

“ HYBRID SOLUTION FOR NATIONAL ELECTION SYSTEM ”

A Thesis

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by

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DECLARATION

This is certified that, I, Md. Rashidul Hasan bearing university ID 01201066 completed some modules of our proposed Hybrid Solution for National Election System (Polling Center Details Setup, Polling Booth Details Setup and Vote Casting Process System) under the CSE 400 course and I therefore declare that the thesis has not been submitted elsewhere for the requirement of any degree or for any other purposes except this publication.

Signature of
Supervisor

Signature of
Author

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Finally I express my sincere appreciation to my parents and friends without whose support and encouragement it would not have been possible to complete this work. I would like to dedicate my thesis to my mother and late father.

ABSTRACT

Objective of this project is to understand the existing National Election System in depth, to find out the problems in each stage. According to the findings we will try to give possible solutions of the problems in different stages in the context of Bangladesh. Our main objective is to find out a “Hybrid” solution for existing National Election System for a smoother & transparent way from using current infrastructure & resources.

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CHAPTER 1

INTRODUCTION

1.1 Information on Bangladesh Electoral System

Bangladesh started its journey with Parliamentary System of Government, then switched over to Presidential System and in 1991 reverted back to Parliamentary system. Parliament consists of three hundred members elected in accordance with law from single-member territorial constituencies. Besides this there was a provision for thirty seats reserved exclusively for women members up to the year 2000 who were elected according to law by the members of Parliament. Parliament has tenure of 5 years unless dissolved sooner.

1.2 Criteria for Election Systems

Based on the tradition of elections and voting systems in the Bangladesh, elections systems—whether through traditional voting methods or SMS voting are commonly expected to satisfy a number of criteria, including:

Eligibility and Authentication - only authorized voters should be able to vote

Uniqueness - no voter should be able to vote more than one time

Accuracy - election systems should record the votes correctly

Integrity - votes should not be able to be modified, forged, or deleted without detection

- Verifiability and Audit ability - it should be possible to verify that all votes have been correctly accounted for in the final election tally, and there should be reliable and demonstrably authentic election records

- Reliability - election systems should work robustly, without loss of any votes, even in the face of numerous failures, including failures of voting machines and total loss of Mobile communication
- Secrecy and Non-Coercibility - no one should be able to determine how any individual voted, and voters should not be able to prove how they voted (which would facilitate vote selling or coercion)
- Flexibility - election equipment should allow for a variety of ballot question formats (e.g., write-in candidates, survey questions) be compatible with a variety of standard platforms and technologies; and be accessible to people with disabilities
- Convenience - voters should be able to cast votes quickly with minimal equipment or skills
- Certifiability - election systems should be testable so that election officials have confidence that they meet the necessary criteria
- Transparency - voters should be able to possess a general knowledge and understanding of the voting process
- Cost-effectiveness - election systems should be affordable and efficient.

For new election systems to be adopted, it is likely that they will need to satisfy all, or nearly all, of these requirements.

1.3 Voter Awareness

Voter awareness is an important factor to conduct an election in a free, fair and impartial manner. Willingness of the eligible persons to be registered as voters and their participation in the voting process are important ingredients for a sound democratic process.

Right from enumeration work for registration of voters to the time of casting of votes at the Polling station, efforts are made to make people aware of their right of franchise and the importance of the exercise of this right. The Election Commission undertakes voter education programs on democracy and various aspects of election through different news-media, cinema slides, Radio and TV.

The Mass Communication media, Department of Films and Publications also play significant roles to educate voters on their right of franchise and the method of casting votes. The Election Commission also arranges through the Divisional and District authorities including Thana administration meetings/rallies with the electorate, representatives of political parties, local elite and people of all walks of life for creating awareness about democracy, the right and value of franchise.

The public awareness campaign also includes a series of poster campaigns. Rallies and processions are organized to mobilize public support for free and fair elections. Special events like folk songs and drama are also organized by local volunteers.

Non-government organizations are also encouraged by the Election Commission to conduct voter education programs with the materials (posters, slides, films etc.) developed by them highlighting the importance of vote, the right of the voter, functions of the legislature, responsibilities of the elected representatives to the electorate.

The underlying idea of voter awareness programs is to ensure large-scale participation of citizens in the choice of their representatives so that establishment of a representative and responsible government is ensured.

1.4 Gender and the Electoral Process

Nearly fifty percent of the total populations in the country are women. It is, therefore, essential that they participate in large numbers in the electoral process.

In the electoral process, persons irrespective of gender status can contest the elections for general seat in the Parliament and also elections to local bodies. During the last general elections to the Parliament in October, 2001, 38 women

contested in 46 general constituencies. Of them 6 won seats. One woman won in all the 5 seats she contested. Another woman won 4 seats out of 5 she contested. Besides, there are reserved seats for women candidates in the local level elections. But women participation in the electoral process has been found to be discouraged by a number of factors. Conservative women feel hesitant to meet male registration personnel due to social and religious restrictions. Potential violence and absence of convenient transportation system, especially in the rural areas, also discourage women from participating in the electoral process.

For the convenience of women voters, electoral rolls are prepared separately for them and separate polling booths are set up in the polling centers. Women polling personnel are generally appointed to help women voters go about meeting voting formalities in the polling station. Deployment of women security personnel and magistrates in and around the polling centers are preferred, so that women voters can cast their votes without intimidation, fear and hindrance. Extensive voter education program for large-scale female participation is also conducted. All these steps have resulted in noticeably large turn-out of women voters in large numbers.

What is needed to attain their extensive participation in exercising suffrage is to motivate them adequately through education while creating a reassuring environment in which female voters can come to the polling station and cast their vote without intimidation and fear.

1.5 Training and Technology

Election is an integral part of the institution of democracy and as such, a free, fair and efficient election process is a must for safeguarding democracy. Effective and fairly conducted election largely depends on skilled and well-trained election personnel as well as on the awareness of the voters and political activists about their franchise rights and knowledge of election rules and regulations.

1.5.1 Training Objectives of Bangladesh Election Commission

The Bangladesh Election Commission is putting in considerable efforts in making the existing election process effective and smooth. In a bid to cope with the changing circumstances and to familiarize the election officials, political activities and voters with the election process, the Election Commission has established one Electoral Training Institute in Dhaka. Since election process involves complex functions and procedures it is necessary that the election personnel take extensive training in performing their task properly and effectively. This applies also to voters and political activists so that they also share similar knowledge about election procedures. The objectives of such specialized training are:

- To create an efficient electoral management system.
- To provide training facilities for the polling personnel.
- To educate the polling agents and political activists.
- To make the voters aware about their civil, political and franchise rights.

1.5.2 Training Programs

So far training programs have been conducted on the methods and procedures of –

- Voter Registration.
- Up-dating the electoral rolls of election.
- Election offences.
- Pre-poll irregularities.
- Duties and responsibilities of the polling personnel.
- Role of Judicial officials of Electoral Enquiry Committees.
- Duties and responsibilities of law enforcing agencies.

- The requirement and the use of different forms, packets and materials at the polling station.
- Conducting polls, franchise rights and role of the voters.
- Role of observers.
- Role of political activists in ensuring fair election.
- Process of counting of votes.
- Preparation of ballot paper account.
- Statement of counts and consolidation of results etc.

1.5.3 Training through Election Commission

The Election Commission arranges several training programs for training of the polling personnel on election process centrally at the Electoral Training Institute in Dhaka as well as at Divisional, District and Thana/Upzila head quarters. Separate handbooks and manuals on election process for the guidance of the Returning Officers, Presiding and Assistant Presiding Officers, Polling Officers etc. are also prepared and distributed under the direction of the Election Commission.

1.5.4 Role of Radio and Television

Extensive use of the mass media including Radio & TV has been made in relaying voter education message through radio spots, documentaries, and short films etc.

1.5.5 Training Through Computer Technologies

The Election Commission Secretariat already houses several stand-alone PCs. Projects are underway to equip the secretariat with modern powerful computers which will be connected to the computers located in all districts of Bangladesh.

Upon successful completion of such countrywide network, the Election Commission Secretariat will be able to train all district election personnel through this network. The Electoral Training Institute which already uses some of its computers for preparing training materials will be able to send training manuals electronically to all district office computers.

1.6 Poll and Count

According to law, casting of votes and counting of votes are the pivotal and final tasks in the whole process of the election, though the consolidation of results and declaration of the names of returned candidates are the subsequent legal requirements.

1.6.1 Before Poll

The Returning Officer provides each Presiding Officer with necessary ballot boxes of such material and design as are approved by the Commission. Not more than one ballot box is used at a time for the purpose of the poll at any polling booth.

1.6.2 Poll

At least half an hour before the time fixed for the commencement of the poll, the Presiding Officer is required to ensure that every ballot box to be used is empty, show the empty ballot box to the contesting candidates and their election agents and polling agents whoever may be present, close and seal the ballot box and place the ballot box so as to be conveniently accessible to the elector visible to all present in the booth officials and election or polling agents as may be present. Every elector will mark his ballot paper in secret before the same is folded and inserted in the ballot box by the elector himself. The Presiding Officer regulates

the number of electors to be admitted to the polling station at a time and excludes from the polling station all other persons except those connected with the polling. The Presiding Officer is responsible for keeping order at the polling station so that an elector can exercise his free will to cast his vote at the polling station.

Where an elector presents himself at the polling station to vote, the Presiding Officer shall, after satisfying himself about his identity, issue to him a ballot paper after giving him a personal mark made with indelible ink on his thumb or any other finger of either hand, placing a mark on the electoral roll against the number and name of the elector to indicate that a ballot paper has been issued to him and recording the elector's number and procuring signature of the elector on the counter foils of electoral roll and ballot paper respectively . The elector, on receiving the ballot paper, shall forthwith proceed to the place reserved for marking the ballot paper, put the prescribed mark on the ballot paper at any place within the space containing the name and symbol of the contesting candidate for whom he wishes to vote and after he has so marked, fold the ballot paper and insert it in the ballot box. He has to do the whole thing at the quickest speed.

If a person representing himself as an elector applies for a ballot paper when another person has already represented himself as that elector and has voted under the name of the person so applying, he shall be entitled to receive a ballot paper which is called a tendered ballot paper. The Presiding Officer maintains separate accounts of tendered and challenged votes and also spoilt ballot papers as per law.

1.6.3 Count of Votes

The polling time is generally 0800-1600hrs local time. No person is allowed entry into the polling station enclosure after 1600hrs.

Immediately after the close of the poll with the casting of vote by the last voter of the day, the Presiding Officer, in the presence of such of the contesting candidates, election agents, polling agents and election observers as may be present, proceeds with the count of votes.

The Presiding Officer gives such of the contesting candidates, election agents and polling agents as may be present, reasonable facility of observing the count and gives them such information with respect there to as can be given consistent with the orderly conduct of the count and the discharge of his duties in connection therewith.

Under the law no person other than the Presiding Officer, the Polling Officer, any other person on duty in connection with the poll, the contesting candidates, their election agents and polling agents are to be present at the count. However, authorized observers are allowed by the Election Commission to observe the count as a special dispensation. The Presiding Officer shall open the used ballot box or ballot boxes and count the entire lot of ballot papers taken out there from in presence of these persons.

The valid ballot papers cast in favor of each contesting candidate are preserved in separate packets. The Presiding Officer, immediately after the count, prepares a statement of the count and if so requested by any candidate or election agent or polling agent present, gives him a certified copy of the statement of the count and the ballot paper account. The Presiding Officer puts in good order all records of the poll and sends them to the Returning officer immediately.

The Returning Officer is required to give the contesting candidates and their election agents a notice in writing of the day, time and place for the consolidation of the results and, in the presence of such of the contesting candidates and election agents as may be present, consolidate in the prescribed manner the

results of the count furnished by the Presiding Officer, including there in, the postal ballots received by him before the time aforesaid.

1.6.4 Recount

The Returning Officer shall recount the valid ballot papers in respect of any polling station if the count by the Presiding Officer is challenged in writing by a contesting candidate or his election agent and the Returning Officer is satisfied about the reasonableness of the challenge or he is directed so to do by the Commission.

1.7 Our Findings from the current National Election System

Composite paper ballot elections have been prone to human error, particularly -

- Subjective discretion applied when deciding valid votes.
- Tallying votes when the deputy returning officer is communicating votes to the poll clerk orally.
- Transposition errors when carrying figures from tally sheets to final statements.

In addition, the operating costs associated with composite paper ballot elections are as much as three times that of an automated election. The increase in costs include –

- The requirement for more voting subdivisions with fewer voters to ensure the manageability of the counting process.
- The employment of staff at the voting places and additional staff to count ballots at the close of voting and
- The associated recount costs.

1.8 Voting System Used in Abroad

It examines the following types of voting systems:

- Mechanical Lever Machines
- Punch cards
- Optical Mark Reading (Optical Scan)
- Direct Recording Electronic (Touch Screen)
- Telephone
- Mail
- Automated Terminals or Kiosks
- Internet

1.9 Our Proposed Solution

- Greater professionalism, transparency and accountability in delivering cost-effective elections.
- Re-delimitation of the country into voting districts to improve access to polling stations.
- Increasing voter participation.
- Conducting ongoing and specific registration activities to grow the existing voters' roll.
- Enhancing the information technology (IT) infrastructure.
- Increasing the use of emerging technologies to improve efficiency.
- Counting, verification and announcing of results within short period of time.

To improve the overall efficiency of this processes and to provide multiple service channels to both its election commission employees and the public, we implemented leading-edge Short Message Service (SMS). The SMS and Wireless Application Protocol (WAP) services provided included the following:

- On Election Day the voter will cast their vote by pressing the button and through SMS (Short Message Service) system this vote will send to the main database server. At the end of the Election Day the database server will automatically generate the result for each constituency.
- Voters could obtain voter registration information using their mobile phone simply by sending an SMS with their 13-digit identity number. The voters would then receive reply SMS containing information about their voter status and where they were registered to vote.
- The public SMS service was expanded during election period to provide the public with news headlines and election results. The public could obtain national election results by sending an SMS with key words.

