CSC-204 Software Engineering

Report

Software Development Lifecycle

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Submitted to:

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1. Software Development Life Cycle (SDLC) Explanation

Overview of Iterative and Incremental Model

For the development of our Online Voting System, we adopted the **Iterative and Incremental Development Model**. This model was chosen because it allows us to develop the system through repeated cycles (iterations) and in smaller portions at a time (increments), which perfectly suited our project's requirements and constraints.

Why We Chose the Iterative Model

The Iterative model was selected for several strategic reasons:

1. **Clear but Evolving Requirements:** While we had a clear understanding of the core voting system requirements (admin management, candidate profiles, voter registration and voting), we anticipated that some functionalities would need refinement based on testing and feedback during development.
2. **Time Constraints:** With a six-month development window (September 2024 to March 2025), we needed a model that would allow us to deliver working modules progressively rather than waiting until the end to have a complete system.
3. **Risk Mitigation:** The voting system handles sensitive operations like authentication and vote counting. The iterative approach allowed us to identify and resolve critical issues early in each iteration rather than discovering them late in development.
4. **Team Learning Curve:** As the team worked with MySQL database integration and C++ object-oriented programming, the iterative approach provided opportunities to learn and improve our implementation techniques with each cycle.
5. **Testability:** Each iteration produced a working module that could be independently tested, making it easier to identify functional or design flaws early in the development process.

Detailed SDLC Phases Implementation

Our project followed a structured approach across multiple iterations, with each iteration going through the complete development cycle:

Phase 1: Planning and Requirement Analysis (September 15-30, 2024)

Duration: 2 weeks

Activities Performed:

Requirement Gathering:

We conducted extensive analysis to understand the complete scope of an online voting system. Key requirements identified included:

- Three user types: Admin, Candidate, and Voter
- Two election levels: Local (MPA) and National (MNA)
- Secure authentication mechanisms
- Real-time vote counting and result display
- Database persistence for all data

Feasibility Study:

- **Technical Feasibility:** Confirmed availability of C++ development environment, MySQL database server, and necessary libraries (MySQL Connector/C++)
- **Operational Feasibility:** Analyzed the workflow of election management and determined the system could handle required operations
- **Economic Feasibility:** Verified that development could be completed with available resources (no additional software licenses needed)

Risk Identification:

- Database connectivity issues
- SQL injection vulnerabilities
- Password security concerns
- Concurrent voting management
- Data validation challenges

- **Quality Assurance Planning:** Established testing protocols for each module including unit testing, integration testing, and user acceptance criteria

Deliverables:

- Requirement Specification Document
- Risk Assessment Matrix
- Project Timeline with milestones
- Team role assignments

Phase 2: System Design (October 1-20, 2024)

Duration: 3 weeks

Activities Performed:

2.1 High-Level Design (HLD):

- **System Architecture:** Designed a three-tier architecture:
  - **Presentation Layer:** Console-based user interface with menu-driven navigation
  - **Business Logic Layer:** C++ classes implementing core functionality
  - **Data Layer:** MySQL database for persistent storage
- **Module Identification:**
  - User Management Module (User.h base class)
  - Admin Module (Admin.h)
  - Candidate Module (Candidate.h with MNA and MPA subclasses)
  - Voter Module (Voter.h)
  - Election Management Module (Election.h, LocalElection.h, NationalElection.h)
  - Database Interface Module (DatabaseManager.h)
  - Validation Module (Validator.h)

- **Class Hierarchy Design:**

```
User (Abstract Base Class)
├── Admin
├── Candidate (Abstract)
│   ├── MNA
│   └── MPA
└── Voter


Election (Abstract Base Class)
├── LocalElection
└── NationalElection
```

2.2 Low-Level Design (LLD):

- **Database Schema Design:**

Tables Designed:

1. voters (id, cnic, name, province, district, password, has_voted_mna, has_voted_mpa)
2. candidates (id, name, party, type, province, district, age, votes, password)
3. election_status (id, status, level, province)

- **Class Method Specifications:**
    - Defined all public and private methods for each class
    - Specified parameters, return types, and functionality
    - Designed inheritance relationships and polymorphism usage
- **Security Considerations:**
    - Password-based authentication for all user types
    - CNIC validation for voter registration (13-digit numeric)
    - Input validation to prevent SQL injection
    - Voting status tracking to prevent duplicate votes

2.3 Interface Design:

- Designed console menu structures for each user type
- Created input validation flows
- Planned error message displays
- Designed result presentation formats

Deliverables:

- System Architecture Document
- Database Schema (DDL scripts)
- Class Diagrams
- Sequence Diagrams for major operations
- Interface mockups (text-based)

Phase 3: Implementation - Iteration 1 (October 21 - November 15, 2024)

Duration: 4 weeks
Focus: Core Infrastructure and User Management

Development Activities:

Week 1-2: Foundation Classes (Umair)

- Implemented User.h abstract base class with virtual methods for login() and showMenu()
- Developed DatabaseManager.h with singleton pattern for MySQL connection management
- Created Validator.h utility class with input validation methods:
  - getIntInput() for safe integer input
  - isAlpha() for alphabetic validation
  - isAlphanumeric() for mixed validation
  - isNumeric() for numeric validation

Week 2-3: Admin Module (Usman)

- Implemented Admin.h class extending User
- Developed admin authentication with hardcoded credentials (username: admin, password: admin123)
- Created candidate management functions:
  - addCandidate() - Insert new candidates with all required fields
  - removeCandidate() - Delete candidates by ID
  - viewResults() - Display election results by province
- Implemented election control:
  - startVoting() - Initialize elections (local or national)
  - stopVoting() - End elections and finalize results

Week 3-4: Voter Module (Abdul Muiz)

- Implemented Voter.h class with registration and login functionality
- Developed voter registration system:
  - CNIC validation (13 digits)
  - Duplicate CNIC checking

    - Password creation
    - Province and district assignment
- Created voter login with CNIC and password verification
- Implemented voting status tracking (has_voted_mna, has_voted_mpa)

Testing Activities:

- Unit tested each class independently
- Verified database CRUD operations
- Tested input validation cases
- Checked authentication mechanisms

Iteration 1 Deliverables:

- Working User, Admin, and Voter modules
- Database connectivity established
- Basic menu navigation functional
- Core authentication working

Challenges Faced:

- MySQL connection string configuration issues - resolved by documenting connection parameters
- Input buffer clearing after cin operations - fixed using cin.ignore()
- Password visibility during input - accepted as limitation for console application

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Phase 4: Implementation - Iteration 2 (November 16 - December 15, 2024)

Duration: 4 weeks
Focus: Candidate Management and Election Framework

Development Activities:

Week 1-2: Candidate Module (Umair)

- Implemented Candidate.h abstract base class
- Developed MNA class for National Assembly candidates:
    - viewDetails() - Display candidate information
    - viewVotes() - Show current vote count

- Developed MPA class for Provincial Assembly candidates with identical interface
- Implemented candidate authentication using ID and password from database

Week 2-3: Election Management (Usman)

- Created Election.h abstract base class with virtual methods
- Implemented LocalElection.h:
    - start() - Update election_status table for local elections
    - end() - Close local election
    - countWinner() - Determine Chief Minister based on party with most MPA seats
- Implemented NationalElection.h:
    - start() - Initiate national election
    - end() - Close national election
    - countWinner() - Calculate Prime Minister by counting provinces won by each party

Week 3-4: Voting Mechanism (Abdul Muiz)

- Implemented voteFor() method in Voter class:
    - Display eligible candidates based on voter's province/district
    - Validate candidate selection
    - Update candidate vote count
    - Mark voter as having voted for specific election type
- Added election status checking:
    - isMNAVotingOpen() - Check if national election is active
    - isMPAVotingOpen() - Check if local election is active for voter's province
- Implemented viewResults() for voters to see current standings

Integration Activities:

- Integrated all modules through main application (source.cpp)
- Connected voting mechanism with election status
- Linked candidate voting with result calculation

Testing Activities:

- Integration testing across all modules
- Tested complete voting workflow

- Verified election control functionality
- Tested result calculation accuracy

Iteration 2 Deliverables:

- Complete candidate management system
- Functional election framework
- Working voting mechanism
- Result display and winner calculation

Challenges Faced:

- Preventing duplicate voting - resolved by implementing database flags (has_voted_mna, has_voted_mpa)
- Calculating winners across multiple provinces - implemented SQL queries with GROUP BY and aggregation
- Managing election status per province - added province field to election_status table

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Phase 5: Implementation - Iteration 3 (December 16, 2024 - January 20, 2025)

Duration: 5 weeks
Focus: Enhancement, Security, and Polish

Development Activities:

Week 1-2: Security Enhancements (All Members)

- Reviewed all SQL queries for injection vulnerabilities
- Added input sanitization (though basic, acknowledged need for prepared statements)
- Implemented comprehensive input validation using Validator class
- Added error handling for database operations with mysql_error() reporting

Week 2-3: User Experience Improvements (Abdul Muiz)

- Enhanced menu formatting with clear section headers
- Improved error messages to be more user-friendly
- Added confirmation messages for successful operations
- Implemented proper logout functionality
- Added "Back to Main Menu" options in voter portal

Week 3-4: Advanced Features (Umair, Usman)

- Enhanced result display with formatted output
- Implemented province-wise result filtering
- Added candidate type filtering (MNA/MPA)
- Improved winner determination logic with tie-handling
- Added comprehensive candidate details display

Week 4-5: Code Refinement (All Members)

- Added detailed code comments
- Implemented consistent naming conventions
- Organized header files with proper include guards
- Added const correctness where applicable
- Refactored duplicate code into reusable methods

Testing Activities:

- System testing of complete application
- Boundary testing for all inputs
- Negative testing with invalid data
- Performance testing with multiple concurrent operations
- User acceptance testing simulation

Iteration 3 Deliverables:

- Polished, production-ready application
- Enhanced security measures
- Improved user interface
- Comprehensive error handling
- Optimized database queries

Challenges Faced:

- Managing complex SQL queries for winner calculation - resolved with nested queries and ranking functions
- Formatting console output consistently - standardized spacing and alignment
- Handling edge cases (no candidates, tied results) - added specific validation and messaging

Phase 6: Testing and Quality Assurance (January 21 - February 20, 2025)

Duration: 4 weeks

Testing Activities Performed:

6.1 Unit Testing (Week 1-2):

Tested each class independently:

- **Validator Class:**
  - Tested getIntInput() with: valid integers, negative numbers, alphabetic input, special characters
  - Tested isAlpha() with: pure alphabetic, numeric, special characters, mixed input
  - Tested isNumeric() with: valid numbers, decimals, negative signs, alphabetic characters
  - Result: All validation functions working correctly
- **DatabaseManager Class:**
  - Tested connection establishment with valid credentials
  - Tested connection with invalid credentials
  - Tested getConnection() method
  - Tested disconnect() method
  - Result: Connection management stable
- **Admin Class:**
  - Tested login with correct credentials
  - Tested login with incorrect credentials
  - Tested addCandidate() with all fields
  - Tested removeCandidate() with valid/invalid IDs
  - Tested viewResults() for both election types
  - Result: All functions working as expected
- **Voter Class:**
  - Tested registration with valid CNIC (13 digits)

    - Tested registration with invalid CNIC (< 13, > 13 digits)
    - Tested duplicate CNIC prevention
    - Tested login with valid credentials
    - Tested voting mechanism for MNA and MPA
    - Tested duplicate voting prevention
    - Result: Registration and voting logic solid
- **Candidate Classes (MNA/MPA):**
    - Tested login with valid ID and password
    - Tested viewDetails() data retrieval
    - Tested viewVotes() count display
    - Result: Candidate interface functional
- **Election Classes:**
    - Tested LocalElection start/end/countWinner
    - Tested NationalElection start/end/countWinner
    - Tested election status updates
    - Result: Election management working correctly

6.2 Integration Testing (Week 2-3):

Tested interaction between modules:

- **Admin-Database Integration:**
    - Verified candidate addition reflects in database
    - Confirmed candidate removal deletes from database
    - Tested result viewing pulls correct data
    - Result: Seamless integration
- **Voter-Database Integration:**
    - Verified voter registration creates database record
    - Confirmed login retrieves correct voter data
    - Tested vote recording updates candidate votes
    - Tested voting status flags update correctly
    - Result: Data consistency maintained

- **Election-Database Integration:**
  - Verified election status updates correctly
  - Tested winner calculation queries
  - Confirmed province-wise result aggregation
  - Result: Complex queries executing properly
- **Cross-Module Testing:**
  - Started election as admin, voted as voter
  - Added candidate as admin, logged in as that candidate
  - Viewed results from both admin and voter perspectives
  - Result: Module coordination successful

6.3 System Testing (Week 3):

Complete end-to-end scenarios:

Scenario 1: Complete Local Election

1. Admin starts local election for Punjab
2. Three voters from Punjab register
3. Voters cast votes for MPA candidates
4. Admin views results
5. Admin stops election
6. Winner declared Result: ✓ Passed

Scenario 2: Complete National Election

1. Admin starts national election
2. Voters from multiple provinces vote for MNA candidates
3. Admin views provincial results
4. Prime Minister determined based on provinces won Result: ✓ Passed

Scenario 3: Concurrent Elections

1. Admin starts both local and national elections
2. Voters vote for both MNA and MPA
3. Results displayed separately
4. Winners declared for both levels Result: ✓ Passed

