate them, then they can participate in using them all year round and avoid the cost of having to store them. It's obvious that investing in the acquisition and maintenance of these ICT infrastructures will be well worthwhile.