1.10 Our proposed Voting System

Our system works in three phases. The work flow of our system is described below:

- **Initial Setup of the System:**
 - *Mobile Phone Registration:* Each Polling Booth will be registered with a unique mobile number in the system's database
 - *Candidate Registration:* Each candidate will be registered in the system's database with their unique candidate ID's
 - *Party and Constituency Registration:* Each party and constituency will be registered in the system's database with their detail information
- **Vote Casting Process:**
 - *Voter Authentication:* When a voter comes to the polling center for voting he/she is manually authenticated by the Polling Officer whether he/she is a valid voter
 - *Electronic Voting:* Voters send the unique candidate IDs as their votes using the Voting Device which utilizes SMS technology

- *SMS Delivery Notification*: Voter is notified of successful SMS delivery. This will be done by the mobile network service providers like GP, Aktel, Bangla Link etc.
- *Invalid Vote Cast Notification*: Voter is notified of unsuccessful Vote Cast like invalid voting format or mobile number
- *Electronic Vote Recording*: Successful vote casts are updated in the database server accordingly
- **Result Generation:**
 - *Electronic Vote Counting*: After polling hour Super User initiates the counting command, the stored data is then retrieved from the database for counting by the system
 - *Electronic Report Generation*: Based on the counting results the system will generate following reports:
 - Result by Constituency
 - Result for each polling center
 - Determining the winning candidate

In the Vote Casting Process for voting we will use an Electronic Device on the National Election Day. The device will have two components. First one is a Control Unit which will be kept to the Polling Officer to Activate the Voting Machine. Another one is the main voting machine which will be kept into the Polling Booth. The voter will just have to press the button besides his/her preferred candidate. Voters can select any candidate for several times till he/she press the final voting button. Once the voter press the final Voting button the vote will be casts and the device will be inactive. Now again the Polling Officer will have to re-active the device by pressing the control button for next voter.

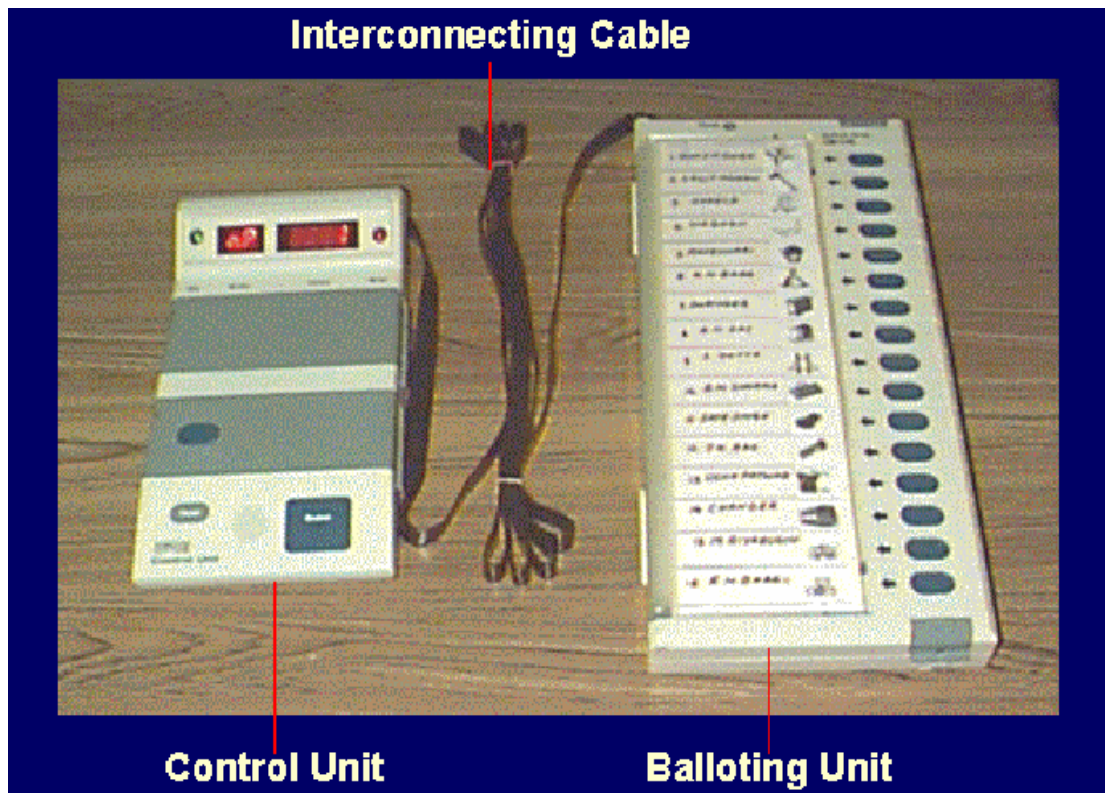


Figure 1.10: Electronic Voting Device

1.11 Feasibility of our solution

- May be initially installed in highly risked areas where the risk of ballot box hijacking is very high. We can use our system as the Pilot Project.
- For election it is possible to switch off all the mobile connections except registered mobiles with Dedicated Network.
- So the possibility of the mobile network congestion will not occur as there will be less numbers of mobiles under each Base Transceiver Station(BTS)
- Our system will be re-usable in the next election by simply resetting the machine
- It is a very simple system to operate and can be installed in short time.

1.12 Advantages of the System

- System has simple voting interface for the voters.
- System Counts and Generates Results automatically within short period of time.
- By using our system Involvement of high human workforce will go down
- This system is more Secured, more Dependable and more Efficient

1.13 Limitations of the System

- Though we implemented the voting data encryption-decryption but has not yet been integrated to the system
- We could not able to test the system with huge amount of data for shortage of human resource
- We could not able to test the system with huge number of mobiles for the shortage of adequate number of mobile phones

1.14 Module Design

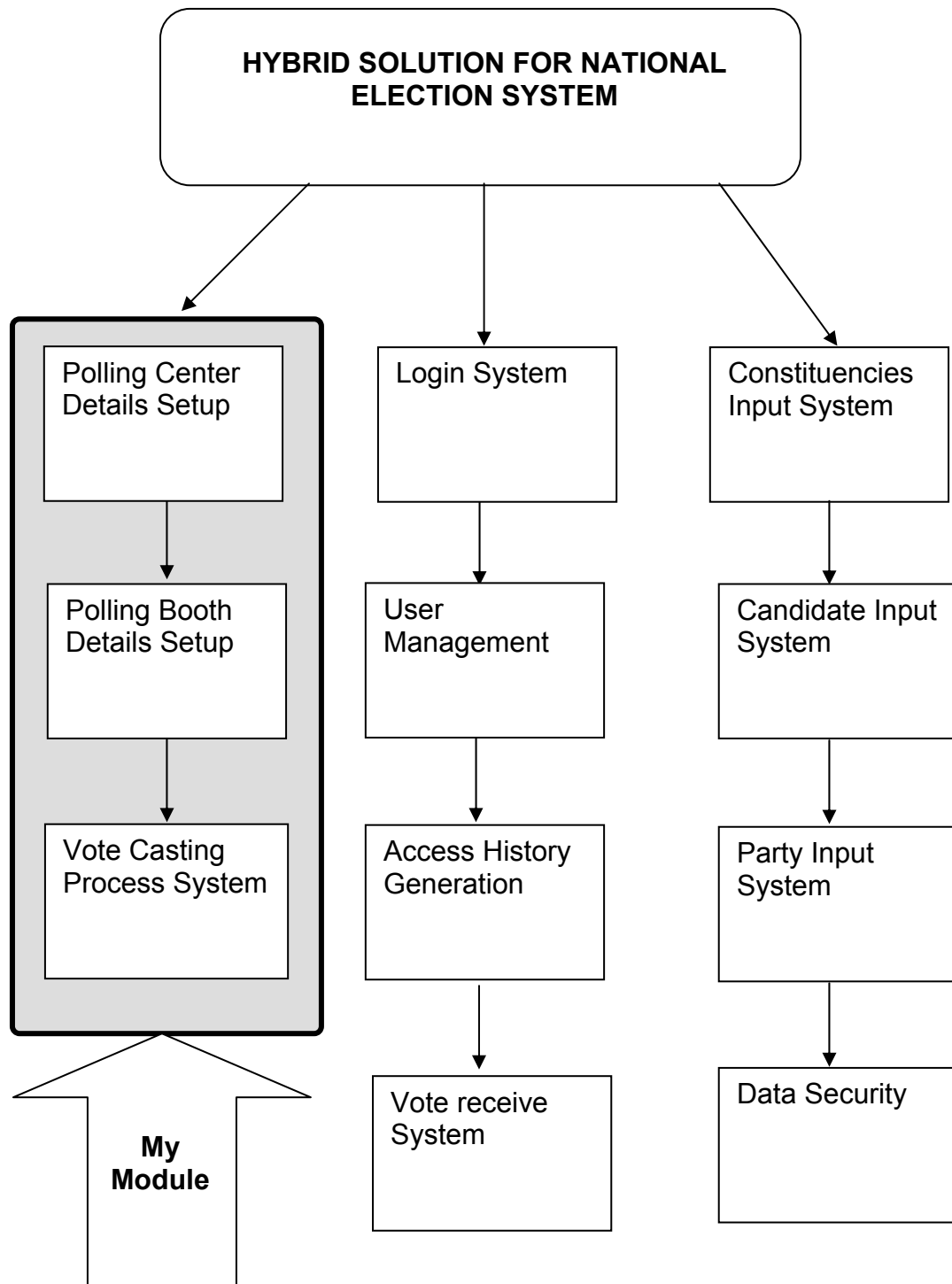


Figure 1.14: Module Diagram of proposed Electronic Election System

The upper figure shows the full system block diagram for a hybrid solution for national election system. There are eleven modules in the diagram that were distributed to the team members. The list of the team members and corresponding modules are as follows :

Team Members	Modules
1. Md.Rashidul Hasan	Polling Center Details Setup Polling Booth Details Setup Vote Casting Process System
2. Hasanul Bari	Login System User Management Access History Generation Vote Receive System
3. Md.Naimuzzaman	Constituencies Input System Candidate Input System Party Input System Data Security

CHAPTER 2

METHODOLOGY

2.1 System Development Methodology

The systems development methodology is meant to provide a uniform approach to managing systems development while providing sufficient flexibility to choose the techniques and tools best suited for a specific task. It is to be used as a guideline to all of those involved in systems development, acquisition, implementation, and conversion. Each model defines the deliverables that are to be produced during the process as well as the tasks to be performed and who is to perform them. It also defines what should be created and what tasks are likely to be executed to create the deliverable

As we were to develop National Election System software where we need a huge amount of data collection like constituencies details, polling center details, candidate details and party details so we chose RAD(Rapid Application Development) methodology for our system development. There was another reason behind that we had only 5 weeks ahead of us when we started that means we had time constraints.

“Rapid Application Development (RAD) is a development lifecycle designed to give much faster development and higher quality than the traditional lifecycle. It is designed to take advantage of powerful development software. RAD is used for building large Information System applications of the kind which occur in every large business.”

- Rapid Applications Development by James Martin

2.2 RAD Methodology

A methodology must be used which has been adapted to match the needs of the toolset being used. Toolsets should integrate:

- prototyping
- graphical computer aided modeling and design
- a repository of design information and reusable components
- automation for enforcing design integrity
- integrated code generator, testing tools
- thorough end-user interaction with developer, aided by tools

2.3 Spiral Development Methodology

In our system development process we used throwaway prototyping. Our throwaway prototyping methodology is a modified version of the spiral development methodology developed by Barry W. Boehm, "A Spiral Model of Software Development and Enhancement" Computer, May 1988, 21(5): 61-72.

2.4 Advantages of the Spiral Model

- The spiral model is a realistic approach to the development of large-scale software products because the software evolves as the process progresses. In addition, the developer and the client better understand and react to risks at each evolutionary level.
- The model uses prototyping as a risk reduction mechanism and allows for the development of prototypes at any stage of the evolutionary development.

- It maintains a systematic stepwise approach, like the classic life cycle model, but incorporates it into an iterative framework that more reflect the real world.
- If employed correctly, this model should reduce risks before they become problematic, as consideration of technical risks are considered at all stages.

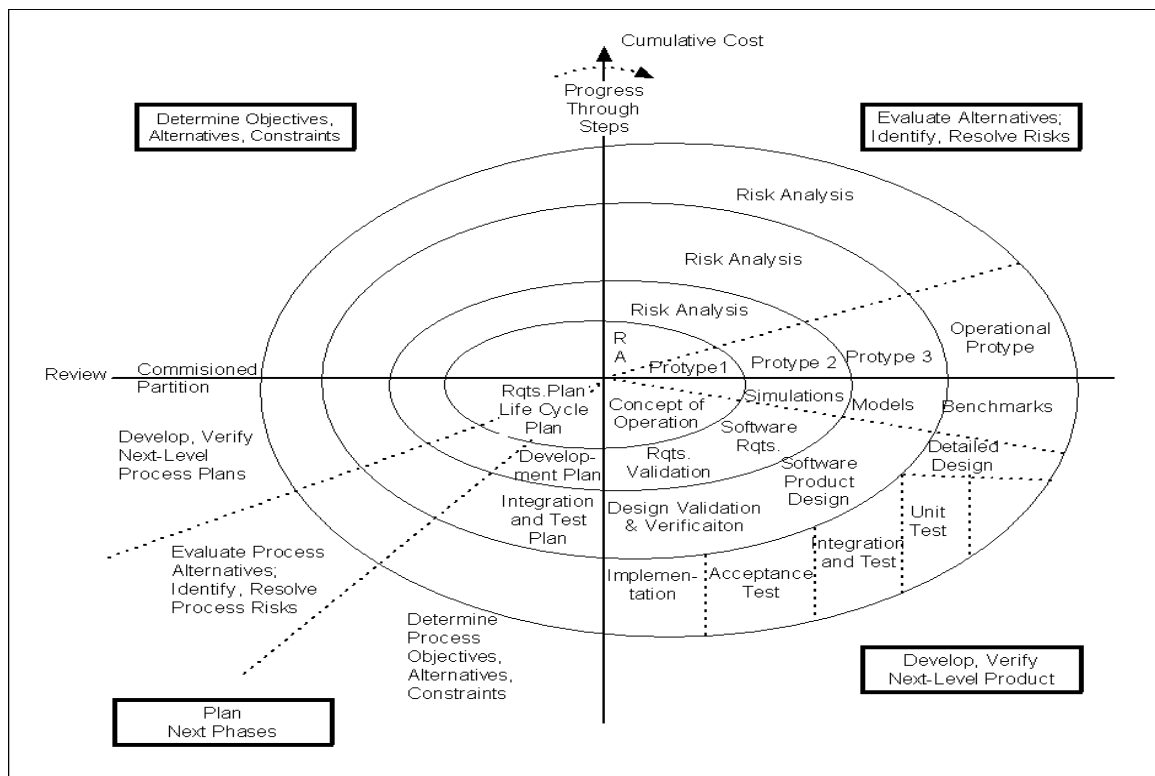


Figure 2.4: The Spiral Model

CHAPTER 3

SYSTEM DEVELOPMENT

3.1 Project Initialization and Planning

3.1.1 Polling Center Details Setup

As our system is an election system so there has to be an input system where polling center details will be input. This input is done by the administrator because there is a matter of security. Otherwise unauthorized center name can be inserted. Polling center details setup module is a process that does the following things:

- Input the center number then it will generate a unique center no
- Input the center name
- Input the constituency name
- Input the number of booths
- Input the number of registered voter
- Administrators can see the details of the polling center

3.1.1.1 Benefits

- Can get detail list of polling centers
- Easy to get the number of polling center for each constituency
- Easy to get the number of booths for each center
- Easy to get the number of registered voter for each center
- Easy to generate reports based on centers

3.1.1.2 Special Issues

This module is secured by the authentication of administrators so, other users will not be able to give the inputs. It shows the detail list of authorize centers.