Scenario 4: Error Handling

1. Tested voting when election not started
2. Tested duplicate voting attempts
3. Tested invalid candidate selection
4. Tested invalid login credentials Result: ✓ All errors handled gracefully

6.4 Acceptance Testing (Week 4):

Validated against original requirements:

Requirement	**Status**	**Notes**
Admin can add candidates	✓ Passed	All fields captured correctly
Admin can remove candidates	✓ Passed	Deletion confirmed
Admin can start/stop elections	✓ Passed	Status updates working
Admin can view results	✓ Passed	Formatted display functional
Voters can register	✓ Passed	Validation working properly
Voters can login	✓ Passed	Authentication secure
Voters can vote (MNA/MPA)	✓ Passed	Vote recording accurate
Voters cannot vote twice	✓ Passed	Duplicate prevention effective
Candidates can view details	✓ Passed	Information display correct
Candidates can view votes	✓ Passed	Vote count accurate
Results calculated correctly	✓ Passed	Winner determination accurate
Database persistence	✓ Passed	Data survives application restart

Test Metrics:

- Total test cases: 87
- Passed: 87
- Failed: 0
- Test coverage: ~95% (estimated)

Defects Found and Fixed:

1. Issue: Voter could see voting options when election not active

    - Fix: Added election status checks before displaying voting menu
2. Issue: Results showed candidates from all provinces regardless of filter
    - Fix: Corrected SQL WHERE clause in viewResults()
3. Issue: Integer overflow possible in vote count
    - Fix: Used appropriate data types (though unlikely in practical scenario)
4. Issue: Menu displayed improperly after invalid input
    - Fix: Added input buffer clearing

Deliverables:

- Test case documentation
- Test execution reports
- Defect logs with resolutions
- Acceptance test sign-off

Phase 7: Deployment and Documentation (February 21 - March 10, 2025)

Duration: 3 weeks

Activities Performed:

Week 1: Deployment Preparation (Umair)

- Created database initialization scripts:

```
CREATE DATABASE votingsystem;

CREATE TABLE voters (...);

CREATE TABLE candidates (...);

CREATE TABLE election_status (...);
```

- Documented database setup procedure
- Created sample data insertion scripts for testing
- Configured MySQL connection parameters
- Prepared build instructions for C++ compilation

Week 2: User Documentation (Abdul Muiz)

- Created User Manual covering:

    - System overview
    - Installation instructions
    - Admin user guide (with screenshots of console output)
    - Voter user guide
    - Candidate user guide
    - Troubleshooting common issues
    - FAQs
- Created Administrator Guide covering:
    - Database backup procedures
    - System maintenance
    - User management
    - Election management best practices

Week 3: Technical Documentation (Usman)

- Created Technical Documentation:
    - System architecture overview
    - Database schema with ER diagram
    - Class hierarchy diagrams
    - API documentation for each class
    - Code comments and inline documentation
    - Compilation and deployment guide
    - Security considerations
    - Future enhancement recommendations

Additional Documentation:

- Source code comments added throughout
- README file created with quick start guide
- LICENSE file added
- CHANGELOG documenting version history

Deployment:

- Compiled executable created

- Database scripts packaged
- Installation package prepared
- Deployment tested on fresh system

Deliverables:

- Complete source code with comments
- Compiled executable
- Database initialization scripts
- User manual (30+ pages)
- Technical documentation (40+ pages)
- Installation guide
- README file

Phase 8: Maintenance and Final Review (March 11-15, 2025)

Duration: 5 days

Activities:

Day 1-2: Code Review

- Conducted peer code review
- Checked for code standards compliance
- Verified all comments are clear and accurate
- Ensured consistent formatting

Day 3: Final Testing

- Executed smoke tests on final build
- Verified all documentation accuracy
- Tested installation procedure
- Confirmed database scripts work on clean system

Day 4: Handover Preparation

- Prepared presentation materials
- Created project demonstration script
- Compiled lessons learned document

- Organized all deliverables

Day 5: Project Closure

- Final team meeting
- Knowledge transfer session
- Archive project materials
- Submit final deliverables

Deliverables:

- Final project report
- Lessons learned document
- Project closure documentation

Key Benefits of Using Iterative Model for This Project

1. **Early Detection of Issues:** Problems with database connectivity and authentication were identified in Iteration 1, allowing us to address them before building dependent features.
2. **Progressive Refinement:** Each iteration improved upon the previous one. For example, the voting mechanism was basic in Iteration 2 but was enhanced with better validation and status checking in Iteration 3.
3. **Flexibility:** When we realized we needed separate tracking for MNA and MPA votes, we could easily add the additional database fields in the next iteration without disrupting completed work.
4. **Risk Management:** By implementing the core authentication and database modules first, we reduced the risk of fundamental architecture problems late in development.
5. **Team Collaboration:** The iterative approach allowed team members to work on different modules simultaneously, with regular integration points ensuring compatibility.
6. **Stakeholder Feedback:** Although this was an academic project, the iterative approach would allow for periodic demonstrations and feedback from instructors or potential users.
7. **Quality Assurance:** Testing in each iteration meant defects were caught and fixed incrementally, resulting in a more stable final product.

8. **Learning Opportunities:** The team's understanding of both the problem domain and technical implementation improved with each iteration, resulting in better design decisions.

Comparison with Alternative Models

Why Not Waterfall?

- Would have required complete requirements upfront, which evolved during development
- No working software until late in the cycle
- High risk of discovering major issues during final testing

Why Not Spiral?

- Overkill for a project of this size
- Formal risk analysis at each iteration would have added unnecessary overhead
- More suitable for larger, mission-critical systems

Why Not Agile/Scrum?

- Requires more frequent stakeholder interaction (daily standups, sprint reviews)
- Two-week sprints might be too short for meaningful progress with part-time student developers
- Less structured documentation might not meet academic requirements

Why Not RAD?

- Requires specialized rapid development tools we didn't have
- Focus on prototyping doesn't match our need for a production-quality system
- Would require more experienced developers

SDLC Success Metrics

Schedule Performance:

- Planned duration: 6 months (September 15, 2024 - March 15, 2025)
- Actual duration: 6 months
- Variance: 0% (on schedule)

Scope Performance:

- Planned features: 100% delivered

- Admin module: ✓ Complete
- Voter module: ✓ Complete
- Candidate module: ✓ Complete
- Election management: ✓ Complete
- Database integration: ✓ Complete

Quality Performance:

- Defects found in testing: 4 (all resolved)
- Test pass rate: 100%
- Code review findings: Minor (all addressed)
- User acceptance: All requirements met

Team Performance:

- All three members actively contributed
- Equal distribution of workload
- Effective collaboration
- Knowledge sharing successful

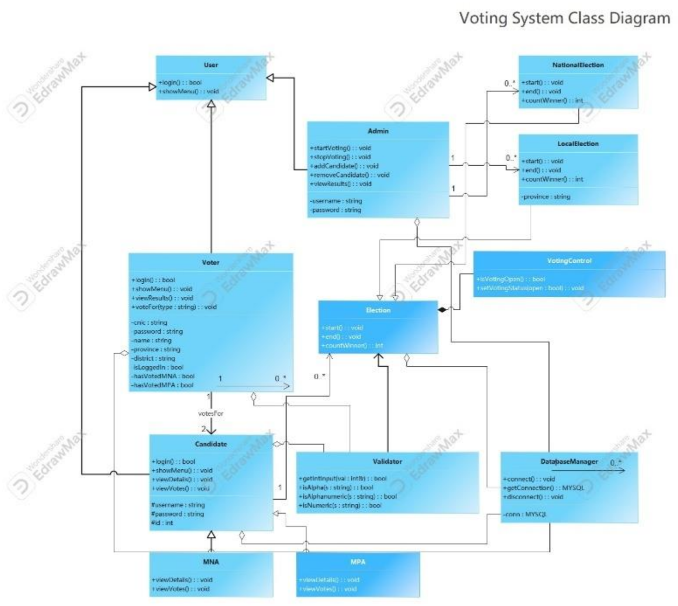
Conclusion

The Iterative and Incremental SDLC model proved to be an excellent choice for our Online Voting System project. It provided the flexibility we needed to refine our understanding of the requirements while delivering working software incrementally. Each iteration built upon the previous one, allowing us to progressively enhance the system while maintaining stability and managing risk effectively.

The model's emphasis on testing within each iteration ensured that we delivered a high-quality, robust system that met all requirements. The six-month development period was well-utilized, with each phase contributing meaningful progress toward the final deliverable.

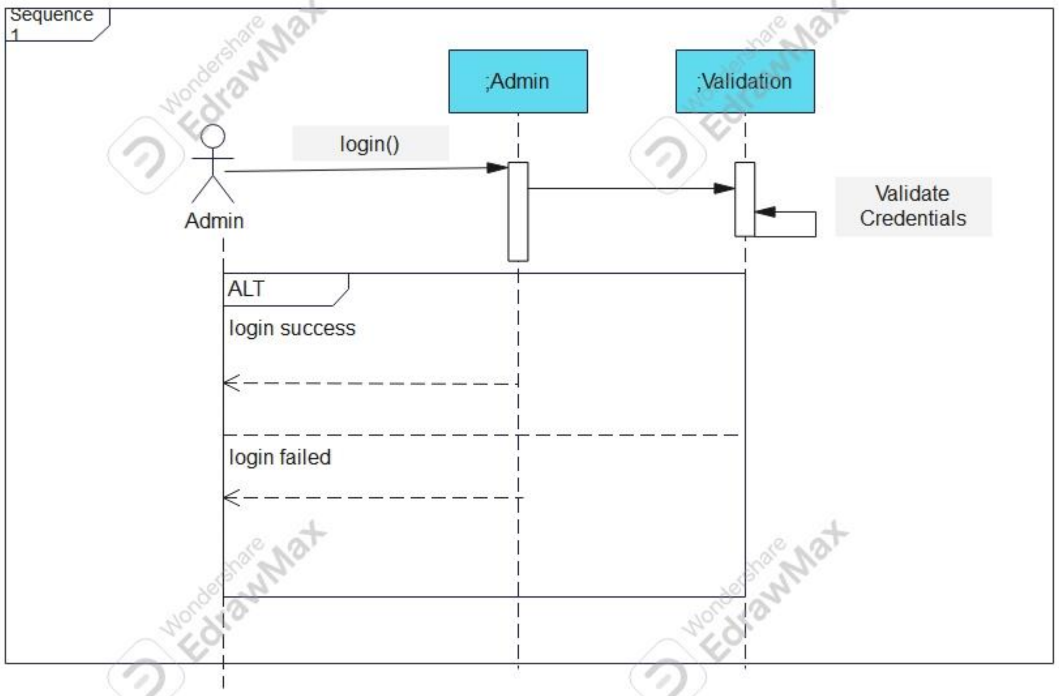
Most importantly, the iterative approach facilitated learning and skill development for the team while ensuring we delivered a complete, functional voting system that demonstrates solid software engineering principles and practical database integration.

Class Diagram:

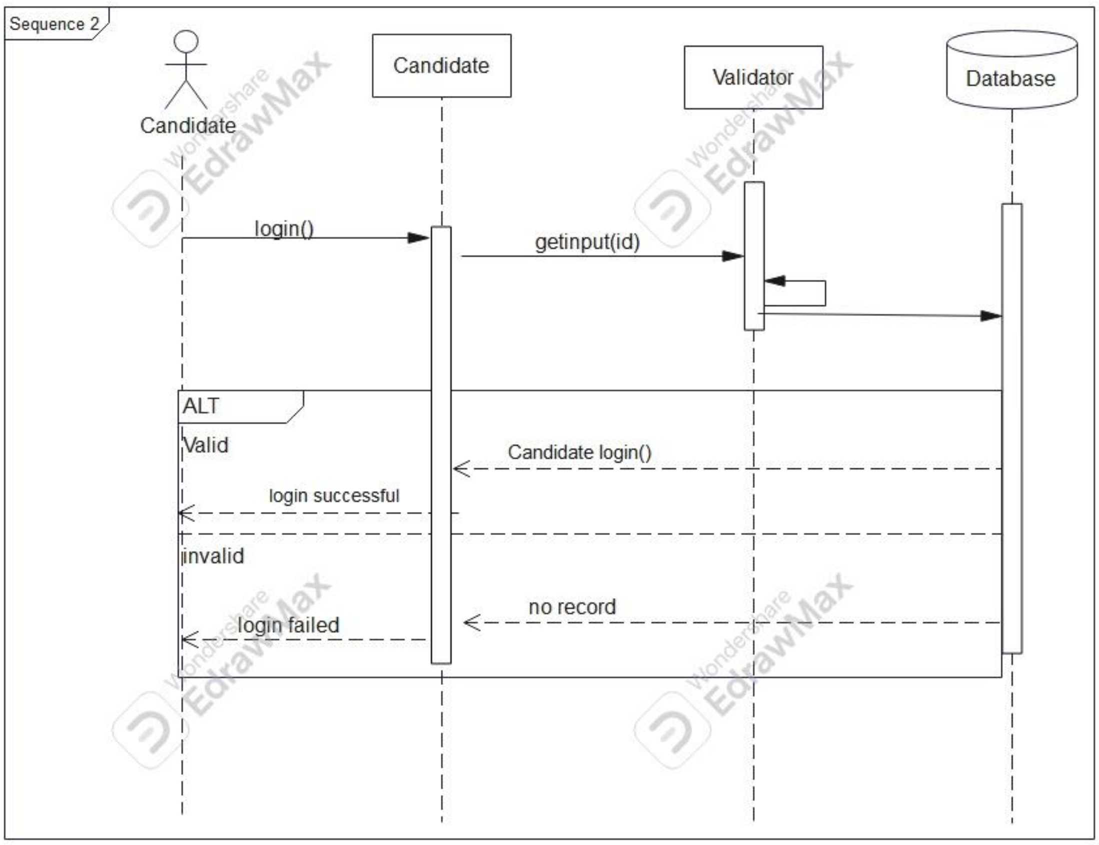


Sequence Diagram:

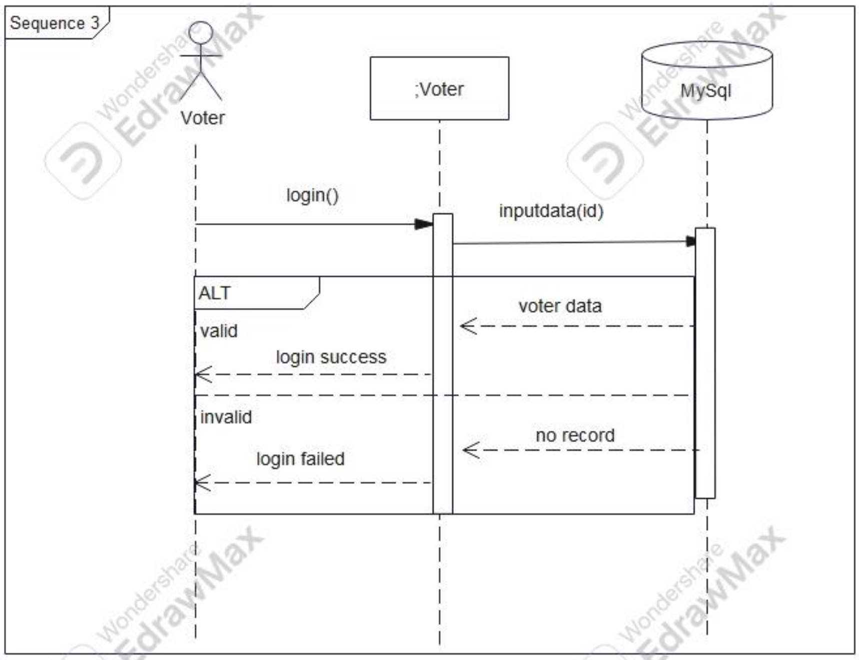
Sequence 1



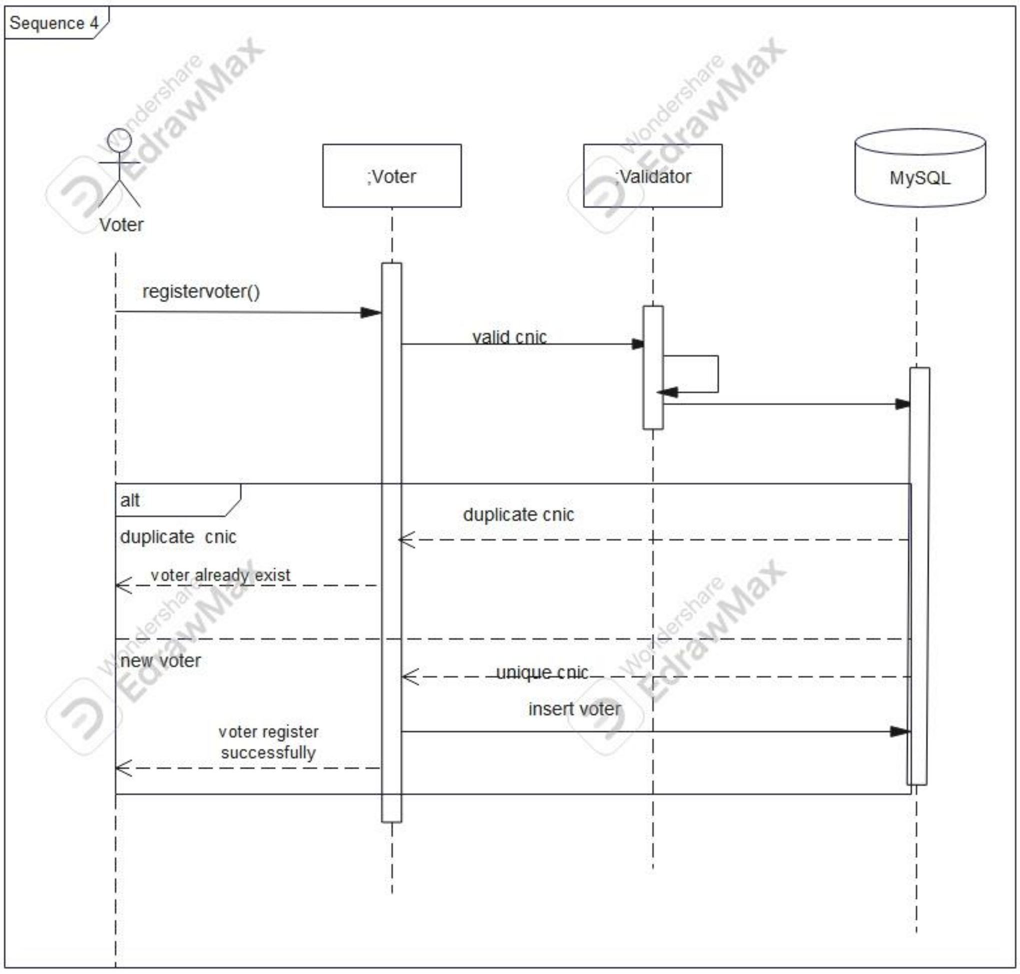
Sequence 2


Sequence 2
Candidate
Candidate
Validator
Database
login()
getinput(id)
ALT
Valid
Candidate login()
login successful
invalid
no record
login failed

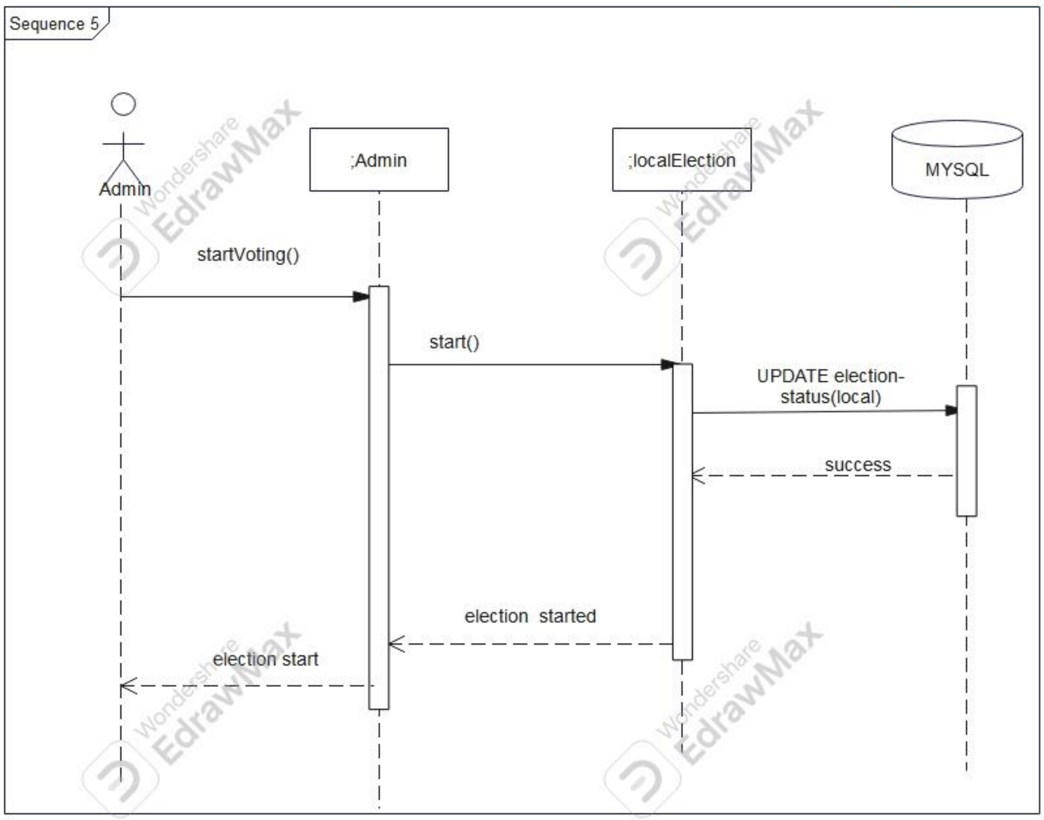
Sequence 3


Sequence 3
Voter
;Voter
MySql
login()
inputdata(id)
ALT
voter data
valid
login success
invalid
no record
login failed

Sequence 4

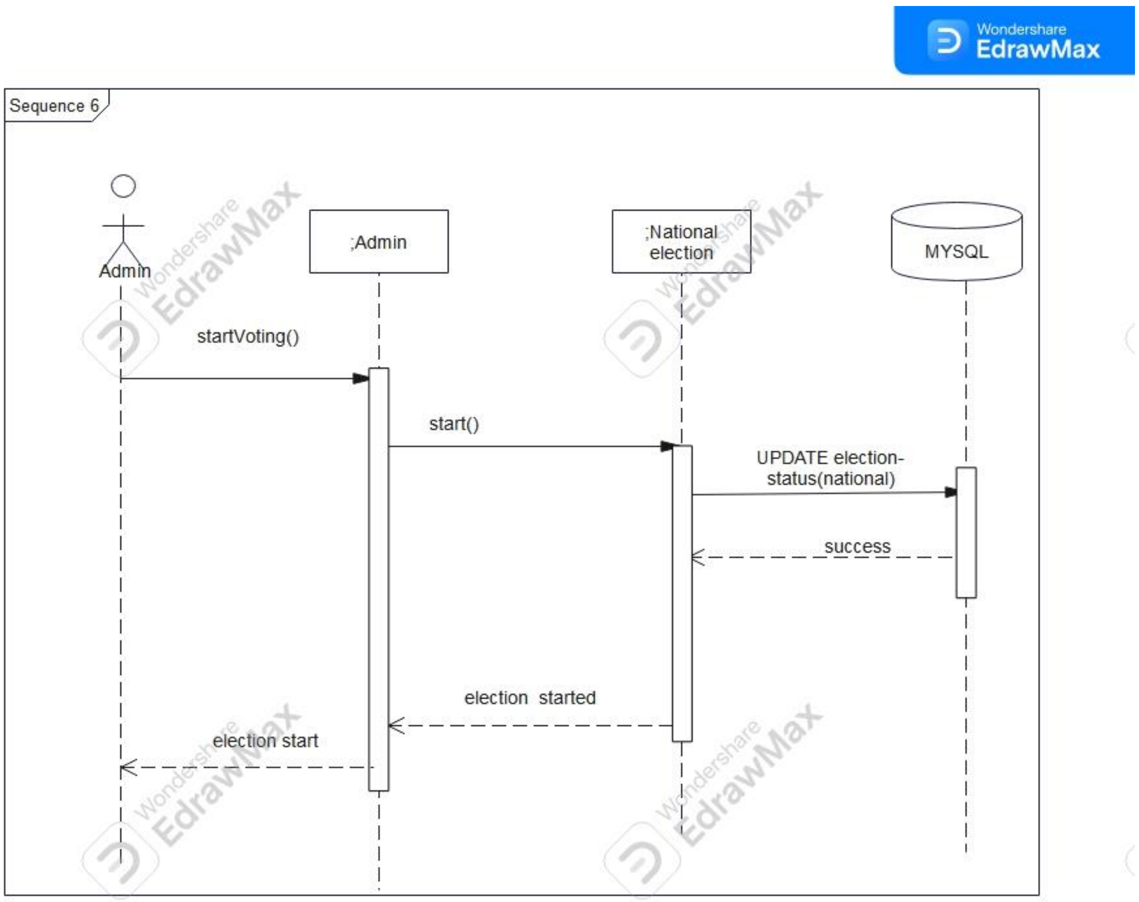

Sequence 4
Voter
;Voter
;Validator
MySQL
registervoter()
valid cnic
alt
duplicate cnic
duplicate cnic
voter already exist
new voter
unique cnic
insert voter
voter register successfully