3.1.1.3 Feasibility Analysis

- Polling center details setup is done manually which is a lengthy process. Hence our process is easier, short and faster
- Use MS Excel to store information which is not secured. It gives the storage security

3.1.2 Polling Booth Details Setup

For each polling center there will be at least three or more than three polling booths depend on the registered voter. In our system for each polling booth there will be one registered mobile. So this mobile number input is done by the administrator because there is a matter of security. Otherwise any mobile number can be inserted. Polling booth details setup module is a process that does the following things:

- Input the center no
- Input the registered mobile number
- It shows the details of registered mobile number for each polling center

3.1.2.1 Benefits

- Get the list of registered mobile number of any polling center
- Easy to generate reports based on registered mobile number

3.1.2.2 Special Issues

This module is secured by the authentication of administrators so, other users will not be able to give the inputs. It shows the detail list of registered mobile number.

3.1.2.3 Feasibility Analysis

- In our system mobile number registration process is easier, short and faster.
- Use MS Excel to store information which is not secured. It gives the storage security
- Effective searching method

3.1.3 Vote Casting Process System

On Election Day the voter will go to the polling booth and cast their vote. Voter will only send the candidate number which is an unique number all over the constituency.

Vote Casting Process System module is a process that does the following things:

- Unique candidate number for the contestant candidates
- Input the candidate number

3.1.3.1 Benefits

- Easy to generate result by center, by constituency, by party and by candidate based on the casts votes.

3.1.3.2 Special Issues

This module is secured by the authentication of administrators so, other users will not be able to give the inputs.

3.1.3.3 Feasibility Analysis

- Paper based vote casting which is a lengthy process. Hence our process is easier, short and faster.

- Use MS Excel to store information which is not secured. It gives the storage security

3.1.4 Test Plan

There is often a temptation to rush into testing as soon as the very first program modules are complete and spontaneously test different events and possibilities without spending time to develop a comprehensive test plan. This is dangerous because important tests may be overlooked, and if error does occur, it may be difficult to reproduce the exact sequence of events that caused it. So instead, testing like that we do testing systematically and the results keep inform of documentation so that we must know what has and has not been tested. Below is my test plan sequence:

Unite Testing: Unit testing focuses on one unit- Polling center details setup module, polling booth details setup module, vote casting process module, it focused on the performance of each module that I built. I used black-box testing method as being a programmer I tested the unit. So, no need for interpretation.
[Ref to testing, Chapter 5]

Integration testing: After my unit testing I checked whether my modules worked properly. So I ensured that the interfaces and the linkage between my modules are working accurately. The focus moved to the flow of controls among my first two modules and the process of proper vote casting.

System testing: Our respected supervisor conducted system testing. Our complete system was tested in broad version. It examined how well the system meets our national election purposes and its usability, security, and performance under heavy load.

Acceptance testing: It was more likely beta testing. Our real virtual remote users were sitting back as users and our respected supervisor conducted the polling. There were no test data. We used real data and closely monitor the system for errors or use.

3.2 Analysis

Requirement analysis unambiguously describes what has to be built. There are many ways of specifying requirements like plans, models, prototypes and simulation. Prototyping is excellent choice because they best enable the project team to adjust the functionality in the system on the basis of a specific delivery date. We being the project developer had our solution with mobile technology and we use SMS for communication. It is a new technology adopted by the computer programmer. So there is high risk with such technology. Prototype is particular appropriate for a lack of familiarity with technology because it explicitly encourages the developers to develop design prototypes for areas with high risks. So we had chosen prototype for our initial requirement gathering after field work of requirement gathering.

3.2.1 Building the Prototype

There are two important aspects here. One aspect is communication. In all of these processes it is necessary to reach agreement, to specify what we are to do and to represent it in an unambiguous way. The second aspect is organization of this work into a process that must eventually produce a new system. Doing so is not an easy work to accomplish. Our respective supervisor asked us to go to the National Election Commission (NEC) to know in depth the whole election process. We first talked to the External Relation Officer (ERO) to know the whole working system on the Election Day. We tried to find out how the voting is done and who plays the roles of several responsibilities. Then we personally did all steps of voting like coming to the polling center to result generation. We also did some paper works to calculate the time difference between existing system and our planned system. We were concerned about the triggers in the complete scenario. We must need to understand some important aspects:

- The main objectives that drive how voting is done
- The information people need for the voters and also to do vote
- The data (party info, candidate info, constituency info, polling center info, polling booth info, voter info) handled within the NEC
- When, how, and by whom vote are counted

- The sequence of voting process
- Security, counting, result generation issues

To work out such difficulty our supervisor recommended us to put up a prototype model. He advised us to exploit excel as the computer tool. Because in excel we be able to see the unprocessed data in front of us and then also monitor the data flow which can solve our data-handling problem. So we designed our prototype using excel and macros. We noticed that here we have three stakeholders; first stake holder is developer who will design and offer program, NEC are responsible for storing votes and other information and also for result generation and voters will cast their votes. Therefore, we divided entire process in respect of activities.

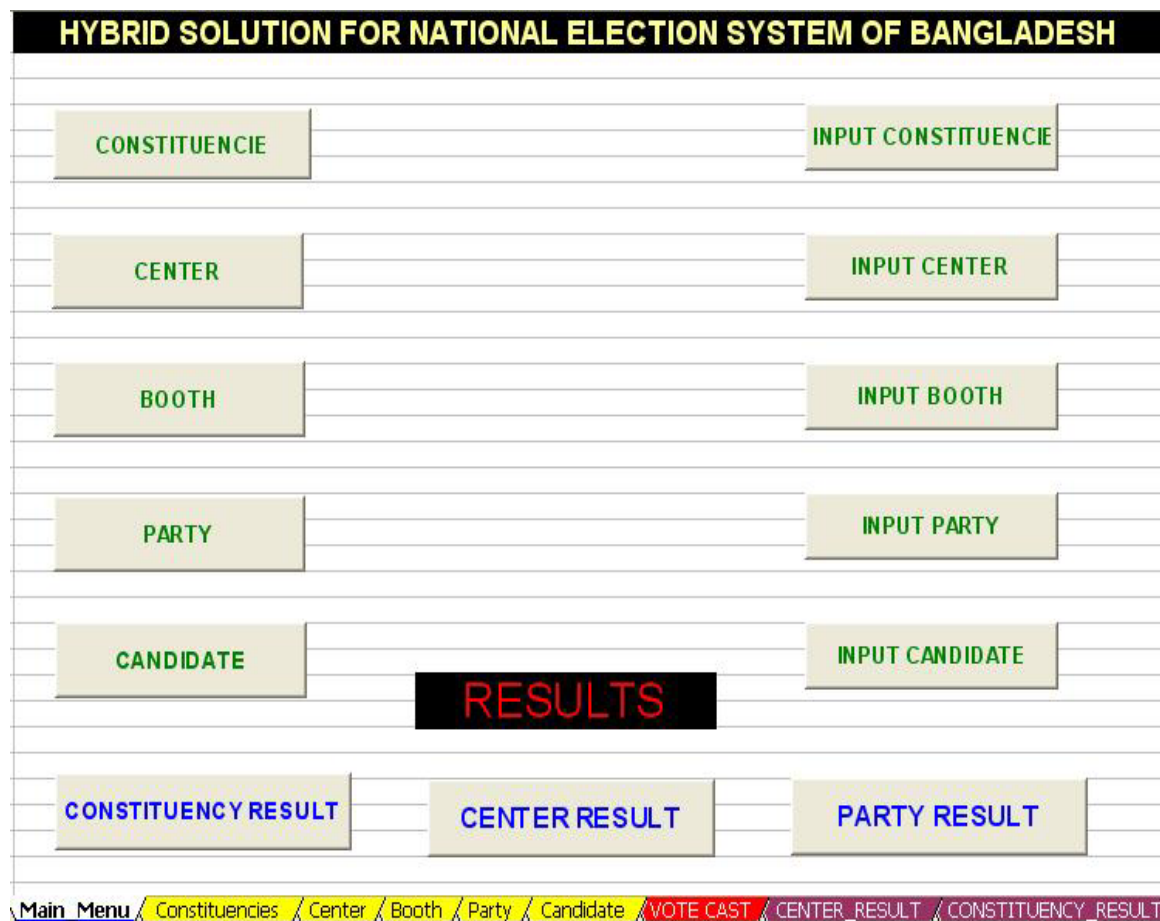
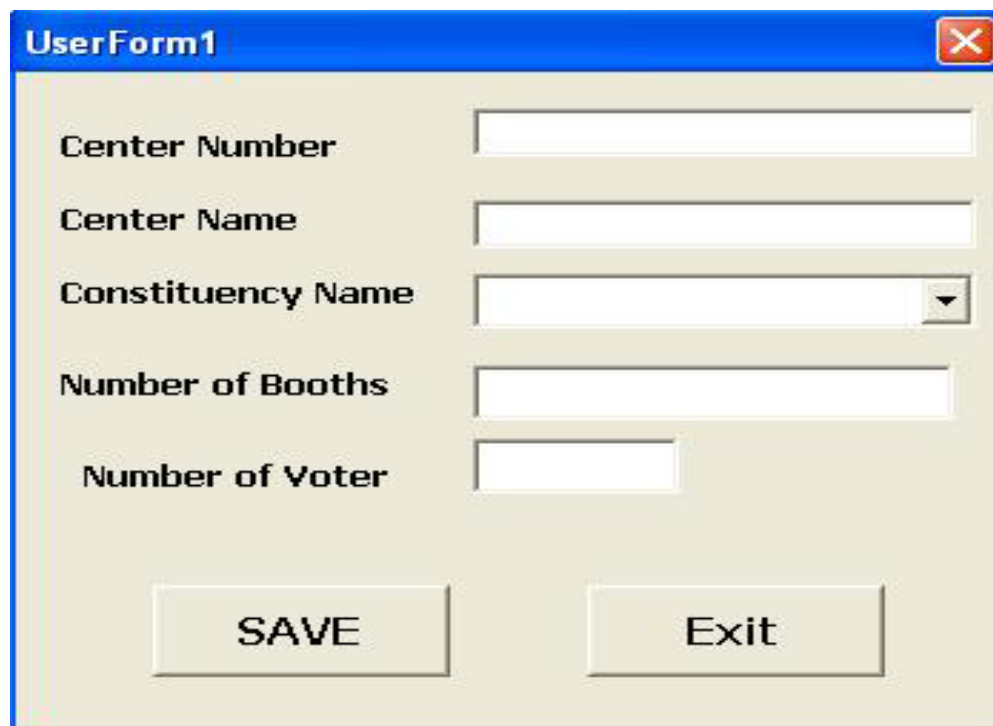


Figure 3.2.1: Interface of the Prototype

At the beginning I tried to figure out what types of information are required to do the voting for the National Election. As my module was polling center details setup, polling center details setup, vote casting process system by giving inputs necessary information, I worked out that module. I, using visual basic scripts on excel, designed the interface and put data. I saved that data on another excel sheet. Thus I distinguished and observed the data flow.



The image shows a Visual Basic UserForm titled "UserForm1". It contains five input fields for data entry:

- Center Number**: A text box.
- Center Name**: A text box.
- Constituency Name**: A dropdown menu.
- Number of Booths**: A text box.
- Number of Voter**: A text box.

At the bottom of the form, there are two buttons: "SAVE" and "Exit".