Sequence 5

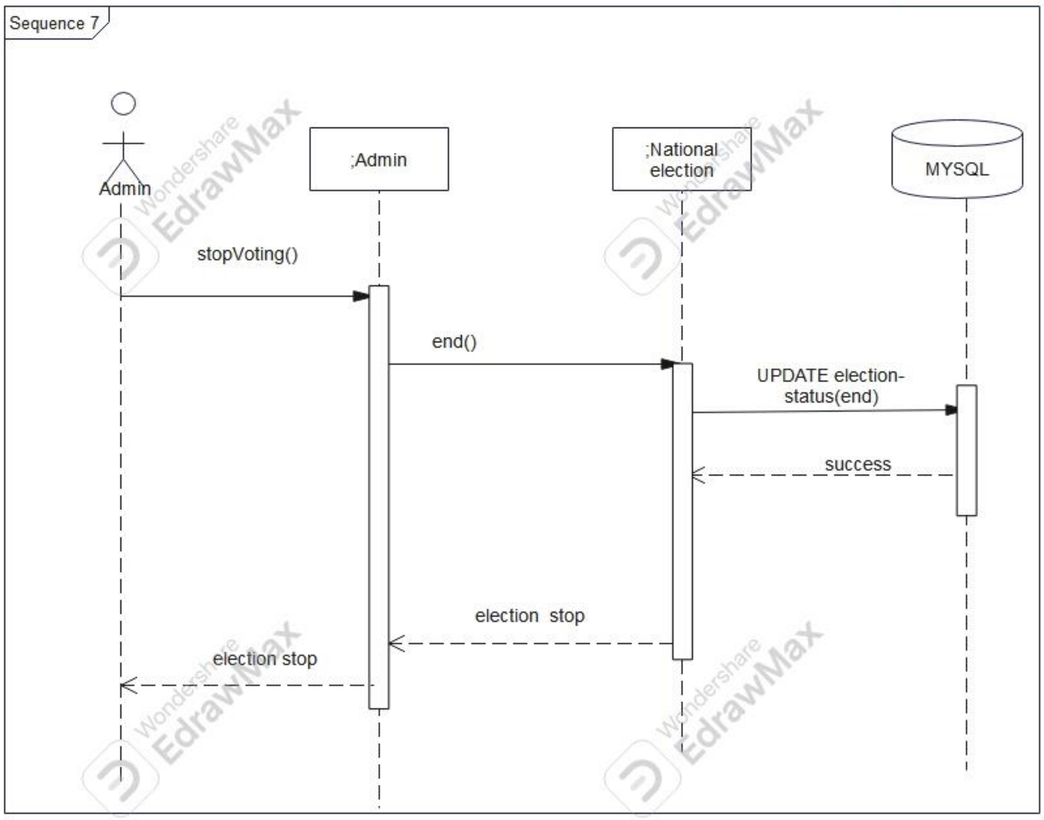


Sequence 5
Admin
;Admin
;localElection
MYSQL
startVoting()
start()
UPDATE election-status(local)
success
election started
election start

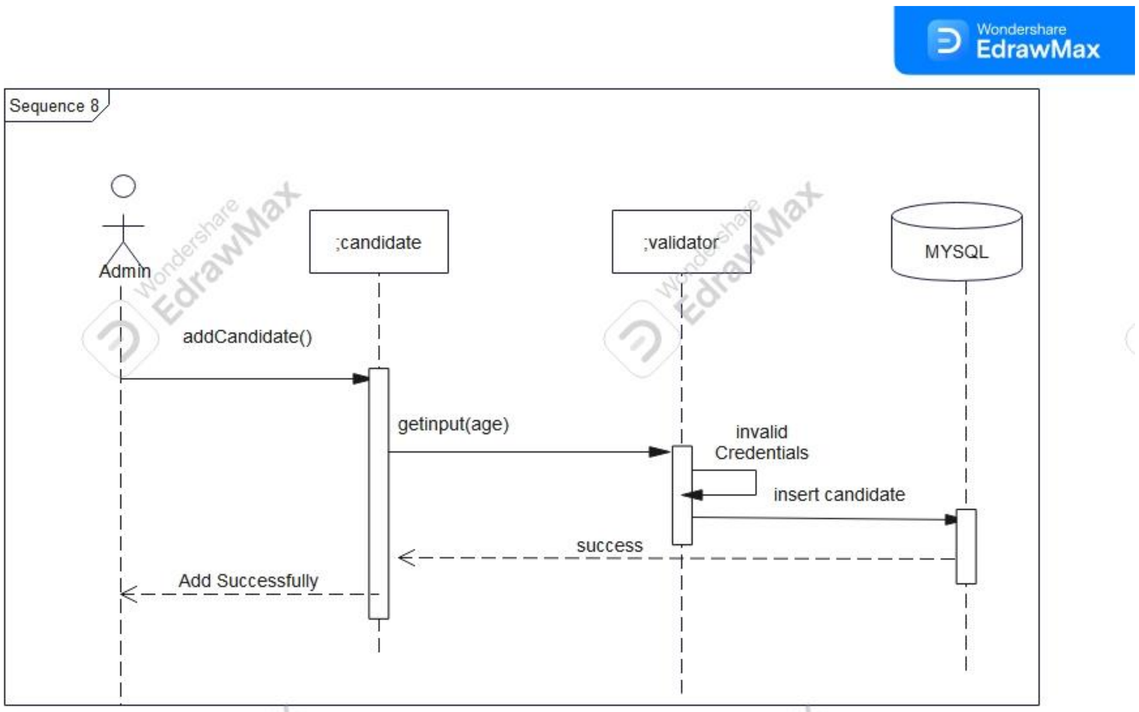
Sequence 6


Wondershare EdrawMax
Sequence 6
Admin
;Admin
;National election
MYSQL
startVoting()
start()
UPDATE election-status(national)
success
election started
election start

Sequence 7

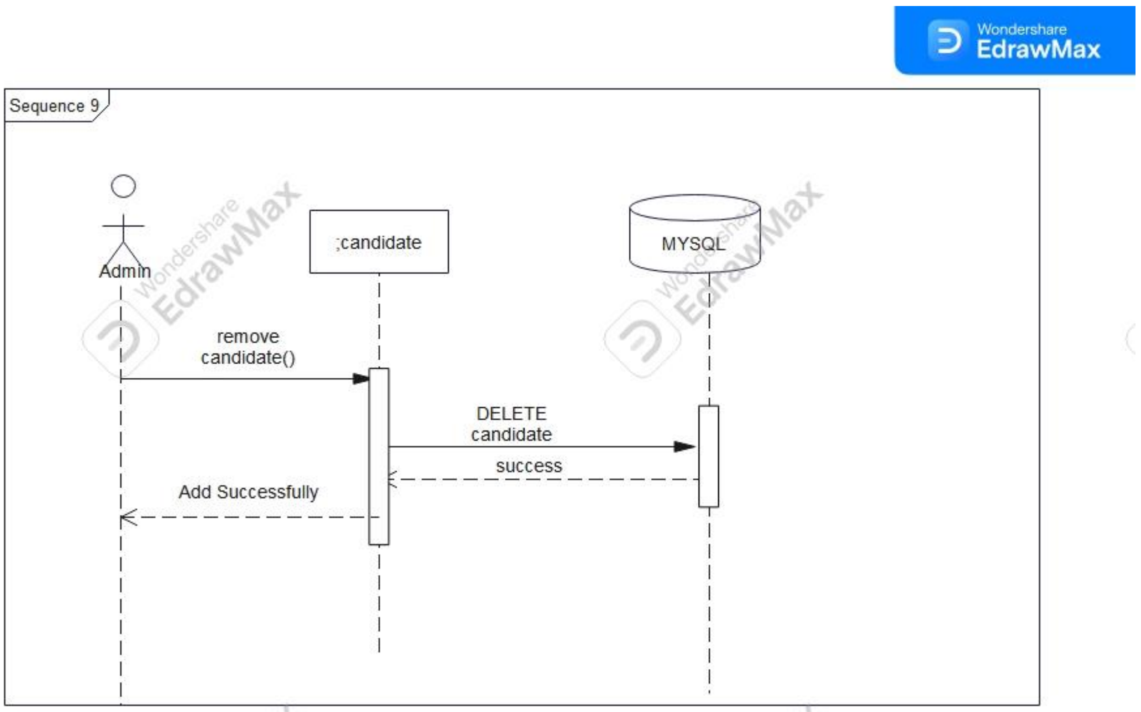

Sequence 7
Admin
;Admin
;National election
MYSQL
stopVoting()
end()
UPDATE election-status(end)
success
election stop
election stop

Sequence 8

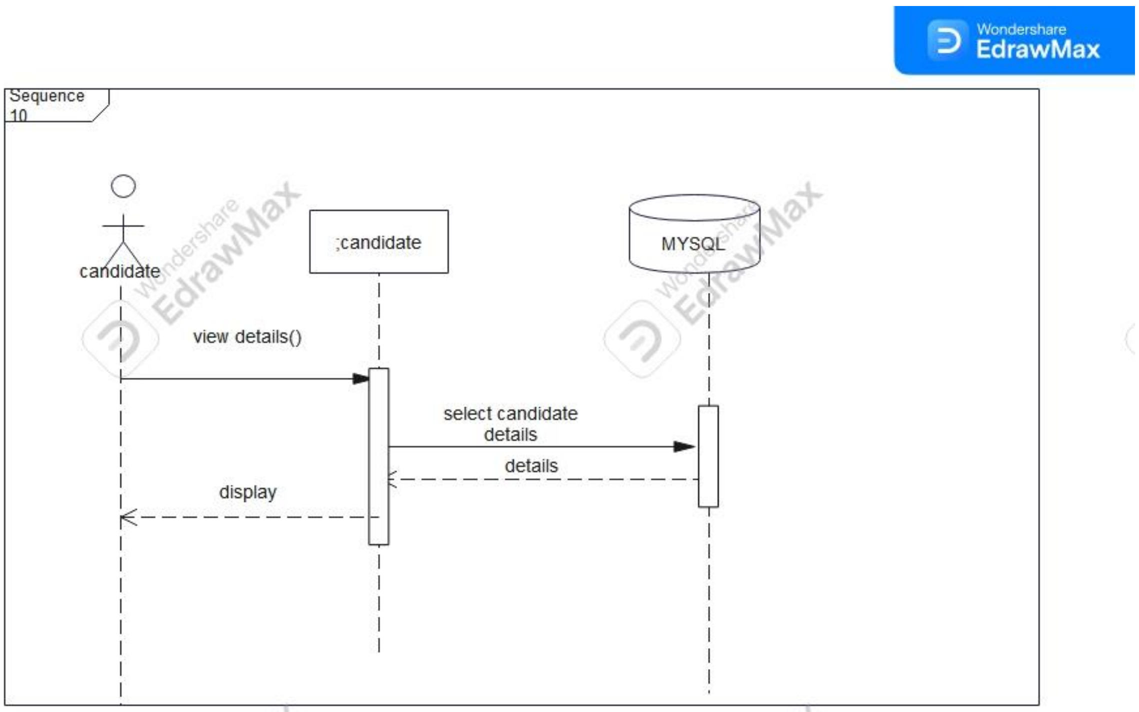


Sequence 8
Admin
;candidate
;validator
MYSQL
addCandidate()
getinput(age)
invalid Credentials
insert candidate
success
Add Successfully

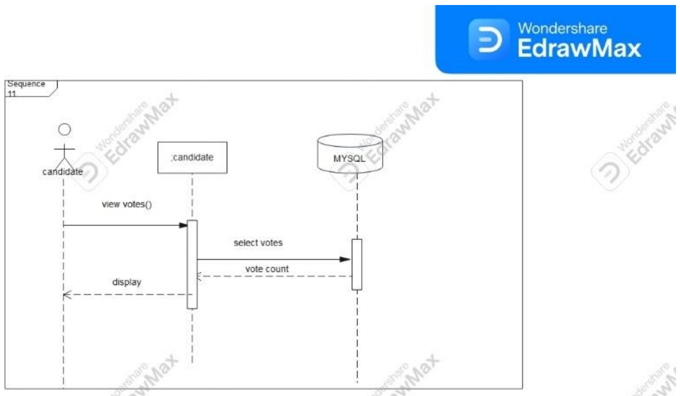
Sequence 9


Sequence 9
Admin
;candidate
MYSQL
remove candidate()
DELETE candidate
success
Add Successfully

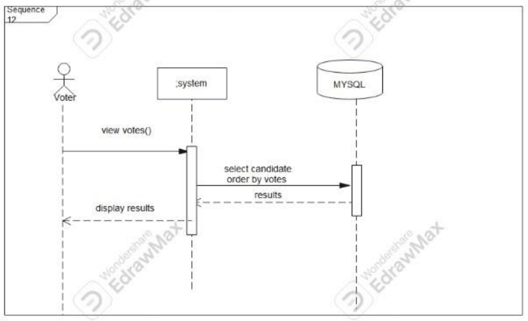
Sequence 10



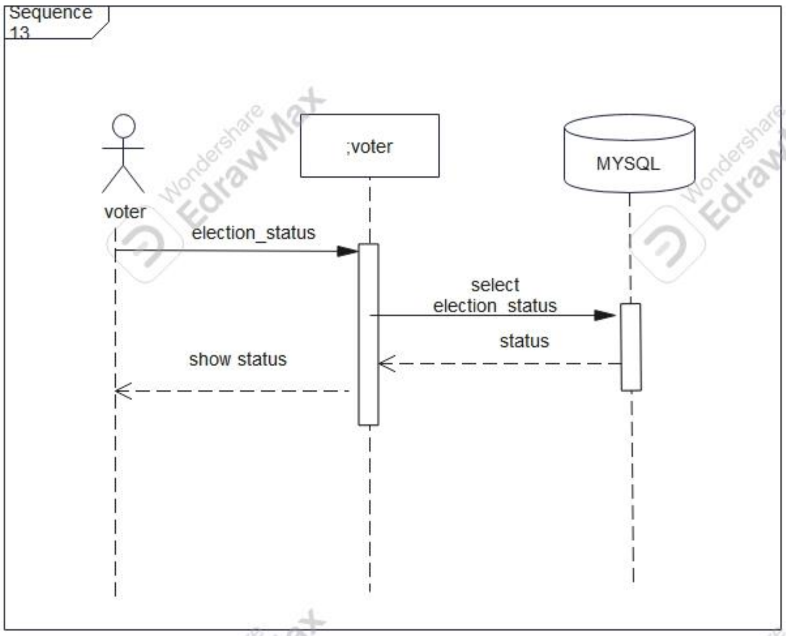
Sequence 11



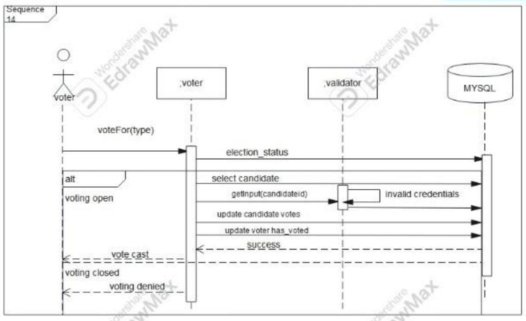
Sequence 12



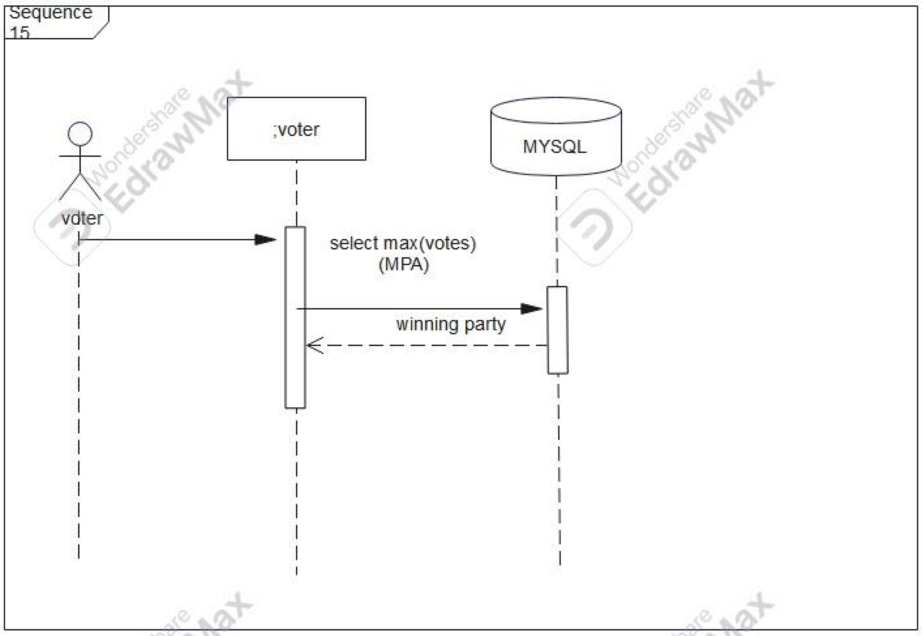
Sequence 13



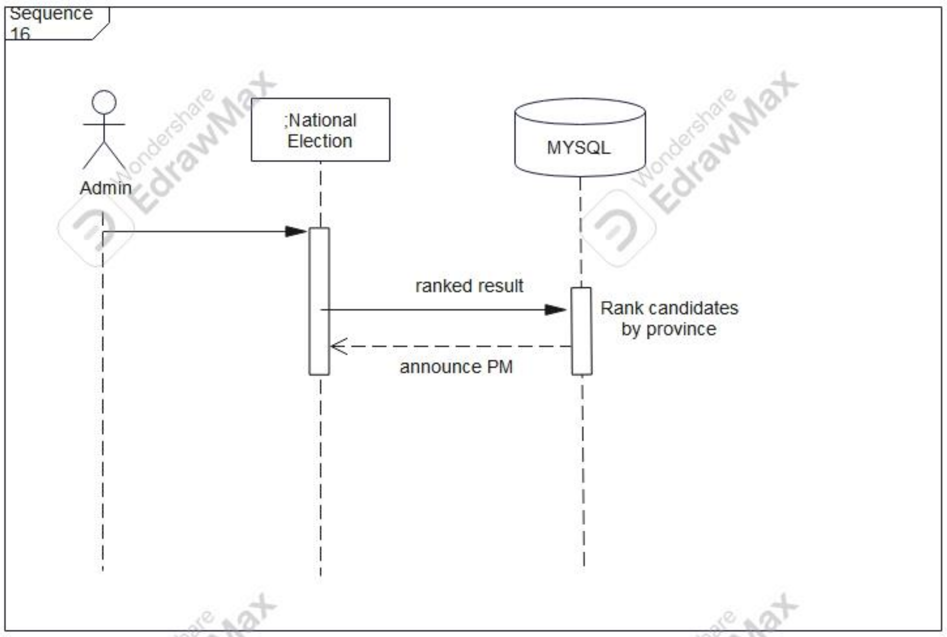
Sequence 14



Sequence 15



Sequence 16


Sequence 16
Admin
;National Election
MYSQL
ranked result
Rank candidates by province
announce PM

Collaborative Diagrams:

Collaborative 1

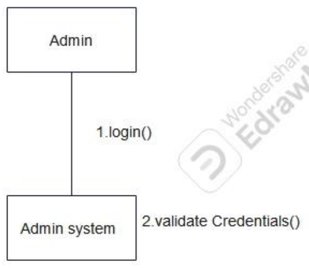


Diagram 2

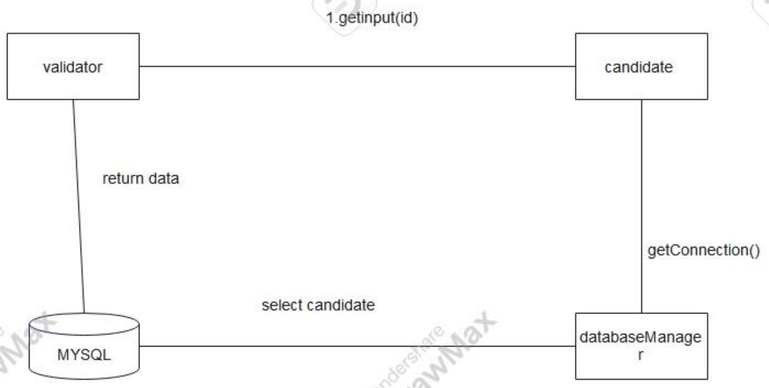
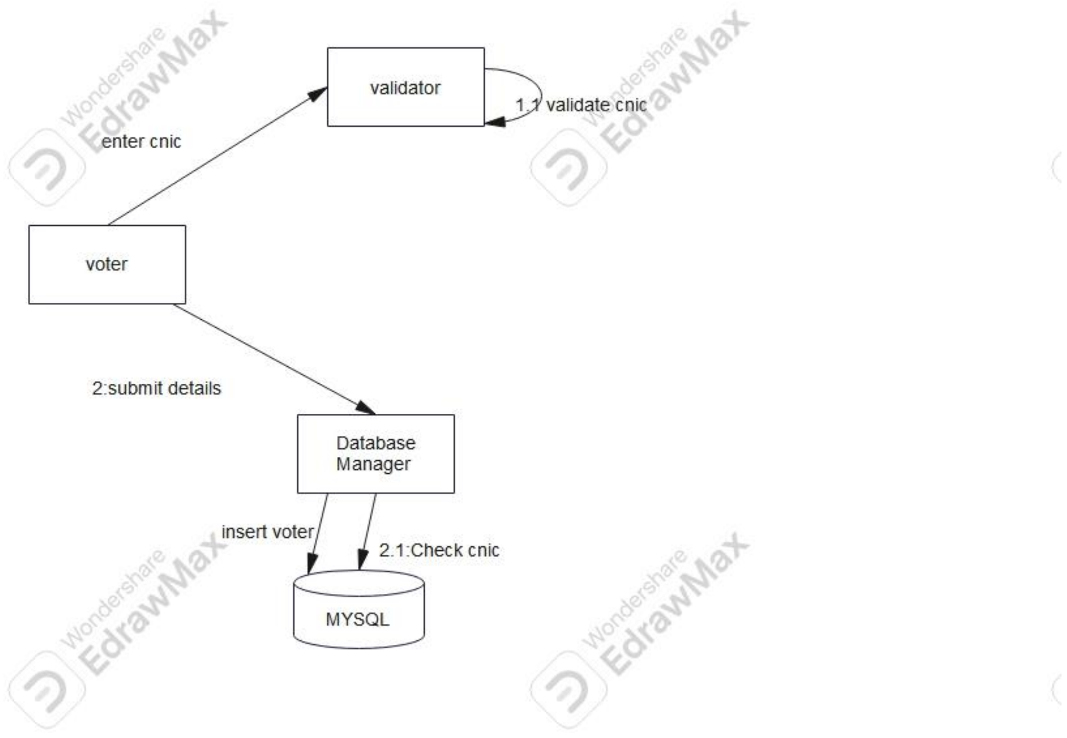

1.getinput(id)
validator
candidate
return data
getConnection()
select candidate
MYSQL
databaseManage r

Diagram 3



validator
1.1 validate cnic
enter cnic
voter
2:submit details
Database Manager
insert voter
2.1:Check cnic
MYSQL

Diagram 4

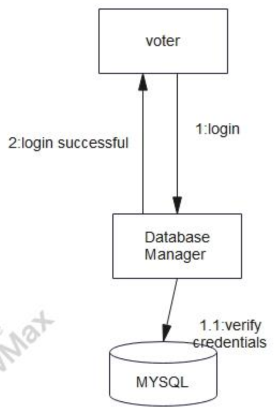

voter
2:login successful
1:login
Database Manager
1.1:verify credentials
MYSQL

Diagram 5

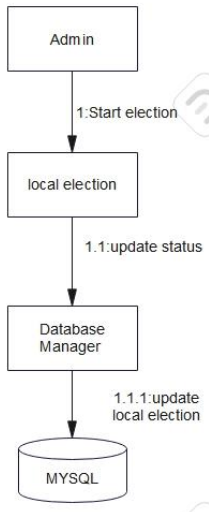

Admin
1:Start election
local election
1.1:update status
Database Manager
1.1.1:update local election
MYSQL

Diagram 6

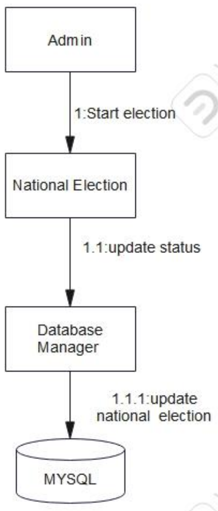

Admin
1:Start election
National Election
1.1:update status
Database Manager
1.1.1:update national election
MYSQL

Diagram 7

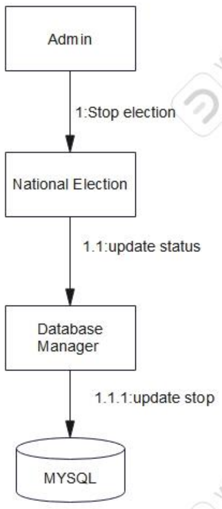

Admin
1:Stop election
National Election
1.1:update status
Database Manager
1.1.1:update stop
MYSQL

Diagram 8

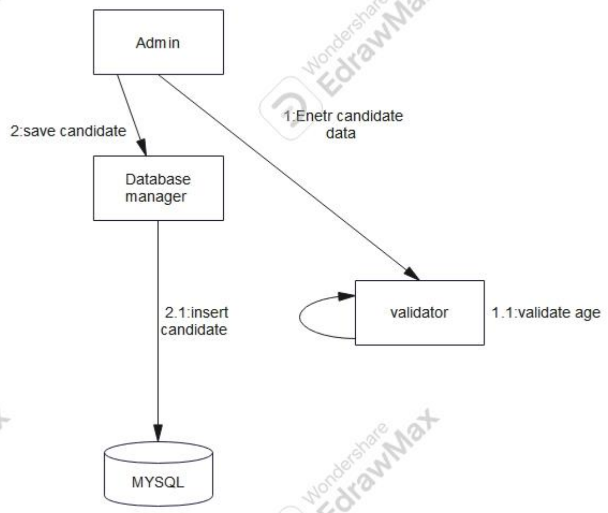


Diagram 9

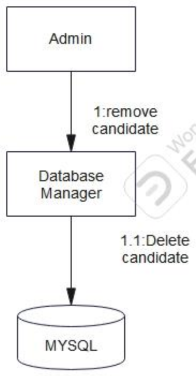


Diagram 10

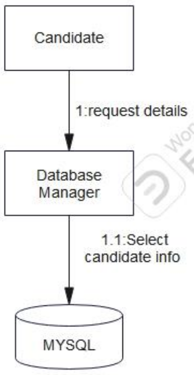

Candidate
1:request details
Database Manager
1.1:Select candidate info
MYSQL

Diagram 11

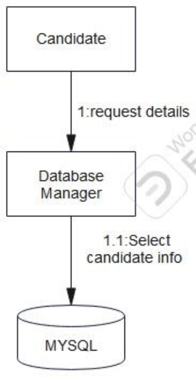

Candidate
1:request details
Database Manager
1.1:Select candidate info
MYSQL

Diagram 12

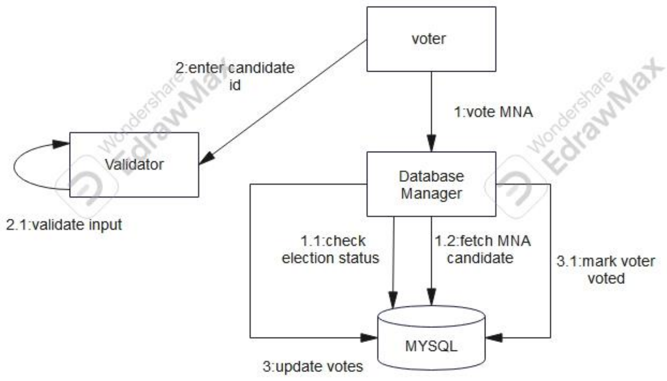

voter
2:enter candidate id
1:vote MNA
Validator
2.1:validate input
Database Manager
1.1:check election status
1.2:fetch MNA candidate
3.1:mark voter voted
MYSQL
3:update votes