Figure 3.2.2(a): Polling center details setup

HYBRID SOLUTION FOR NATIONAL ELECTION SYSTEM							
center_no	center_name	name_of_constituencies	no_of_booth	voter	GO TO MAIN MENU		
1-Dhaka01	Brac Center	Dhaka-1	5	2,009			
1-Dhaka02	Titumir College	Dhaka-1	6	1,692			
1-Dhaka03	East West University	Dhaka-1	5	1,835			
2-Dhaka01	Uttara High School	Dhaka-2	5	1,332			
2-Dhaka02	Uttara Girls School	Dhaka-2	5	1,507			
2-Dhaka03	Azampur Govt. Primary School	Dhaka-2	6	2,073			
3-Dhaka01	Sector -4	Dhaka-3	5	2,003			
3-Dhaka01	Sector -11	Dhaka-3	5	1,073			
3-Dhaka01	Sector -8	Dhaka-3	5	2,070			
1-Rajshahi01	PN School	Rajshahi-1	5	1,696			
1-Rajshahi02	Govt. Laboratory School	Rajshahi-1	8	2,310			
1-Rajshahi03	Collegiate School	Rajshahi-1	5	1,513			
2-Rajshahi01	Tikapara High School	Rajshahi-2	5	1,942			
2-Rajshahi02	Rajshahi College	Rajshahi-2	5	2,776			
2-Rajshahi03	New Govt. Degree College	Rajshahi-2	6	2,017			
3-Rajshahi01	Padma Housing	Rajshahi-3	5	1,042			
3-Rajshahi02	Uposhohor	Rajshahi-3	5	1,902			
3-Rajshahi03	Tanore	Rajshahi-3	5	2,942			

Figure 3.2.2(b): Polling center details setup data

In figure 3.2.1(a), you can see that the administrator is doing polling center details setup by inserting center number, center name, constituency name, number of booths and number of voter. . Figure 3.2.1(b) shows that how the information are stored in the excel sheet. These data will be used to compare

The image shows a Windows-style dialog box titled "UserForm1". It has a blue title bar with a red close button in the top right corner. The main area has a light beige background. There are two labels on the left: "Center Number" and "Mobile Number". To the right of "Center Number" is a dropdown menu showing "1-Dhaka01" with a small downward arrow. To the right of "Mobile Number" is a text input field containing "0171174835". At the bottom, there are two buttons: "SAVE" on the left and "EXIT" on the right.

Field	Value
Center Number	1-Dhaka01
Mobile Number	0171174835

SAVE EXIT

Figure 3.2.3(a): Polling booth details setup

HYBRID SOLUTION FOR NATIONAL ELECTION SYSTEM				
center_no	mobile_no			
1-Dhaka01	0171000001	GO TO MAIN MENU		
1-Dhaka01	0171000002			
1-Dhaka01	0171000003			
1-Dhaka01	0171000004			
1-Dhaka01	0171000005			
1-Dhaka02	0171000006			
1-Dhaka02	0171000007			
1-Dhaka02	0171000008			
1-Dhaka02	0171000009			
1-Dhaka02	0171000010			
1-Dhaka02	0171000011			
1-Dhaka03	0171000012			
1-Dhaka03	0171000013			
1-Dhaka03	0171000014			
1-Dhaka03	0171000015			
1-Dhaka03	0171000016			
2-Dhaka01	0171000017			
2-Dhaka01	0171000018			
1-Rajshahi01	0171000019			
1-Rajshahi01	0171000020			
1-Rajshahi01	0171000021			
2-Rajshahi01	0171000022			
2-Rajshahi01	0171000023			
2-Rajshahi01	0171000024			

Figure 3.2.3(b): Polling booth details setup data

3.2.3(a) you can see that the administrator is giving the input of center number and mobile number. In figure 3.2.3(b), it shows how the data are stored in the excel sheet.

HYBRID SOLUTION FOR NATIONAL ELECTION SYSTEM

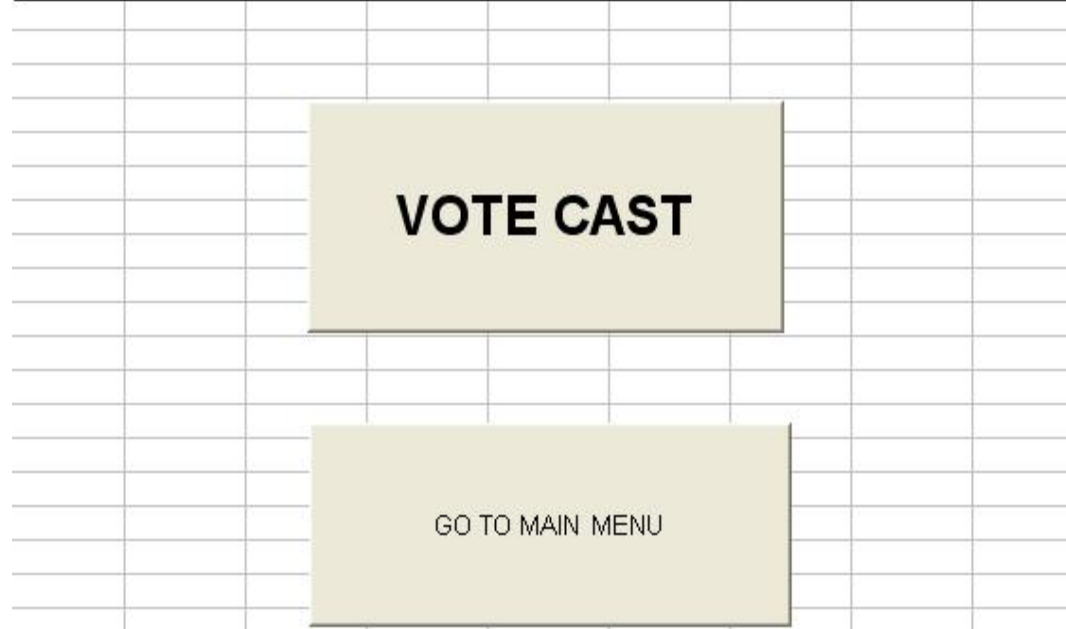


Figure 3.2.4(a): Vote casting process system interface

The screenshot shows a Windows-style form titled "UserForm1". The form has a blue title bar with a close button (X) in the top right corner. The main area of the form is light beige. It contains two input fields. The first field is labeled "MOBILE NUMBER" in blue text, followed by a white text box. The second field is labeled "PARTY NUMBER" in blue text, also followed by a white text box. At the bottom of the form, there is a large rectangular button with a black border and a dotted inner border. The button contains the text "FINAL VOTE CAST" in bold red capital letters.

Figure 3.2.4(b): Vote casting process system

Figure 3.2.4(a) shows the interface of the vote casting process system and figure 3.2.4(b) shows that the voter will cast their vote by inserting mobile number and party number. We have done this vote casting process manually in our prototype.

Thus I gained knowledge about how to make the flow of data and handled those in my input module.

3.2.2 Review and Suggestions from Advisor

During our presentation of the prototype, our supervisor and other respective teachers were keen about the proper input and checking. They asked about the data flow and showed some techniques to handle data properly. Regarding my module they pointed out some key issues:

- How to store data in smart way .
- How to pass polling center details, polling booth and casts vote information to other working module.
- How to deal with the casts vote that it was came from a registered mobile or unregistered mobile.
- What else information I may need for the polling center and polling booths.
- How to accept the vote
- How to search in a efficient way

Now again they advised me to find out some solutions to these issues and asked me to modify the prototype. After modifying the prototype my supervisor asked to formulate a real working database. Because after the excel prototype I gathered ideas about the data flow and I had a clear visualization of what are the things to do next.

3.2.3 Identifying Improvements

3.2.3.1 Informal Benchmarking

The first step in the strategy was to informally benchmark existing polling system scenario of some polling center. Our aim was to identify those techniques and features that usually make a polling center ideal polling environment.

3.2.3.2 Problem Analysis

Since the National Election Commission has the best idea about the whole polling system. So we went there and interviewed the external relation officer to understand the whole system. We tried out the problems with the existing system and the solutions. They told us where they face major problems and what can be better for them. Thus I carried out the problem analysis.

3.2.3.3 Technology Analysis

The next step was to analysis the technology. Firstly, I decided to take a look of there system, how they maintain the data. Then I took help from the internet. I looked for how in abroad these data are handled. I also gathered some knowledge about the interface from the existing ERP. We were concern about the proper and necessary input and output.

3.2.3.4 Outcome Analysis

The goal of outcome analysis is to promote creative thinking to develop other ways of create business value of our system. Our whole team finally integrates the improvement ideas and develops as outline of the final system. After some refine in it into more details through the prototype, our final system will be used as Pilot project for testing and at the end will be used as full working system.

3.2.4 Designing the Data Flow Diagram

The data flow methods center around modeling both the system and the subjects' worlds, although they use mainly system world terms. Consequently, they require analysis to have particular skills in expressing subject world requirements in system world terms. Models in structured systems analysis are made up of three components: the process, he data and the system functions. Data flow diagrams model system processes and is one of the most important modeling tools used by the system analysts.

Although the data flow diagram implies a focus on data, this is not the case. The focus is mainly on the process or activities that are performed [3]. Data modeling,

we will prepare from data flow, presents how the data created and used by processes are organized. I will try to present a combination of logical DFD and physical DFD so that I can easily convert them to entity relationship diagram and then finally able to find data modeling.

I will first describe how I modeled the systems using data flow symbols. A common way to begin is to model the whole system by one process. The DFD that does this is known as the context diagram. It shows all the external entities that interact with the system and the data flows between these external entities and the system.

The figure below shows the data flow in respect of context view. It models the “Hybrid Solution for National Election System”.

Context Diagram

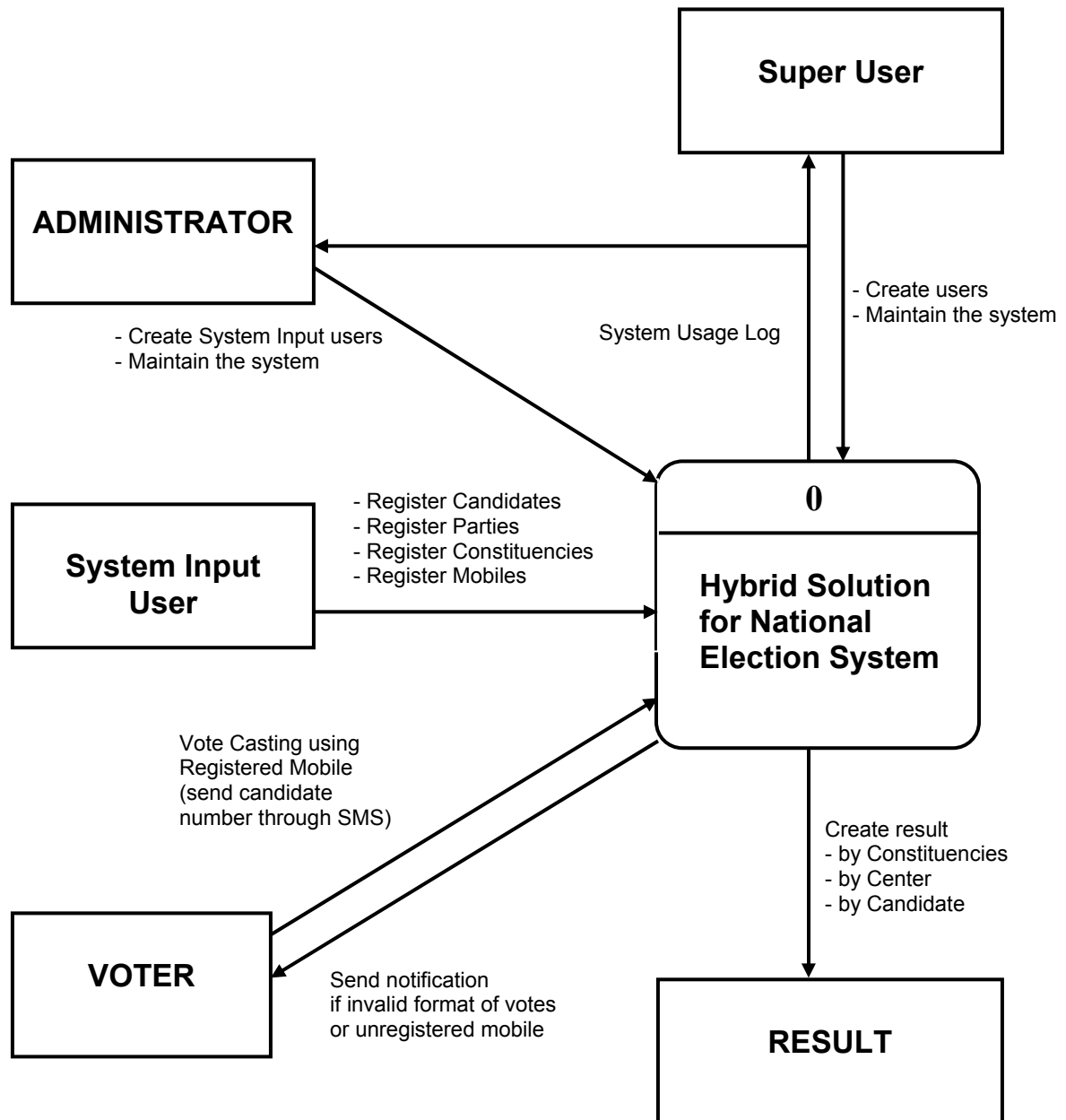


Figure 3.2.5(a): Context Diagram for Hybrid Solution for National Election System