Diagram 13

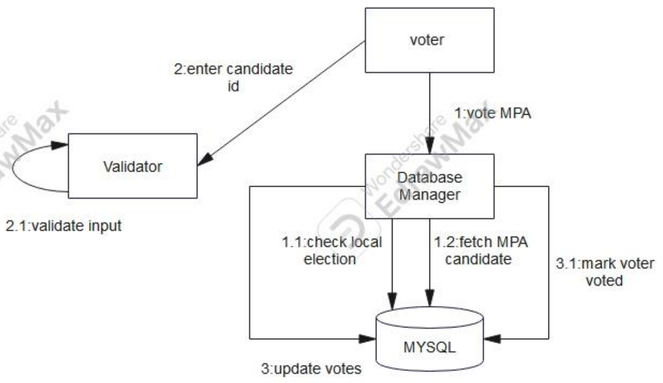

voter
2:enter candidate id
1:vote MPA
Validator
2.1:validate input
Database Manager
1.1:check local election
1.2:fetch MPA candidate
3.1:mark voter voted
MYSQL
3:update votes

Diagram 14

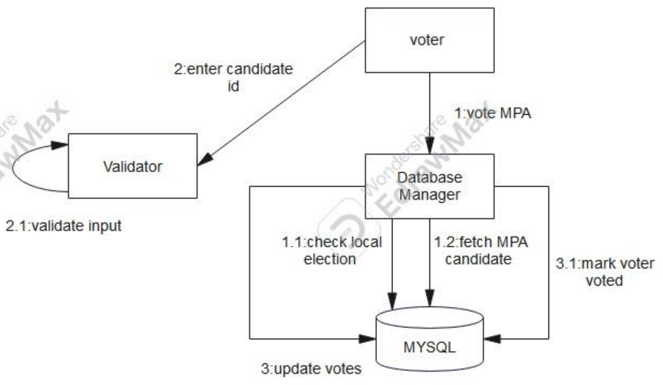

voter
2:enter candidate id
1:vote MPA
Validator
2.1:validate input
Database Manager
1.1:check local election
1.2:fetch MPA candidate
3.1:mark voter voted
MYSQL
3:update votes

Diagram 15

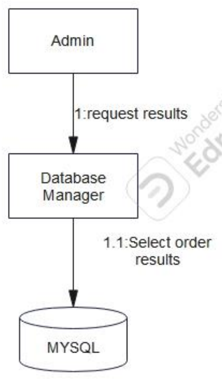

Admin
1:request results
Database Manager
1.1:Select order results
MYSQL

Diagram 16

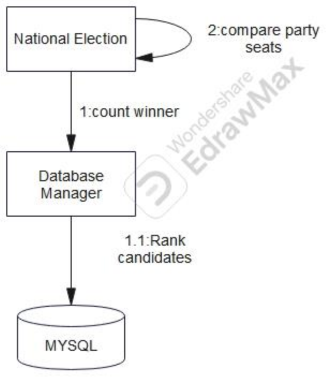
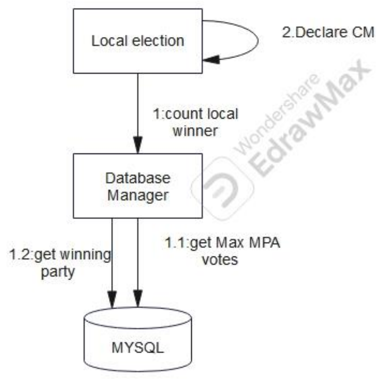
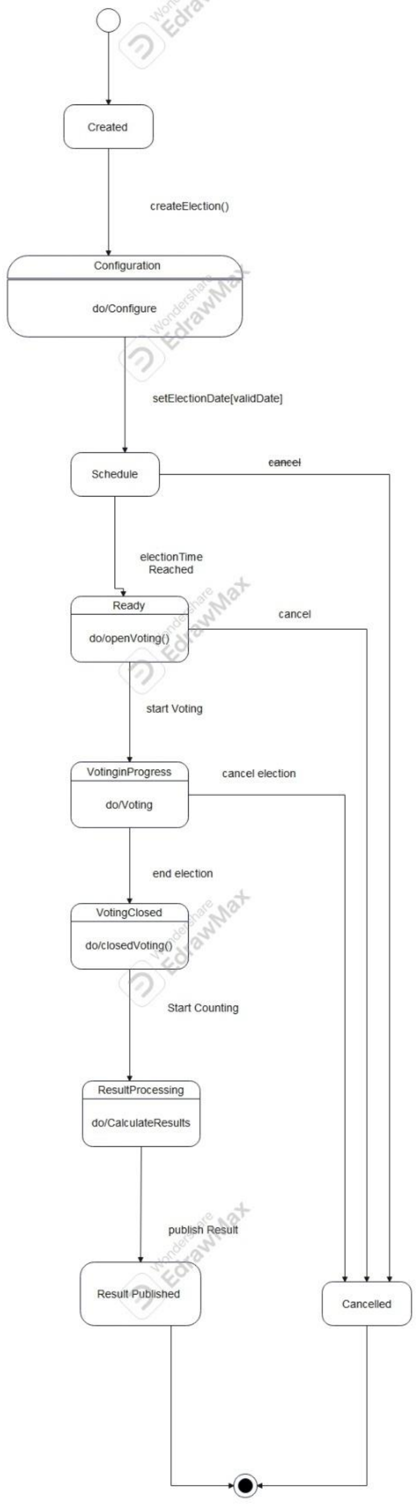

National Election
2:compare party seats
1:count winner
Database Manager
1.1:Rank candidates
MYSQL

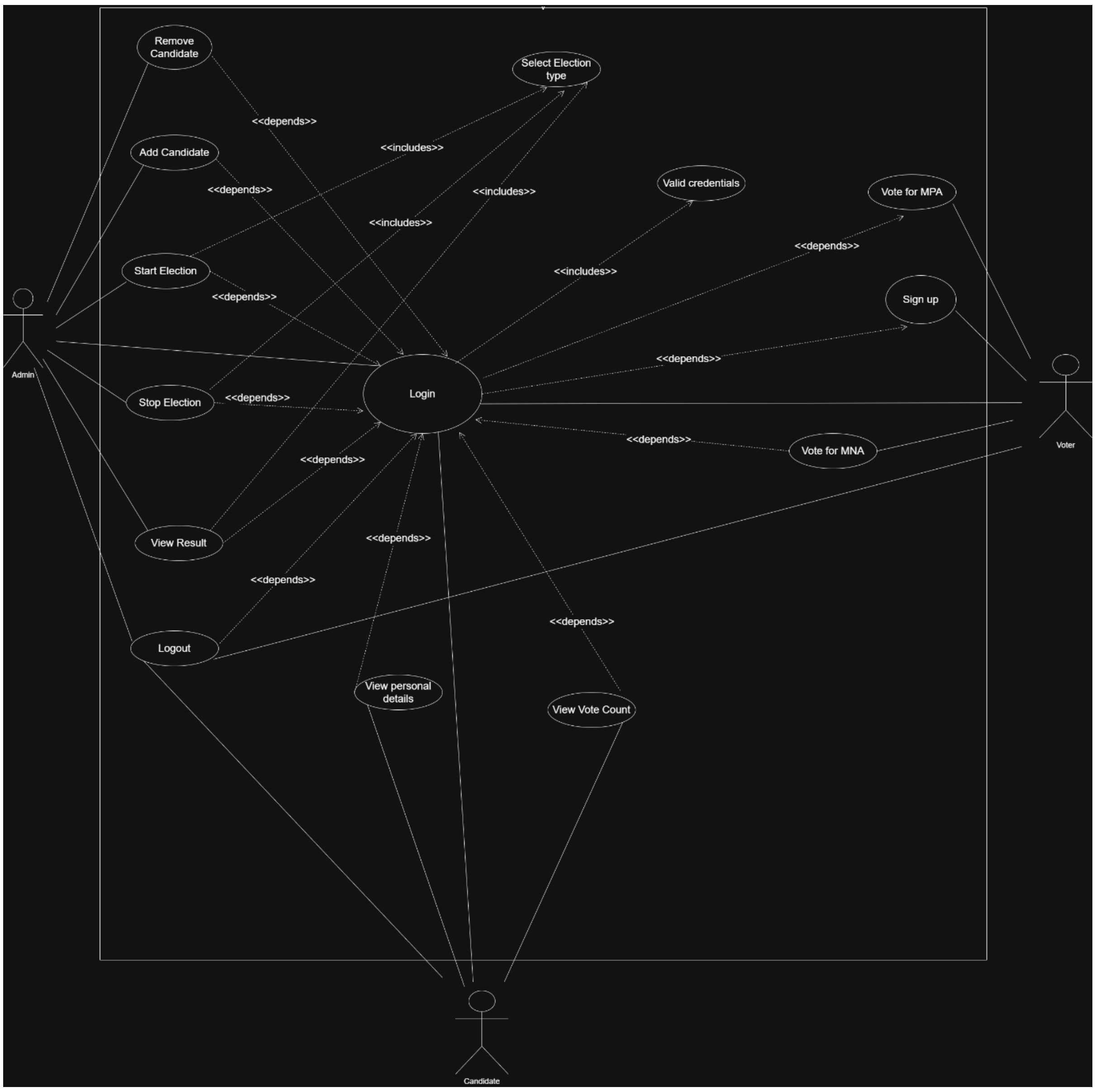
Diagram 17


Local election
2.Declare CM
1:count local winner
Database Manager
1.2:get winning party
1.1:get Max MPA votes
MYSQL

State Diagram

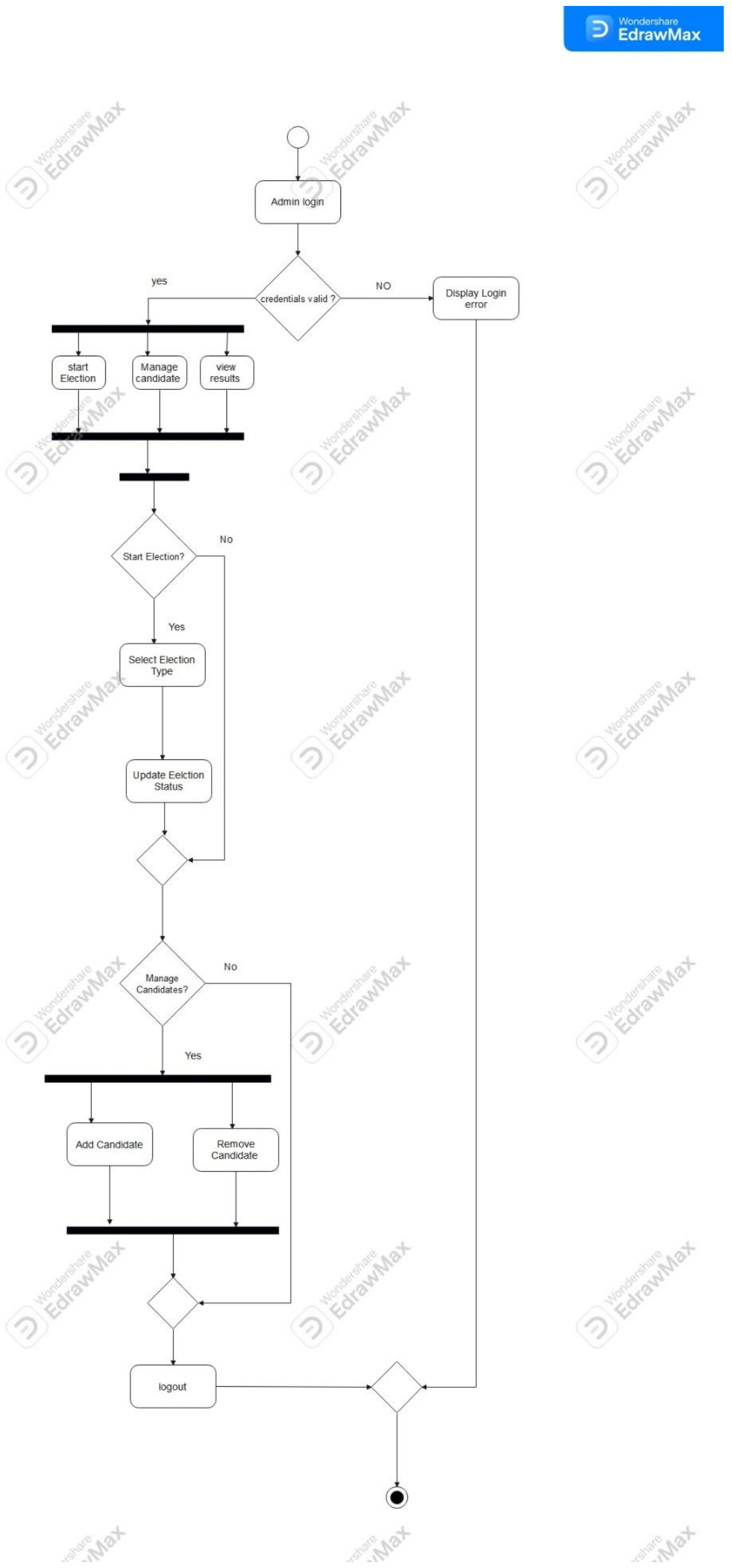


Use Case diagram

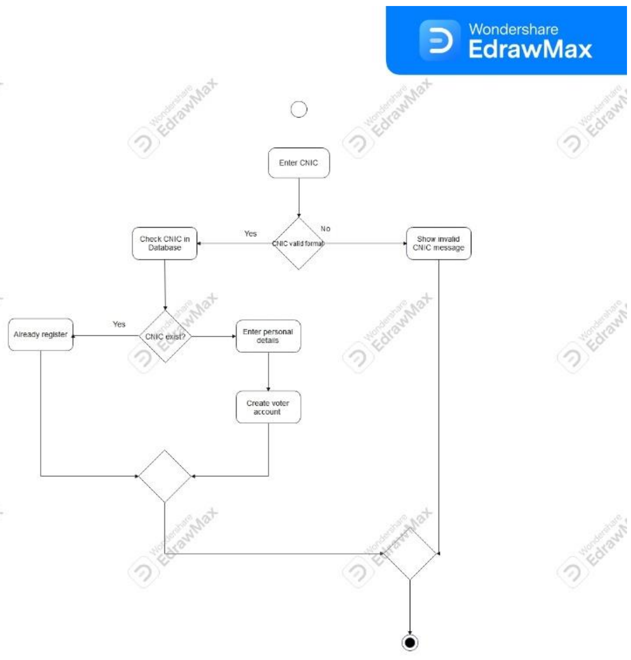


Activity Diagrams

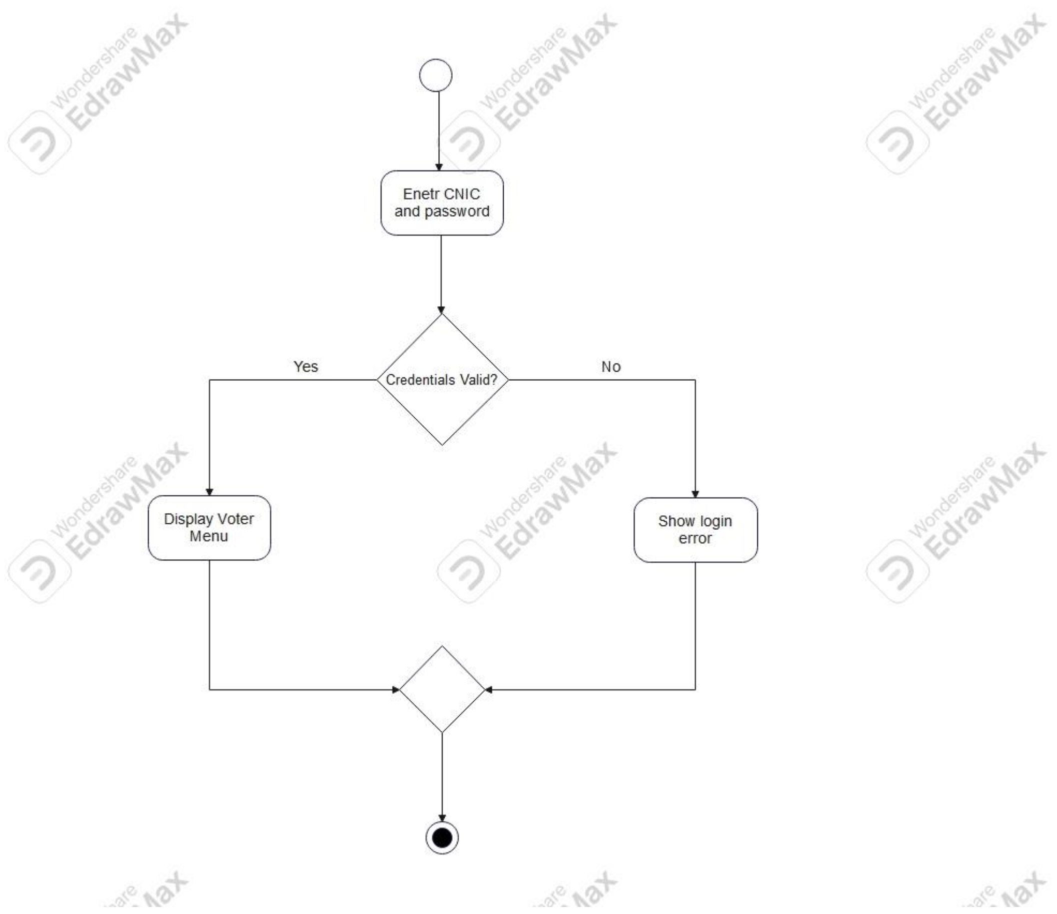
Activity Diagram 1



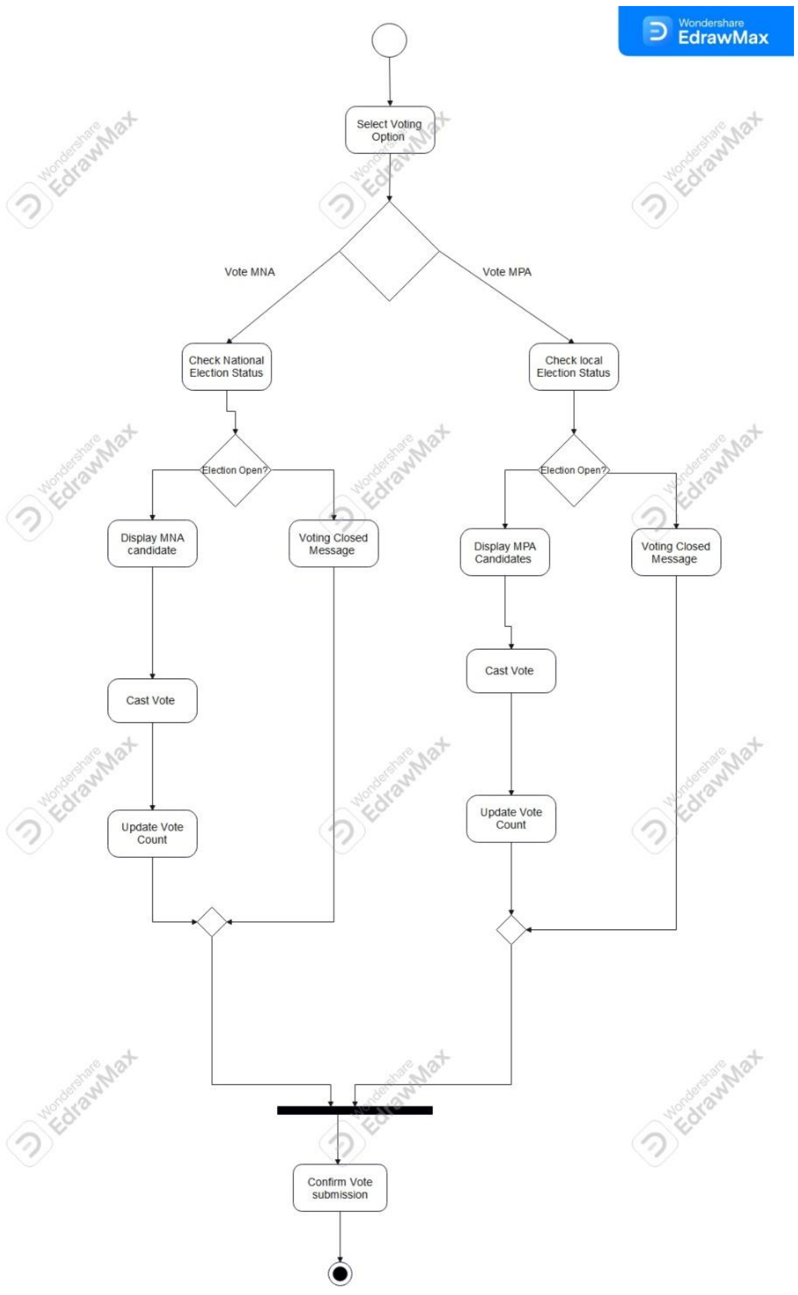
Activity Diagram 2



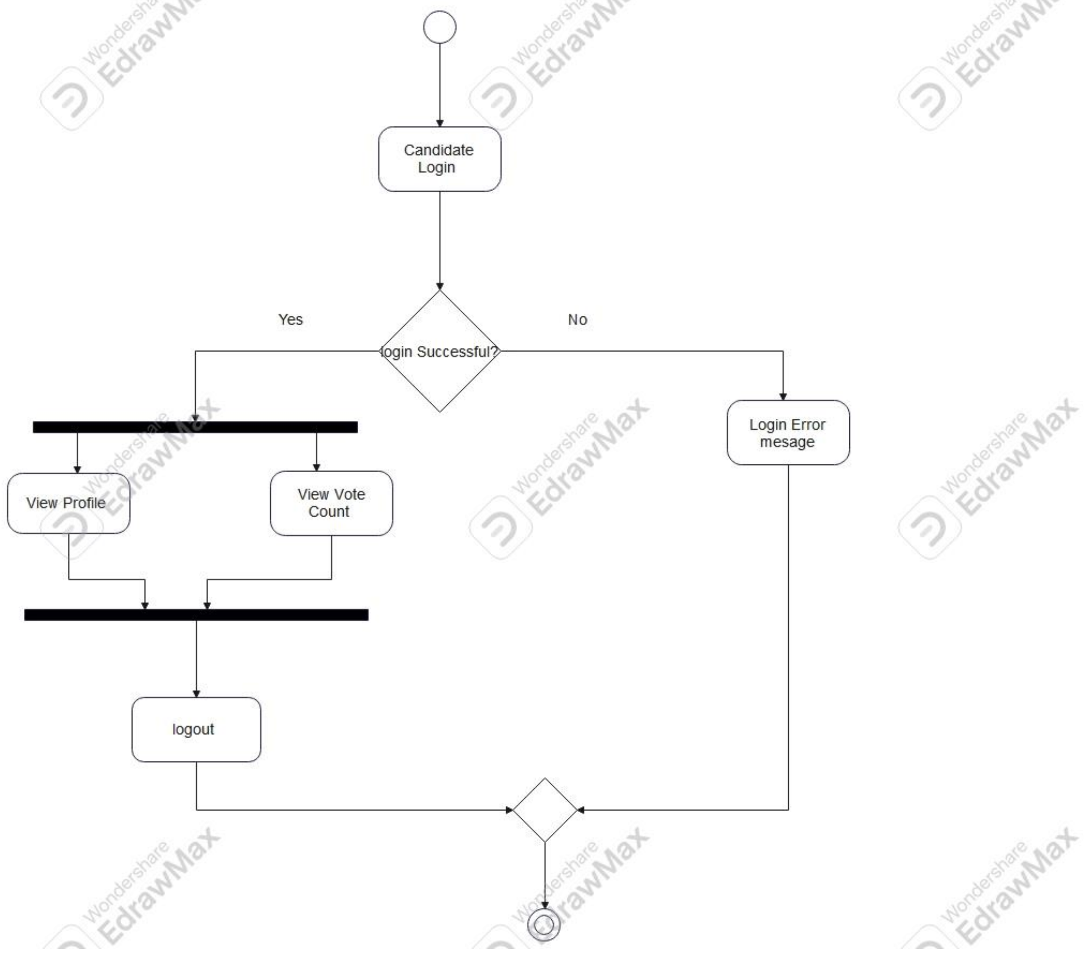
Activity Diagram 3



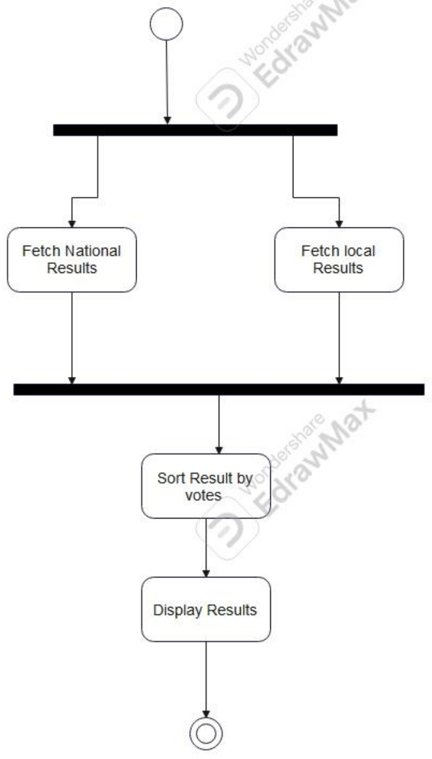
Activity Diagram 4



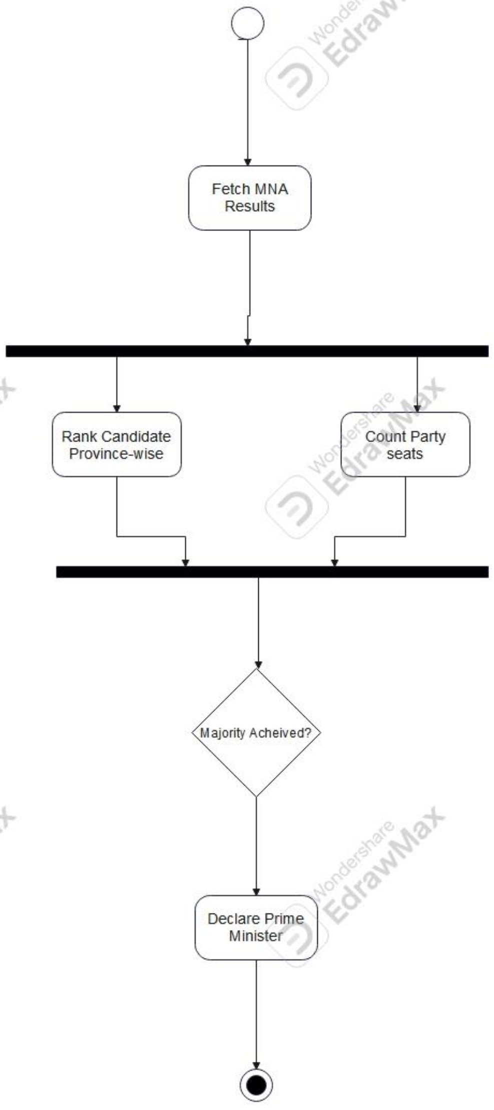
Activity Diagram 5



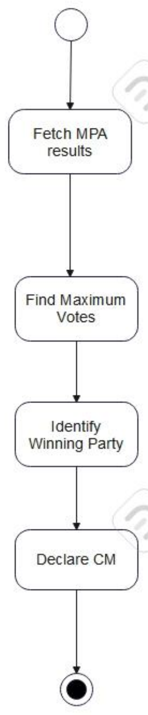
Activity Diagram 6



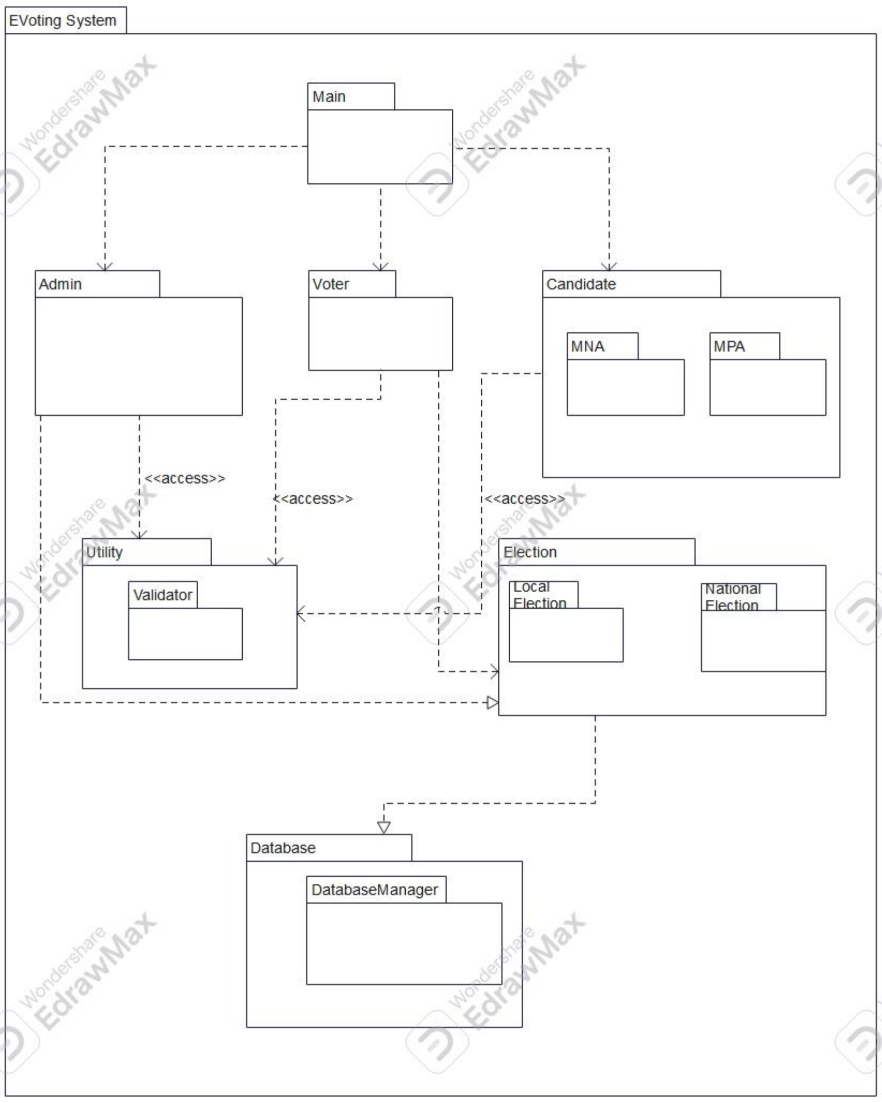
Activity Diagram 7