3.2.5 Data Flow Diagram Level - 0 DFD

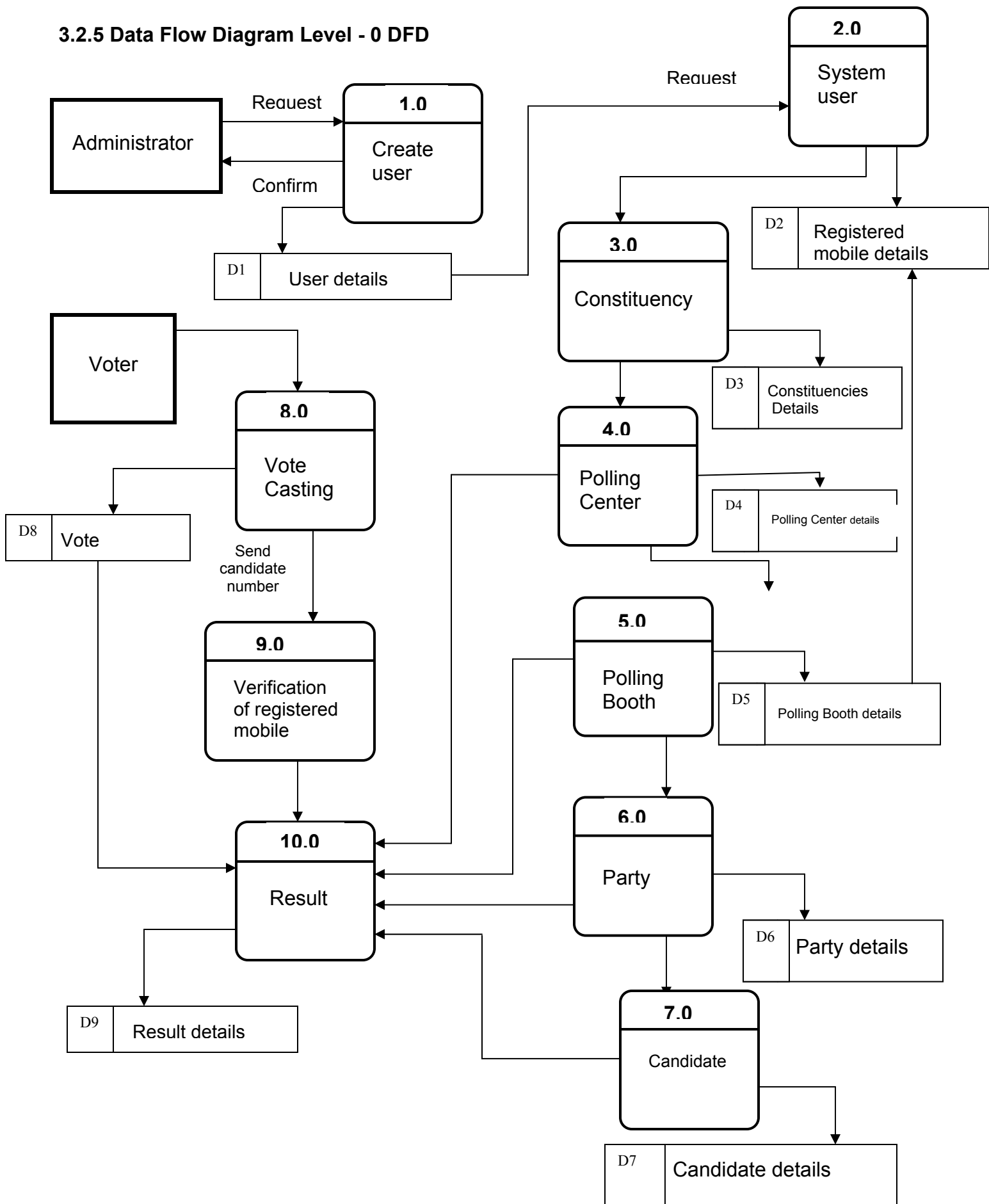


Figure 3.2.5(b): Level 0 DFD for Hybrid Solution for National Election

Level -1 DFD

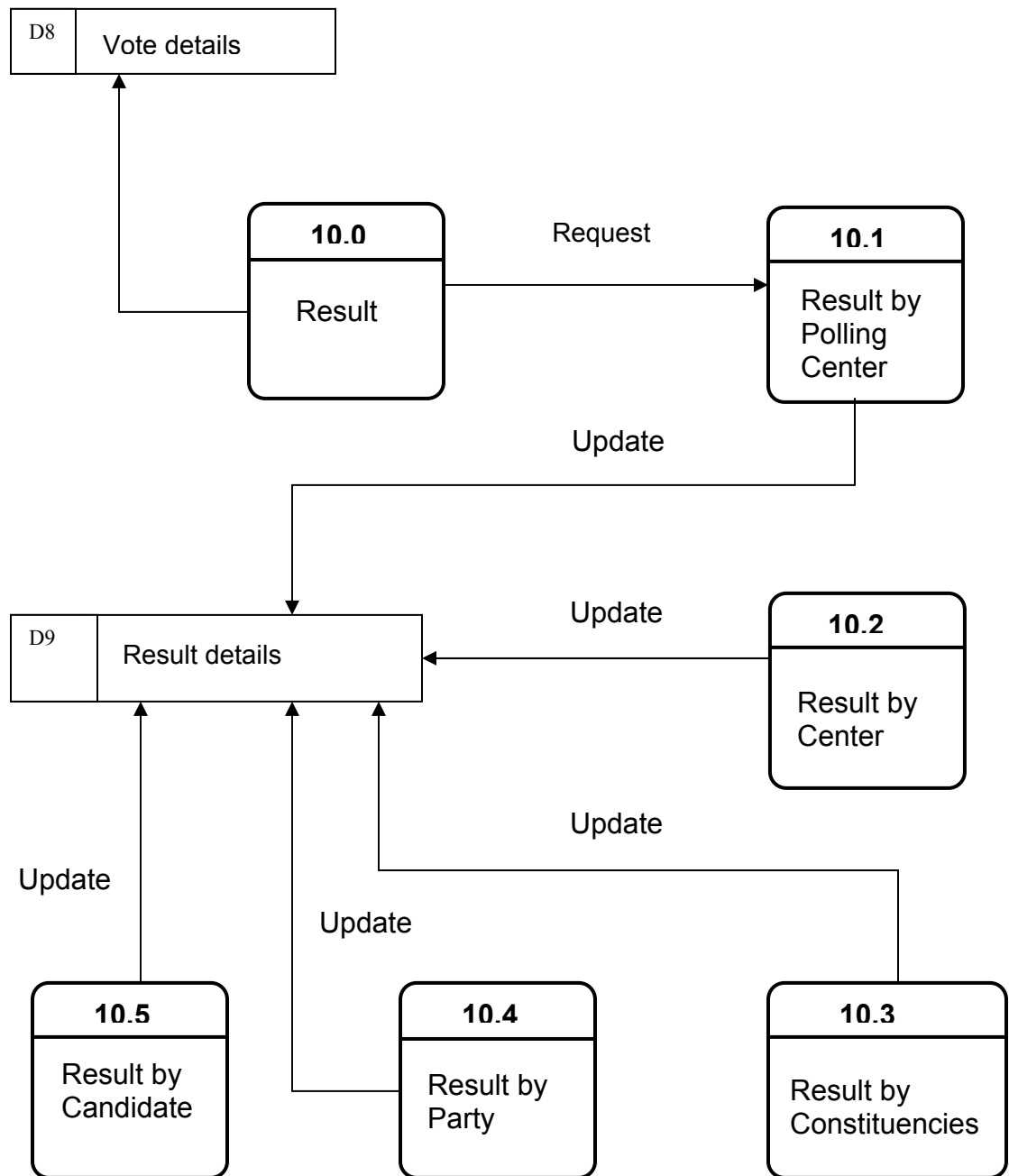


Figure 3.2.5(c): Level 1 DFD for Hybrid Solution for National Election System

3.3 Design

The design phase of the systems development life cycle used the requirements that were gathered during analysis to create a blueprint for the proposed system. A successful design builds on what was learned in earlier phases and leads to a smooth implementation by creating a clear, accurate plan of what needs to be done. The objectives are:

- Understand the initial transaction from analysis to design
- Be able to create physical data flow diagrams and entity relationship diagram
- Be familiar with the custom, package, and outsource design alternatives [3]

Throughout the design phase, I carefully considered the new system with respect to the current environment and systems that exist within current infrastructure. Major considerations of the “how” of a system are environmental factors, such as integrating with existing systems, converting data from legacy systems and leveraging skills that exist in-house [3]. Although planning and analysis phases are taken with prototype, the goal of my design phase is to create a final blueprint for my system that makes sense to easily implement.

I have divided the design phase into four sub-phases:

1. Data Modeling
2. Architecture Design
3. User Interface Design
4. Data Storage Design

3.3.1 Data Modeling

A data model is a formal way of representing the data that are used and created by a business system. It illustrates people, places or things about which information is captured and how they are related to each other [3]. A data model describes the data that support the whole system processes in a proposed system. During the analysis phase, all models represent the logical organization of data without indicating how the data are stored, created, or manipulated so that we can focus on requirement without being distracted by technical details. In

the design phase, analyst draw data model to reflect how the data will physically be stored in databases and files. So in this sub-phase my main objective is to be able to create an entity relationship diagram. In between we must understand how to balance between entity relationship diagrams and data flow diagrams.

ER DIGRAM

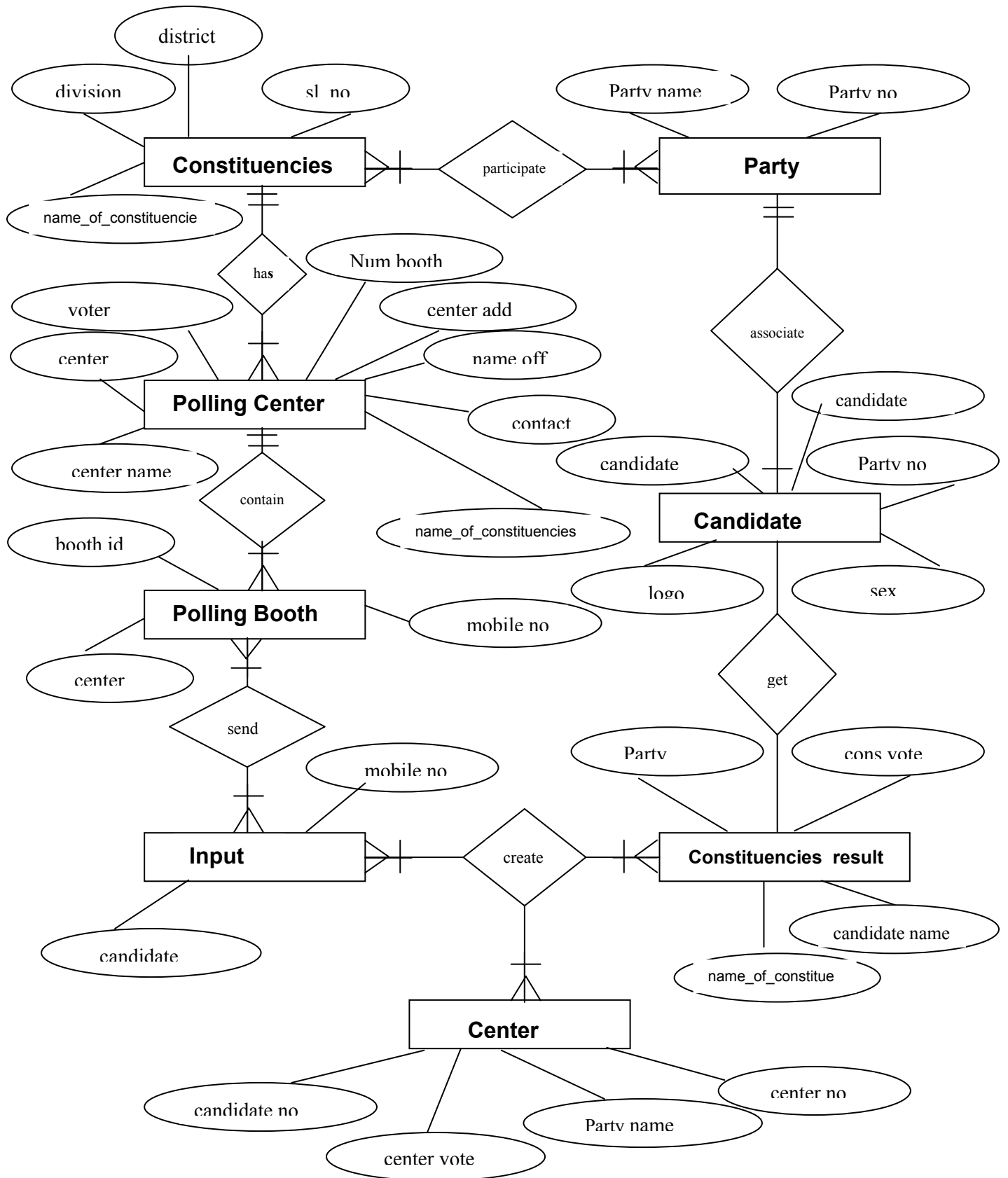


Figure 3.2.5(b): ER diagram for Hybrid Solution for National Election System 40

3.3.2 Architecture Design

An important component of the design phase is the architecture design, which describes the proposed technical environment for the new system. The technical environment contains the hardware, software and communications infrastructure on which the new system will be created and the methods for supporting the system's security need and global requirements. The deliverable from the architecture design contains the network model, the hardware and software specification, and the plan for security and global support.

Computer Architecture: There are three fundamental computing architectures. In server-based computing, the server performs virtually all of the work. In client-based computing, the client computers are responsible for most of the application functions. In client-server computing, the work is shared between the servers and clients.

We have used the client server architecture with attempting to balance the processing between the client and the server by having both do some of the application functions. In this design the client computer will have our software, whereas the server is responsible for the data access logic and data storage. The application in resides on the client fully.

As we have mobile functionality, we have connected the mobile with our client machine. Now days we know mobile have operating system like computers. So we can describe our architecture as three-tiered architecture by definition. Votes are going to database server from mobile through client server. Here client server is acting like an application server. Other inputs like party, constituency and candidate inputs are going to database server from the application server. We have used both windows based server and client. We used ORACLE as database server and Visual Basic for application server

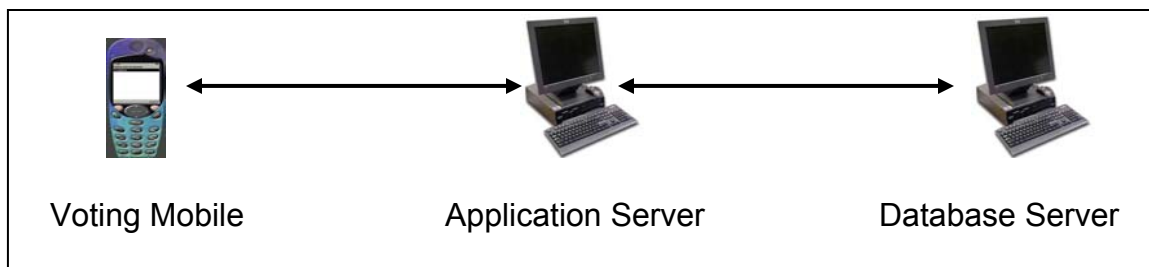


Figure 3.3.2(a): Computer Architecture

3.3.2.1 Advantage of such Architecture

Cost of infrastructure: one of the strongest driving forces toward client-server architectures is the cost of infrastructure [4]. Earlier we thought of server and the cost increases surprisingly. Simply putting the personal computers are ten times cheaper than the server.