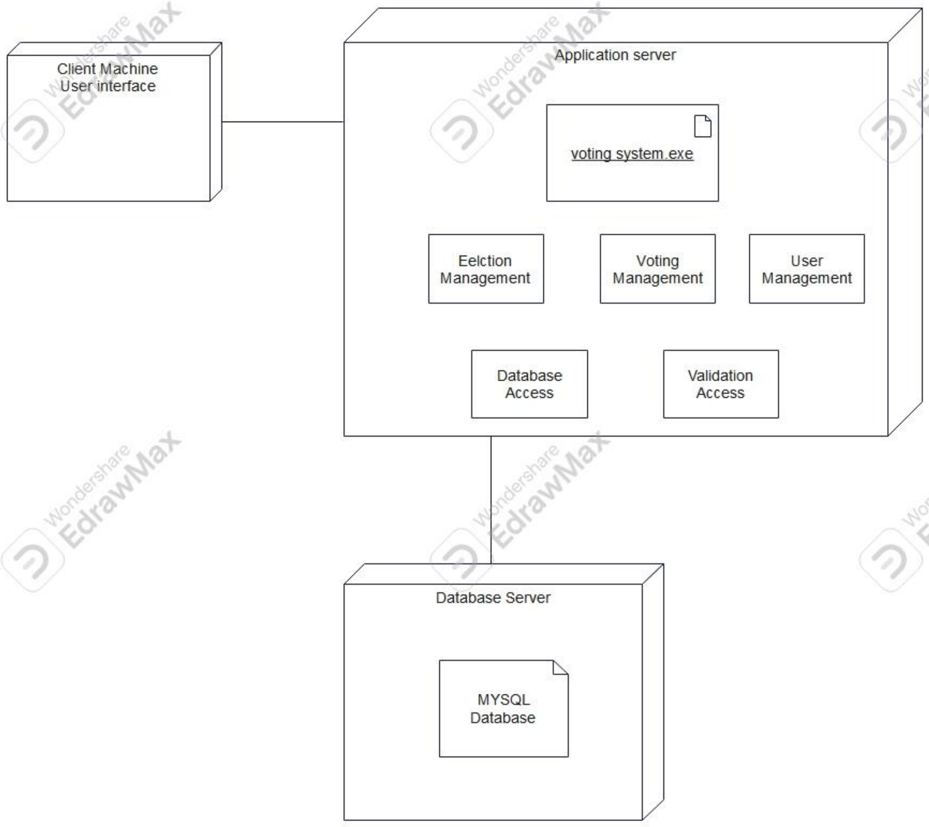
Activity Diagram 8



Package Diagram

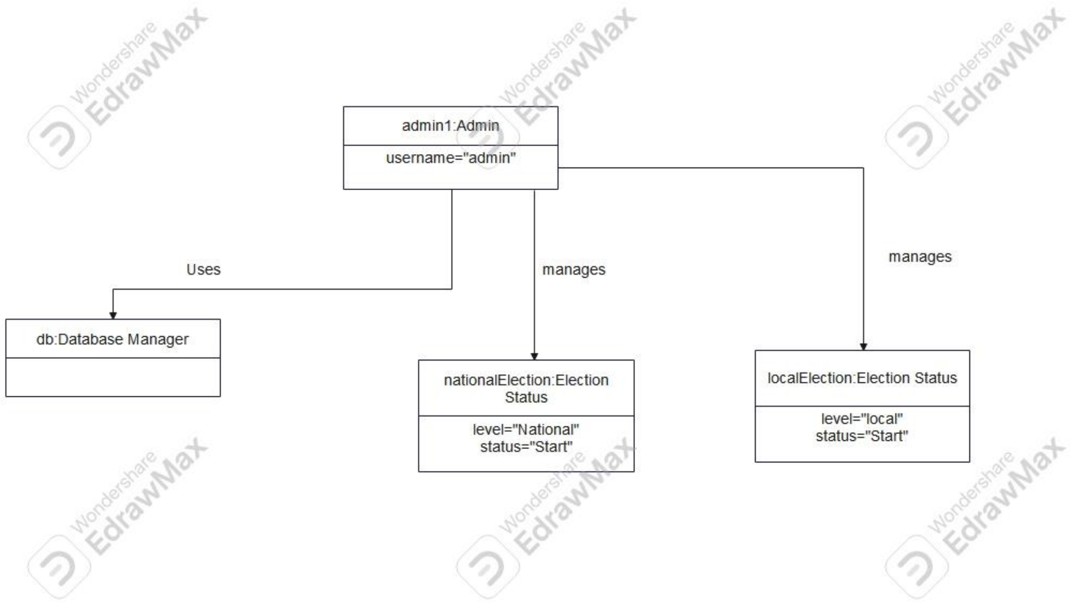


Deployment Diagram

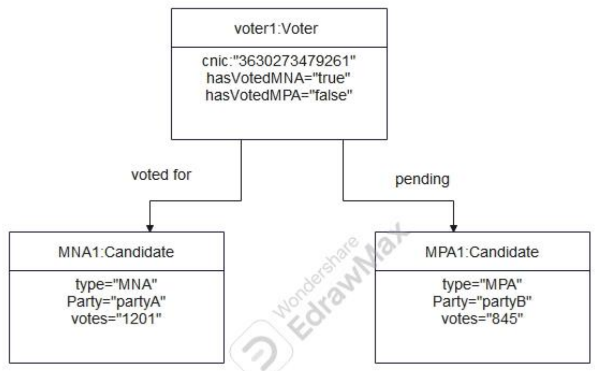


Object Diagrams

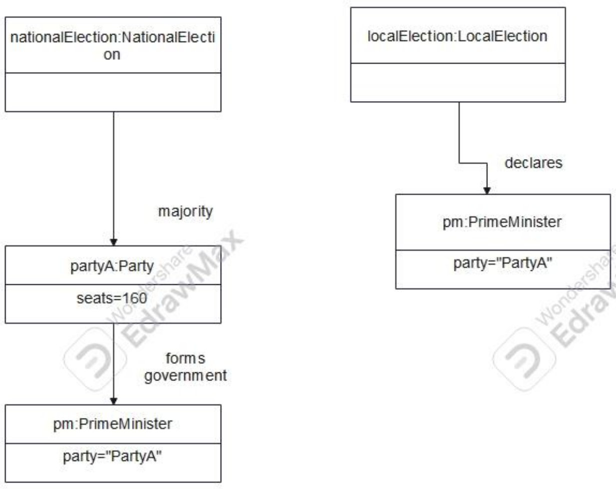
Object Diagram 1



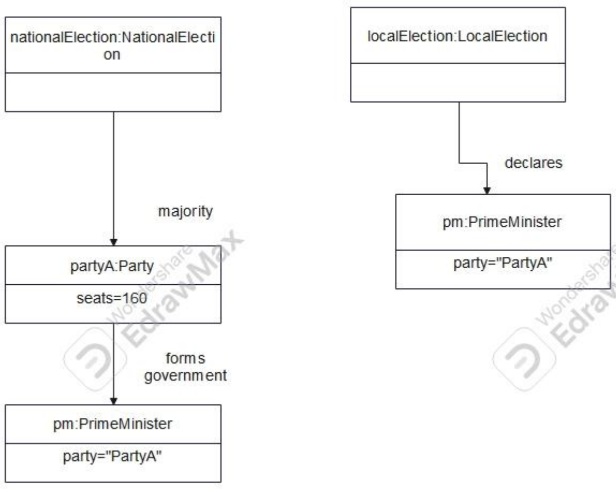
Object Diagram 2



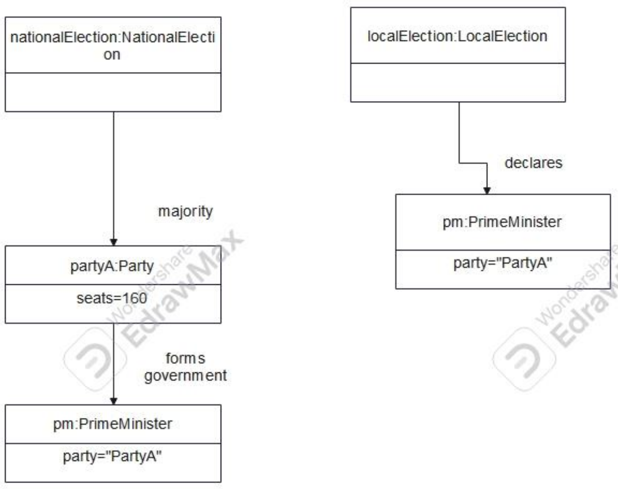
Object Diagram 3



Object Diagram 4



Component Diagram:


nationalElection:NationalElection
majority
partyA:Party
seats=160
forms government
pm:PrimeMinister
party="PartyA"
localElection:LocalElection
declares
pm:PrimeMinister
party="PartyA"