Control and Security: our core database server is far away from the input device. It needs access right and security code to access and run a query. The software has the password protection so that only authorized user can handle the application server.

Scalability: scalability refers to the ability to increase or decrease the capacity of the computing infrastructure in response to the changing capacity needs. We were pretty concern about the SMS load and we designed in such a way that if we need to increase the receiving power in future, we can only add a mobile to the application server. If we need further, we can simply add another application server along a mobile with the database server. Such our designed is scalable in respect with time.

3.3.2.2 Infrastructure

In our cases, we built a system that has hardware, software and communication infrastructure already in place. As we do not have any technological infrastructure in our rural areas and that is the target market of our system. Further, the coordination of infrastructure components wa our main issue during design. Below I tried to summarize some of the key elements of infrastructure design to give a clear view:

Network Model: The network model is a diagram that shows the major components of the information system (IS), such as servers, communication lines, and networks. As we are using the mobile phone, so our network model is the existing mobile network in our country except the server portion. Creating the network model is a top-down exercise whereby we first graphically depict all of the locations where the application will reside. But our aim to spread out our solution through out the country with the help of mobile network. So we will consider an area and show the network model of that particular part.

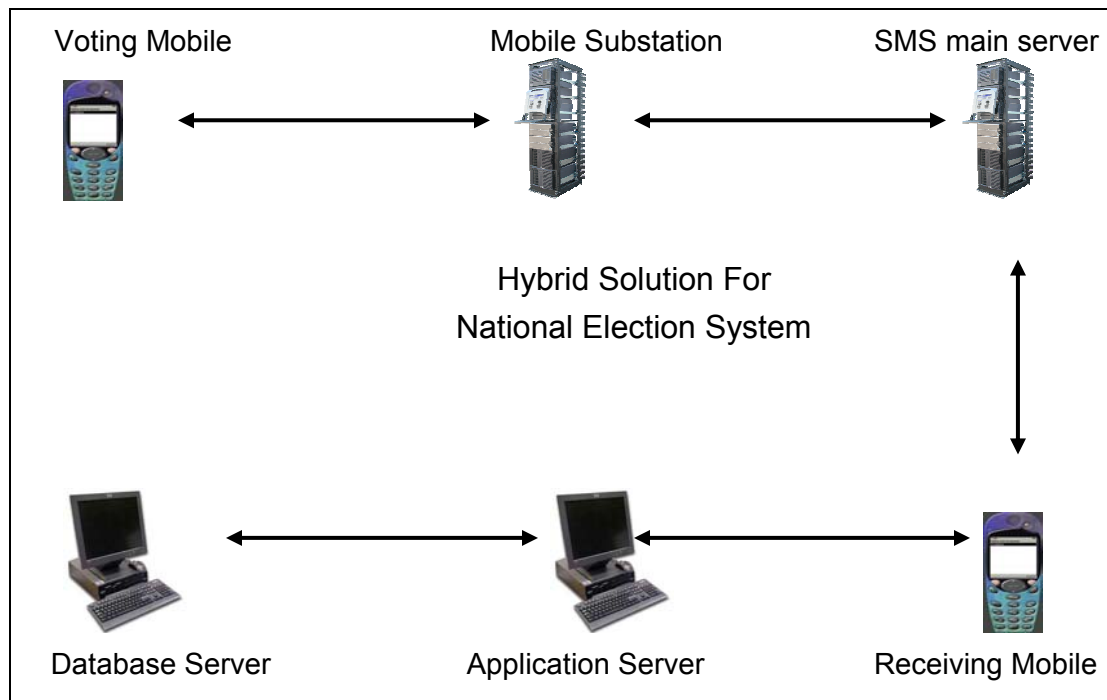


Figure 3.3.2(b): Network Design

Hardware and software Specification: the design phase is the time to begin acquiring the hardware and software that will be needed for the future system. First, I have created a list of the hardware that is required to support my system. The network model provides a good starting point for recording the hardware needs because each of the components on the diagram correspond to an item on hardware requirement list. Second step is to find out the minimum requirements for each piece of hardware. I conveyed such requirements as the amount of processing capacity, the amount of storage space, and the receiving capacity of SMS. Finally, we considered the factors that affect hardware performance, such as response time with SMS, data volumes and memory requirements for the request query etc. the figure presents the specification for my system:

Hardware

Minimum Requirements:

Processors:	6-128 (128-way requires HP-UX 11i v2)
Microprocessor type:	Intel Itanium 2 (1.6 GHz) or mx2 dual-processor modules
Memory:	1 TB
PCI slots:	192 (w/ I/O expander)
Operating systems:	HP-UX 11i v2; Microsoft® Windows® Server 2003, Datacenter Edition for 64-bit Itanium-based systems; Linux® (Red Hat Enterprise Linux AS 3, SUSE SLES 9); OpenVMS (1H2006)
Dimensions:	48"D 60"W 77.2"H

Software

- OS: Windows Server 2003(SP1)
- Oracle9i
- Visual Studio.Net
- SMS Server Control
- J2ME v2.0
- CLDC v1.0

Another piece to include in architecture design is a security plan that addresses how to keep the application and its data secure. Some people will try to gain unauthorized access to the system, some will do no hard; others attempt to access a system for personal gain or to do sabotage the system in some way [3]. Several techniques are available to increase security. The use of password and encryption are central to any type of secure system. I had used this technique to protect the system.

3.3.3.0 User Interface Design

A user interface is the part of the system with which the users interact in our system. I have to design the user interface component such as polling center setup, polling booth setup and SMS connection. In addition I designed some user interface form for the operator of the system and also for the voters.

The first element of the user interface is the layout of the screen form, which is usually rectangular shapes with navigation, and a center area of the form for inputs.

The screenshot shows a software window titled "Input Module/polling Center". Inside the window, there is a navigation bar with five buttons: "Constituencies", "PollingCenter", "Candidate", "Party", and "Logo". Below this bar, the "Polling Center Details" section is active. This section contains a form with the following fields:

- "Enter Center Information For Constituency" with a dropdown menu.
- "Name of the Polling center" with a text input field.
- "Center Id" with a text input field.
- "Center Address" with a text input field and a vertical scrollbar.
- "Registered Voter" with a text input field.
- "Number of Polling Booth" with a text input field.
- "Returning Officer (Name)" with a text input field.
- "Contact (Returning Officer)" with a text input field and a vertical scrollbar.
- "Remarks" with a text input field and a vertical scrollbar.

At the bottom of the form, there are three buttons: "Submit", "Cancel", and "Show details". The entire form area is enclosed in a red rectangular border.

Figure 3.3.3.1: Polling Center Setup

User can show the details of polling center by pressing the show center details button.

Polling Center/Center Details

Select Constituency Name : **Show Center details**

CENTER NAME	CENTER ID	CONS NAME	VOTER	TOTAL BOOTH	ADDRESS	RETURNING OFFICER	CONTACTS	REMARKS
▶ EDEN	6-Dhaka-1	Dhaka-6	5000	5	AJIMPUR	MONA	EDEN GARDEN	GOOD
Titumeer College	6-Dhaka-2	Dhaka-6	5700	7	66,Mohakhali,Dhaka-12	Mofizuddin	Phone:02-8123663	Denger Zone!
EastWest University	6-Dhaka-3	Dhaka-6	4900	5	60,Mohakhali,Dhaka-12	Mr. Mahtabuddin	Ph:02-8126677	Safe
Manarat	6-Dhaka-4	Dhaka-6	6700	6	Gulshan	Mr. Adam	ph.02-9886377	safe
AIUB	6-Dhaka-5	Dhaka-6	5300	7	Gulshan	Mr. Alex	ph.02-8455609	well
NSU	6-Dhaka-6	Dhaka-6	8400	8	Gulshan	Mr.habib	ph:8974562	Good
Stumfor university	6-Dhaka-7	Dhaka-6	4600	4	Dhanmondi	Id. Abul	Ph:9876342	Denger Zone!

Navigation: < > << >>

Figure 3.3.3.2: Polling Center Details

The below in the interface form of polling booth through which the system input user will register the mobile number. In the text fields the user have to give the necessary inputs to do the registration procedure of a polling booth and then have to press the “Submit” button to be done with the setup for one polling booth.

The screenshot displays a web application window titled "Admin Module/Mobile Number". It features a navigation bar with buttons for "Mobile Number", "Candidate Details", "Party", "Logo", and "Search". Below this, there is a "Select Constituency" dropdown menu set to "Dhaka-6" and a "Show Center details" button. A table lists various centers with their IDs, polling booth numbers, registered voter counts, and constituency names. Below the table is a large grey rectangular area. At the bottom, the "Add Booth Information" section is highlighted with a red border, containing three input fields: "Enter Center Id" (with "6-Dhaka-1"), "Enter Mobile Number" (with "0170000001"), and "Booth Identification No. For Mobile Number" (with "4"). "Submit", "Cancel", and "Show Details" buttons are located at the bottom of this section.

Center Name	Center ID	Polling Booth	Reg. Voter	Constituency Name
EDEN	6-Dhaka-1	5	5000	Dhaka-6
Titumeer College	6-Dhaka-2	7	5700	Dhaka-6
EastWest University	6-Dhaka-3	5	4900	Dhaka-6
Manarat	6-Dhaka-4	6	6700	Dhaka-6
AJUB	6-Dhaka-5	7	5300	Dhaka-6
NSU	6-Dhaka-6	8	8400	Dhaka-6
Stunfor university	6-Dhaka-7	4	4600	Dhaka-6

Add Booth Information

Enter Center Id :

Enter Mobile Number :

Booth Identification No. For Mobile Number :

Figure 3.3.3.3: Polling Booth Setup

User can also search the list of registered mobile numbers by pressing the search button. I have kept two types of searching options. One is searching by center ID, second is searching is by mobile number .

Admin Module/Mobile Number/Search

Choose One

☒ Center Id : 1-Dhaka-2

☐ Mobile Number :

Search

CENTER_NAME	CENTER_NO	MOBILE_NO	BOOTH_ID
Su	1-Dhaka-2	118000007	7

Navigation buttons: [Back] [Forward] [Home] [End]

Cancel

Figure 3.3.3.4: Searching Registered Mobile Number

The following interface form shows how the mobile connect with the system and how the data will go to the database server securely. By pressing the SMS gateway button the system user can connect and disconnect the server end mobile with the system on the election day.

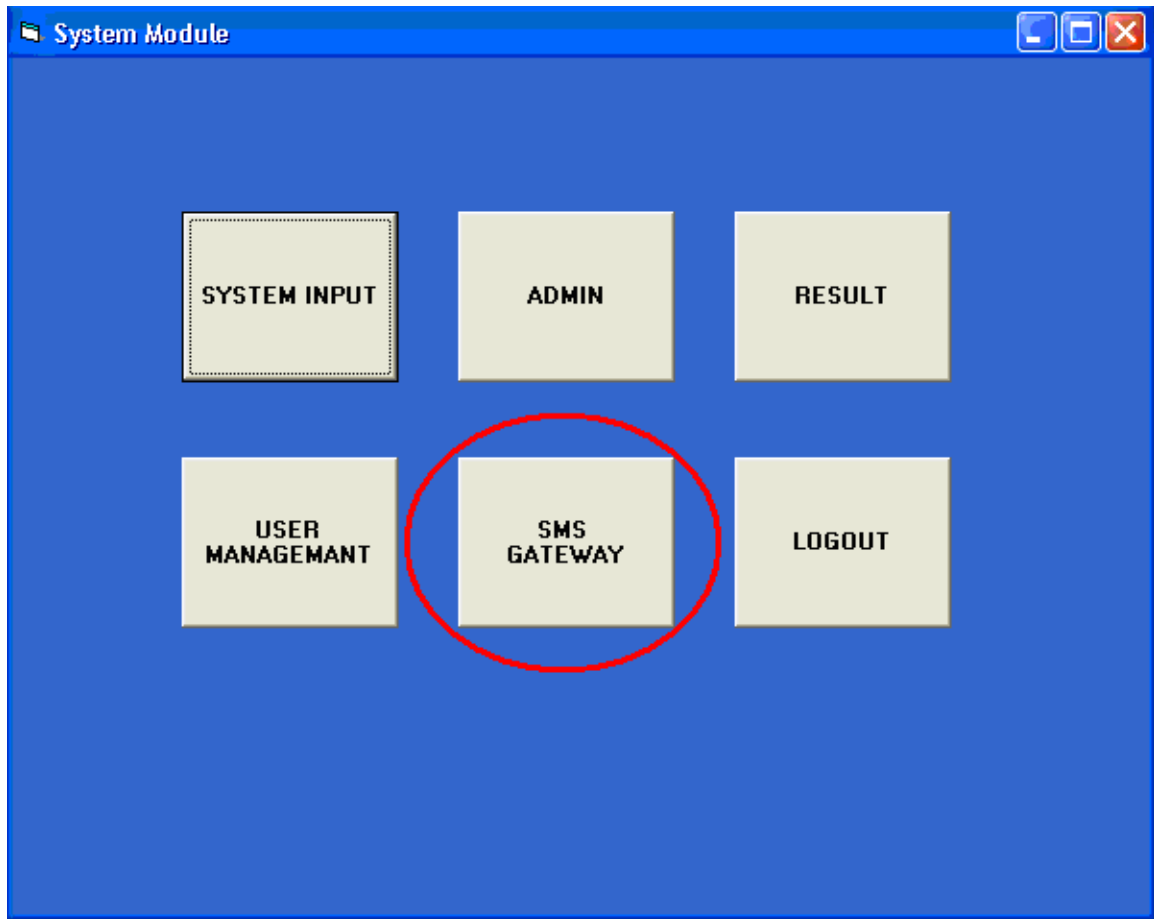


Figure 3.3.3.5: Mobile Connectivity with the System

This module perform the following tasks - Determine Connection status of SMS Gateway, Connect SMS Gateway to the Mobile Terminal, Disconnect SMS Gateway from the Mobile Terminal, Determine Receive Mode status of SMS Gateway, Set SMS Gateway to not transfer incoming messages from the Mobile Terminal, Set SMS Gateway to transfer only incoming messages marked T.E. specific from the Mobile Terminal, Set SMS Gateway to transfer all incoming messages from the Mobile Terminal, Minimize SMS Gateway, Restore SMS Gateway, Copy all messages in Mobile Terminal to SMS Gateway

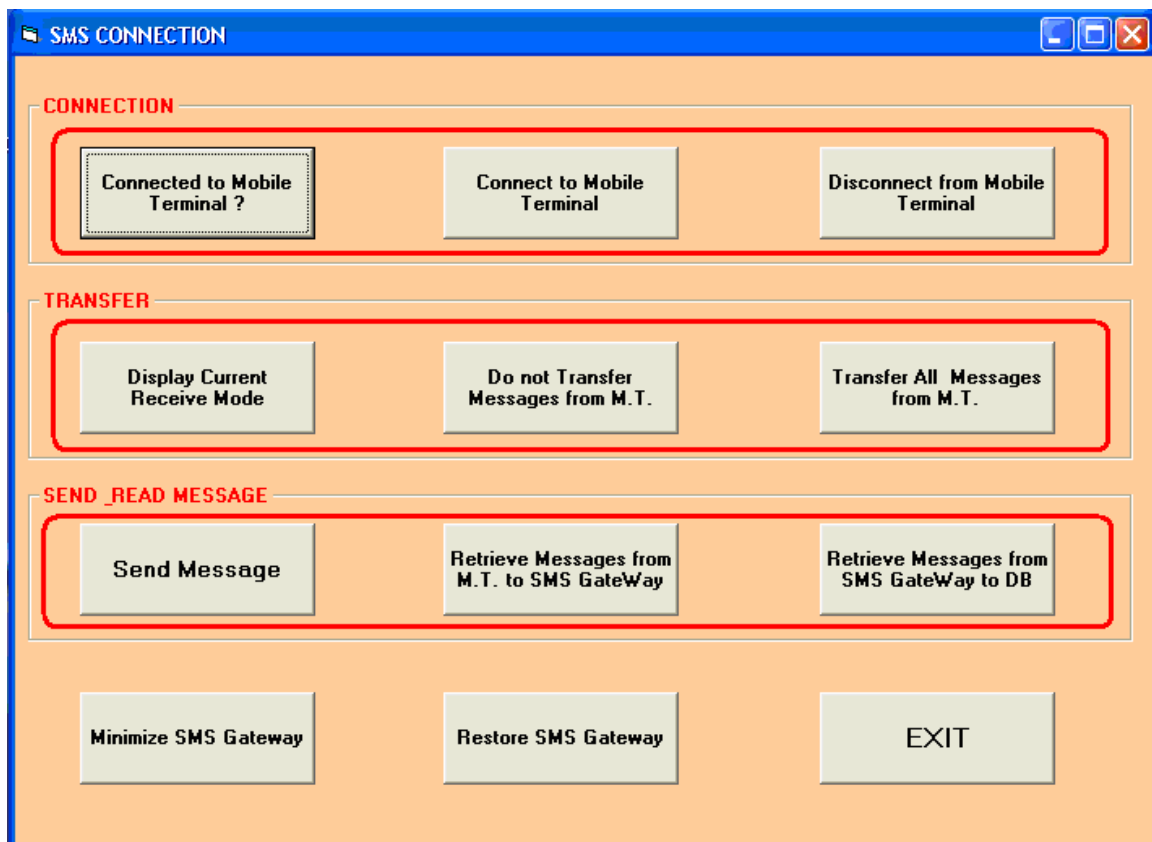


Figure 3.3.3.6: Mobile Connectivity Details

3.3.3.1 Input Design

The goal of the input mechanism is to simply and easily capture accurate information for the system [3]. As we have used prototype so we have gathered the information of input earlier and changed that by the course of time with the appropriate requirement. So here we were concern about the validation by using some combination of completeness checks, format checks, range checks, check digits, consistency checks and database checks.

3.3.3.2 Output Design

The goal of the output mechanism is to present information to users so they can accurately understand it with the least effort [4]. I mainly was concern about the details showing and searching that I will show to the user according to their needs. I had some mistakes with prototype and my supervisor correct me with some suggestion.

3.3.4.0 Data Storage Design

My first step was to convert the E-R model to a relational model, which then be tested to see if it contains any redundancies. A number of criteria were pointed out and implemented for such test. They were defined in terms of functional dependencies and relation keys. Relations that satisfy the criteria are well known as normal relations. I tried to ensure that my data model contains only relations in the highest normal form.

3.3.4.1 Polling Center Setup System

Table Name: POLLING CENTER

Purpose: Store Center Name, Center No, Constituency Name, Voter, Number of Booth, Center Address, Polling Officer Name, Polling Officer Contact Number, Remarks.

Name	Datatype	Size	Scale	Nulls?	Default Value	
CENTER_NAME	CHAR	30				
CENTER_NO	CHAR	20				
NAME_OF_CONSTITUENC...	CHAR	20				
VOTER	NUMBER	5	0			
NUM_BOOTH	NUMBER	5	0			
CENTER_ADD	CHAR	150		✓		
NAME_OFF	CHAR	30		✓		
CONTACT	CHAR	50		✓		
REMARKS	CHAR	50		✓		

3.3.4.2 Polling Booth Setup System

Table Name: POLLING BOOTH

Purpose: Store Center No, Booth ID and Mobile No

Name	Datatype	Size	Scale	Nulls?	Default Value	
CENTER_NO	CHAR	20				
BOOTH_ID	NUMBER	10	0			
MOBILE_NO	NUMBER	15	0			

3.3.4.3 Vote Casting Process System

Table Name: INPUT

Purpose: Store Candidate No and Mobile No

Name	Datatype	Size	Scale	Nulls?	Default Value
CANDIDATE_NO	NUMBER	10	0		
MOBILE_NO	NUMBER	15	0		

3.4 Implementation

3.4.1 Polling Center Details Setup System

After all the analysis and design my polling center details setup system functions like:

1. When a user will seek to setup a polling center for the National Election, he/she will have to go to the polling center details setup form by pressing “Polling Center” button.
2. Then the user will have to select the Constituency Name .After that the user will have to enter Center Name, Center Address, Registered Voter, Number of Polling Booth, Returning officer name, Returning officer contact number and Remarks. If the center details for the selected Constituency Name exist then it will give a notification message saying the center details already exist. On the other hand if the format of the input is wrong then it will ask for right input.
3. After pressing “Submit” button the data will be stored in to database server and the text fields will be empty.

4. Pressing "Show Details" a query will be run and will show all polling center name with their center no in the Polling center Details grid sheet.

3.4.1.1 Pseudo code for Showing Details of Polling Center

1. *Private Sub show_details_Click()*
2. *Set show_polling_center = New ADODB.Recordset*
3. *show_polling_center.Open "select center_name, center_no ,
name_of_constituencies , num_booth , voter ,
center_add,name_off,remarks, from polling_center "*
4. *Set Adodc1.Recordset = show_polling_center*
5. *Adodc1.Refresh*
6. *show_polling_center.Close*
7. *End Sub*

3.4.1.2 Pseudo code for Generate Center ID

1. *Private Function GenerateNewCenterID()*
2. *Set rstFindCenterNo = New ADODB.Recordset*
3. *Dim strCons As String*
4. *Dim i As Long*
5. *strCons = cbocons.Text*
6. *i = InStrRev(strCons, "-")*
7. *Dim strid As String*
8. *strid = Trim(Mid\$(strCons, i + 1, Len(Trim(strCons))))*
9. *Dim strCenter As String*
10. *strCenter = strid & "-" & Mid\$(strCons, 1, i - 1) & "-"*
11. *rstFindCenterNo.Open "select count(*) as max from polling_center where
center_no like '" & strCenter & "%'"*
12. *Dim strnewid As String*
13. *strnewid = strCenter & (CInt(rstFindCenterNo("max")) + 1)*
14. *GenerateNewCenterID = strnewid*

15. Exit Function

3.4.2 Polling Booth Details Setup System

5. When a user will seek to setup a polling booth for the National Election, he/she will have to go to the polling booth details setup form by pressing "Polling Booth" button.
1. Then the user will have to enter the Center ID, Mobile Number and Booth ID. If Mobile Number exists then it will give a notification message saying the Mobile Number is already exist. On the other hand if the format of the input is wrong then it will ask for right input.
2. After pressing "Submit" button the data will be stored in to database server and the text fields will be empty.
3. Pressing "Show Details" a query will be run and will show all polling booth details in the grid sheet.

3.4.2.1 Pseudo code for Showing Details of Polling Booth

1. *Private Sub show_details_Click()*
2. *Set show_polling_booth = New ADODB.Recordset*
3. *show_polling_booth.Open "select center_no ,booth_id,mobile_no
from polling_booth ", db, adOpenDynamic, adLockOptimistic*
4. *Set Adodc1.Recordset = show_polling_booth*
5. *Adodc1.Refresh*
6. *show_polling_booth.Close*
7. *End Sub*

3.4.2.1 Pseudo code for Searching Registered Mobile Number

1. *If center*
2. *Set search_booth = New ADODB.Recordset*
3. *search_booth.Open "select
center_name,Polling_Booth.center_no,mobile_no,booth_id,num_booth,name_of
_constituencies from Polling_Center,Polling_Booth where
Polling_Booth.center_no=" & center & " and
Polling_Booth.center_no=Polling_Center.center_no"*
4. *Elseif mobile*
5. *Set search_booth = New ADODB.Recordset*
*search_booth.Open "select
center_name,Polling_Booth.center_no,mobile_no,booth_id,name_of_constituenc
ies from Polling_Center,Polling_Booth where Polling_Booth.mobile_no=" &
mobile & " and Polling_Booth.center_no=Polling_Center.center_no"*
6. *Set Adodc1.Recordset = search_booth*
7. *Adodc1.Refresh*
8. *search_booth.Close*
9. *End Sub*

3.4.3 Mobile Connectivity Functions

These are the functions that perform the following tasks - Determine Connection status of SMS Gateway, Connect SMS Gateway to the Mobile Terminal, Disconnect SMS Gateway from the Mobile Terminal, Determine Receive Mode status of SMS Gateway, Set SMS Gateway to not transfer incoming messages from the Mobile Terminal, Set SMS Gateway to transfer only incoming messages marked T.E. specific from the Mobile Terminal, Set SMS Gateway to transfer all incoming messages from the Mobile Terminal, Minimize SMS Gateway, Restore SMS Gateway, Copy all messages in Mobile Terminal to SMS Gateway

3.4.3.1 Determine Connection status of SMS Gateway

1. *Set SMSGatewayObject = CreateObject("SMSGateway.SMS")*
2. *If SMSGatewayObject.Is_Connected(AppName) Then*
3. *Connected*
4. *Else*
5. *NOT connected*
6. *End Sub*

3.4.3.2 Connect SMS Gateway to the Mobile Terminal

1. *Set SMSGatewayObject = CreateObject("SMSGateway.SMS")*
2. *SMSGatewayObject.Connect (AppName)*
3. *Connect to the Mobile Terminal*
4. *End Sub*

3.4.3.3 Set SMS Gateway to transfer only incoming messages marked T.E.

1. *Set SMSGatewayObject = CreateObject("SMSGateway.SMS")*
2. *SMSGatewayObject.Transfer_TE_Mode (AppName)*
3. *End Sub*

3.4.3.4 Set SMS Gateway to transfer all incoming messages from the Mobile Terminal to Database

1. *Set SMSGatewayObject = CreateObject("SMSGateway.SMS")*
2. *SMSGatewayObject.Transfer_All_Mode (AppName)*
3. *End Sub*

CHAPTER 4

SYSTEM TESTING

4.1 Unit testing and Integration Testing

As I have put four systems: Party input system, Candidate input system, Constituency input system and sending the data securely that is security, my modules are inter-related. Party, candidate and constituency input system works based on the output information of each other. If any party input failed then that party will not be able to do the election. According to my modules, if party input and constituency input is not done first then candidate input is not possible. So, I prove that given sample data, if all systems individually work properly then integration testing is successful.

Testing For Polling Center Details Setup

Tester: Md. Rashidul Hasan

Date: 18.07.2005

Objective

Ensure that the information provided by the administrator is correct and rightly used by the system.

Data Field	Value
1. Center No, Center Name, Name of Constituencies, Number of Booth, Number of Voter	1-Dhaka-1,Brac Center,Dhaka-1 ,5 ,2009
2. Center No, Center Name, Name of Constituencies, Number of Booth, Number of Voter	2-Dhaka-1,Uttara High School,Dhaka-2 ,5 ,1805

3. Center No, Center Name, 3-Dhaka-3, Eden College , _____ ,5 ,3200
 Name of Constituencies,
 Number of Booth, Number of Voter
4. Center No, Center Name, 2-Dhaka-2, 5 ,Aga Khan School,Dhaka-2,1805
 Name of Constituencies,
 Number of Booth, Number of Voter
5. Center No, Center Name, 2-Dhaka-3, Azampur ,Dhaka ,2560 ,5
 Name of Constituencies,
 Number of Booth, Number of Voter

Table 4.1(a): Testing For Polling Center Details Setup

Expected Result Notes

Test 1 and 2 are valid because they have right format. 3 is not valid because no field cannot be kept empty. 4 is not valid due to misplacement of input.5 is not because Name of Constituencies format is wrong.

Actual Result Notes

Test 1 and 2 are accepted. Test 3, 4 and 5 were rejected with correct error.

Testing For Polling Booth Details Setup

Tester: Md. Rashidul Hasan

Date: 18.07.2005

Objective

Ensure that the information provided by the administrator is correct and rightly used by the system.

Data Field	Value
1. Center Name, Center No, Mobile No, Booth Id	Brac Center, 1-Dhaka-1,0171174835,1
2. Center Name, Center No, Mobile No, Booth Id	Uttara High School,2-Dhaka-1,01711748354,2
3. Center Name, Center No, Mobile No, Booth Id	Eden College, 3-Dhaka-3, 0171002135, 5
4. Center Name, Center No, Mobile No, Booth Id	Aga Khan School, 2-Dhaka, 0171547986, 7
5. Center Name, Center No, Mobile No, Booth Id	Azampur, 2-Dhaka-3, _____ , 3
6. Center Name, Center No, Mobile No, Booth Id	Gazipur, 6-Dhaka-8, 0171547986, 2

Table 4.1(b): Testing For Polling Booth Details Setup

Expected Result Notes

Test 1 and 3 are valid because they have right format. 2 is not valid due the wrong format. 2 are invalid for duplicate insertion. 4 is not valid due to

the wrong format. 5 is not valid because no field cannot be kept empty. 6 is not valid because the mobile number is already registered.

Actual Result Notes

Test 1 and 3 are accepted. Test 2 ,4 ,5 and 6 were rejected with correct error.

Testing For Vote Casting

Tester: Md. Rashidul Hasan

Date: 18.07.2005

Objective

Ensure that the information provided by the voter is correct and rightly used by the system.

Data Field	Value
1. Mobile No, Candidate No	0171174835 , 1001
2. Mobile No, Candidate No	0171174835 , 100
3. Mobile No, Candidate No	0171174835 , _____
4. Mobile No, Candidate No	0171174835 , 1005
5. Mobile No, Candidate No	0181174385 , 1001

Table 4.1(c): Testing For Vote Casting

Expected Result Notes

Test 1 and 4 are valid because they have right format. 2 is not valid due to wrong format of candidate No because candidate no must be four digit number. 3 is not valid because no field cannot be kept empty. 5 is not valid because the vote casts from an unregistered mobile.

Actual Result Notes

Test 1 and 4 are accepted. Test 2, 3 and 5 were rejected with correct error.

Testing For Registered Mobile Number Searching System

Tester: Md. Rashidul Hasan

Date: 18.07.2005

Objective

Ensure that the information provided by the administrator is correct and rightly used by the system.

Data Field	Value
1. Center No / Mobile Number	1-Dhaka-1 / 0171174835
2. Center No / Mobile Number	1-Dhaka / 0171174835
3. Center No / Mobile Number	1-Dhaka-1 / 0171174

Table 4.1(d): Testing For Registered Mobile Number Searching System

Expected Result Notes

For searching we have to search by using any of the data field rather than all of two. So, test 1 is valid because it has right format. 2 is not valid due to wrong input. 3 is not valid due to wrong input. By using first data field of test 1 expected to get the information about the list registered mobile

number under this center. By using last data field, expected to get details of all registered mobile number if it is registered for this center.

Actual Result Notes

Test 1, worked properly by using all two data fields separately. Test 2 and 3 was rejected with correct error.

4.2 System Testing

On 30th July, we tested the system at a software development office in Dhanmondi. There we pre-arranged a room as the polling center to simulate our complete system. We, all three group members mutually tested the system over there. The office stuffs participated in the testing session. They were provided some mobile phones to interact with the system and we also gave them proper instruction how to do the proper inputs. Thus we had our system testing and from there we have gathered ideas how organize the sequence of our entire Electronic Election System.

4.2.1 Manual of Input/output

Polling Center Details Setup: It has one input and five either output according to the situation.

Input: 1-Dhaka-1,Brac Center,Dhaka-1 ,5 ,2009

Output: "Input is done successfully"

Output: "X Field is empty"

Output: "Input format is wrong"

Output: "Center No is already exist"

Output: "You did not select the Constituency Name"

Polling Booth Details Setup: It has one input and four either output according to the situation.

Input : Uttara High School, 2-Dhaka-1, 0171174835, 2

Output: "Input is done successfully"

Output: "X Field is empty"

Output: "Mobile number is already registered"

Output: "Input format is wrong"

Vote casting System: It has one input and three either output according to the situation.

Input : 0171174835 , 1001

Output: "X Field is empty"

Output: "Mobile Number is not registered"

Output: "Candidate No does not exist"

Registered Mobile Number Search System: It has one input and five either output according to the situation.

Input : 1-Dhaka-1 / 0171174835

Output: "X Field is empty"

Output: "Input format is wrong"

Output: "Unregistered mobile number"

Output: if search is done by Center then it will show details of all
registered mobile number under that center

Output: if search is done by mobile number then it will show the details of center
name, center no and booth id

4.2.4 Actual Input Output

Input:

The screenshot shows a mobile application window with a title bar containing a signal strength indicator, the text 'ABC', and a battery icon. Below the title bar is a section labeled 'Displayable Title'. Under this, there are two input fields. The first field is labeled 'Mobile Number' and contains the text '+5550001'. The second field is labeled 'Candidate Number' and contains the text '3001'. Both input fields are highlighted with a red rectangular border. At the bottom of the window, there are two buttons: 'Exit' on the left and 'Send' on the right.

Figure 4.2.4(a) Actual Input

Output:

CANDIDATE_NO	MOBILE_NO
-----	-----
15002	171327701
15001	152377860
15002	171327723
15002	152377860
15001	171327723
15001	171327701
15002	152377860

Storing in Database Server After Decryption

Figure 4.2.4(b): Actual Output

4.3 Acceptance Testing

On 30th July, we tested the system at a software development office in Dhanmondi. There we prearranged a room as the polling center to simulate our complete system. We, all three group members mutually tested the system over there. The office stuffs participated in the testing session. They were provided three mobile phones to interact with the system and we also gave them proper instruction how to do the proper inputs. Thus we had our system testing and from there we have gathered ideas how organize the sequence of our entire Electronic Election System.

Doing so, we separated office stuffs who voted. We selected our Supervisor Dr. Yousuf M Islam and another respective teacher Mr. Zillur Rahman as the candidate and we registered them. We also registered three mobile numbers from which all votes sent. We assigned two parties, constituency and other necessary information against two candidates. Then all the votes had done.

4.4 Test Data

As I have discussed earlier, our acceptance testing will be theoretically a beta testing and all the data we will use here will be real life user data.

CONSTITUENCIES

For testing purpose we registered one constituency under which all the voting were done:

SL_NO	NAME_OF_CONSTITUENCY	DISTRICT	DIVISION
15	Dhaka-15	Dhaka	Dhaka

POLLING_CENTER

For testing purpose we registered one polling center under which all the voting was done:

CENTER_NAME	CENTER_NO	NAME_OF_CONSTITUENCIES	VOTER	NUM_BOOTH
SoftEd	15-Dhaka-1	Dhaka-15	50	3

POLLING_BOOTH

For testing purpose we registered one polling center under which all the voting was done:

CENTER_NO	BOOTH_ID	MOBILE_NO
15-Dhaka-1	1	0171327701
15-Dhaka-1	2	0171327723
15-Dhaka-1	3	0152377860

PARTY

For testing purpose we registered two parties as follows:

PARTY_NAME	PARTY_NO
BNP	1
BAL	2

CANDIDATE

We registered two candidates who contested for election during our testing time

CANDIDATE_NO	CANDIDATE_NAME	PARTY_NO	LOGO	SEX
15001	YMI	1	SOP	M
15002	ZRA	2	BOAT	M

CONSTITUENCIES_CANDIDATE

This table shows which candidate is contesting from which constituency

CANDIDATE_NO	NAME_OF_CONSTITUENCIES
15001	Dhaka-15
15002	Dhaka-15

INPUT

During testing we got the following inputs from the registered mobile as votes:

CANDIDATE_NO	MOBILE_NO
15001	171327701
15001	171327723
15002	171327701
15001	152377860
15002	171327723
15001	171327701
15001	152377860
15002	171327723
15002	171327701
15001	152377860
15002	171327701
15001	171327723
15002	171327701
15001	152377860
15002	171327723
15002	152377860
15001	171327723
15001	171327701
15002	152377860
15001	171327701
15001	171327723
15001	152377860
15002	171327701

4.5 Results

We have tested our system in a Software Development firm using two registered mobile phones. In the following there are few screen shots of the results that we generated after the voting by the participants:

Show result for constituencies

Dhaka-15

Go

Who Is Winner???

Details results in constituencies

	CANDIDATE NO	CANDIDATE NAME	PARTY NAME	NAME OF CONSTITUENCIES	CONS VOTE
▶	15002	ZRA	BAL	Dhaka-15	10
	15001	YMI	BNP	Dhaka-15	13

⏮

⏪

⏩

⏭

Total Reg. Voter : 20

Vote Casted : 23

Percent : 115.00%

Figure 4.5.1: Constituency Result

Result/Details Constituencies Result...

Select Constituencies : Dhaka-15

Result in Details

Constituency Name :	Dhaka-15	Total Center :	1
Name of The winner :	YMI		
Party Name :	BNP		
Symbol :	SOP		
Vote Obtained :	13		
Nearest Competetor :	ZRA		
Party Name :	BAL		
Symbol :	BOAT		
Vote Obtained :	10		

YMI WON BY 3 VOTES.

Figure 4.5.2: Winning Candidate Result

CHAPTER 5

USER MANUAL

5.1 User Instructions for Administrators

5.1.1 Polling Center Details Setup System

This module keeps information of polling center. So, administrators have to give inputs of information about polling center. If an administrator or authority wants to know about any particular polling center, he/she has to just search it as like:

Dhaka-1	1-Dhaka-1
Constituency name	Center No

He/she just has to search by using any of the above field. It will show the list of polling center according to the input.

5.1.2 Polling Booth Details Setup System

This module keeps information of polling booth. So, administrators have to give inputs of information about polling booth. If an administrator or authority wants to know about any particular polling booth, he/she has to just search it as like:

1-Dhaka-1	0171121236
Center No	Mobile Number

He/she just has to search by using any of the above field. It will show the list of polling booth according to the input.

5.2 User Instruction for Voter

This module just takes the votes securely from the voter through the mobile device. If a voter wants to cast his/her vote then he/she just has to send a SMS writing the candidate number only. It is as like:

2006
Candidate name

He/she just has to insert the candidate number and data will go to server end in encrypted format. After storing the vote in data base in decrypted mode it will send a confirmation message to the voter.

CONCLUSION

The current Election System is done manually. In this system we found out some major problems. The system is fully paper based like printing ballot papers and distributing them, high risk of Ballot box hijacking in the remote areas, Ballot paper is manually counted which requires huge manpower. Counting errors occur and it needs recounting, compilation of result requires many stages, which is very time consuming. These problems as a whole put a big question mark on the reliability of the current election system. So we have come up with a hybrid solution, which automates and secures some of the sensitive modules of the system. This hybrid system has a simple voting interface for the voters. The counting and result generation is automated and requires short span of time. Since portions of the system is automated involvement of human workforce decreases. In addition, the system is more secured, more dependable and more efficient as most of the sensitive functions are implicit to the system and done automatically and securely. Our system may be initially installed in areas where the risk of hijacking of ballot box is high. In a word the Hybrid Solution for National Election System improves the overall efficiency of the current election system by providing an alternative for faster, feasible and secured processing of election result.

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APPENDIX

Voting Message Log

The following table contains the voting messages, which are sent by the participants when we did the test in the software development firm.

MESSAGES	MOBILE NUMBER
15001	+880171327701
15001	+880171327723
15002	+880171327701
15001	+880172377860
15002	+880171327723
15001	+880171327701
15001	+880172377860
15002	+880171327723
15002	+880171327701
15001	+880172377860
15002	+880171327701
15001	+880171327723
15002	+880171327701
15001	+880172377860
15002	+880171327723
15002	+880172377860
15001	+880171327723
15001	+880171327701
15002	+880172377860
15001	+880171327701
15001	+880171327723
15001	+880172377860
15002	+880171327701

The following table contains the voting messages, which are sent by the participants when we did the test by ourselves.

MESSAGE	MOBILE NUMBER
1000	+880171176488
1001	+880189111757
1002	+880171174835
1003	+880171176488
1004	+880171174835
1005	+880189111757
1006	+880171174835
1007	+880171176488
1008	+880189111757
1009	+880171174835
1010	+880171176488
1011	+880171174835
1004	+880189111757
1003	+880171174835
1003	+880189111757
1003	+880171176488
1002	+880170000001
1002	+880171174835
1006	+880171176488
1010	+880171174835
1001	+880189111757
1002	+880171174835
1003	+880171176488
1001	+880189111757
1004	+880171176488

1004	+880171174835
1005	+880171174835
1006	+880171176488
1007	+880171174835
1007	+880189111757
1005	+880171176488
1009	+880171174835
1011	+880189111757
1006	+880171176488
1004	+880189111757
1005	+880171174835
1007	+880189111757
1007	+880171174835
1008	+880171176488
1009	+880189111757
1010	+880171174835
1010	+880171176488
1011	+880171174835
1001	+880189111757
1002	+880171176488
1003	+880171174835
1004	+880189111757
1005	+880171176488
1002	+880171174835
1002	+880171176488
1006	+880171174835
1010	+880189111757
1001	+880171174835
1002	+880189111757

1003	+880171176488
1001	+880171174835
1004	+880189111757
1004	+880171176488
1005	+880171174835
1006	+880189111757
1007	+880171176488
1007	+880189111757
1004	+880171174835
1005	+880189111757
1006	+880171174835
1007	+880171176488
1008	+880189111757
1009	+880171174835
1010	+880171176488
1011	+880189111757
1004	+880171174835
1003	+880189111757
1003	+880171174835
1003	+880171176488
1002	+880189111757
1002	+880171176488
1006	+880171174835
1010	+880189111757
1001	+880171174835
1002	+880171176488
1003	+880189111757
1001	+880171176488
1004	+880171174835

1004	+880189111757
1005	+880171174835
1006	+880171176488
1004	+880189111757
1005	+880171176488
1002	+880189111757
1002	+880171174835
1006	+880171176488
1010	+880171174835
1001	+880189111757
1002	+880171176488
1003	+880171174835
1001	+880189111757
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