UNIVERSITÄT
KOBLENZ·LANDAU

Electronic Voting System - Team India

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1. Introduction

This project manual gives an introduction to Electronic Voting System (EVS) and describes the usability of the system. Furthermore, the detailed steps required to set up the system, and the completion status of the project requirements, have also been highlighted.

The purpose of the Electronic Voting System is to conduct electronic polls. This system has been designed to support the polls conducted in universities and is usable by all employees of the university. Any employee who conducts the polls, play the role of the organizer. An organizer can be identified using the LDAP service and can conduct any number of polls. They can manage the poll questions, participant list, and the voting time period. The questions used, can be of the type of binary (yes/no) answers, single choice, or multiple choices.

The participants, who need not be from the same organization that is conducting the poll, are identified using their unique email ids. As soon as a poll starts, the participants chosen by the organizer receive an email with the poll details, a voting token (their ballot paper), and the voting page's hyperlink. The tokens issued to the participants are all random and unique. The anonymity of the voters is preserved in such a way that, though organizers can optionally track who has voted, and who hasn't, a vote or voting token can never be traced back to reveal the voter's identity. The poll details including the participant list and the questions used can be saved by the organizer for reusing purposes.

The entire EVS system is governed using the poll states. When the poll state is in PREPARED, the organizers can add or modify the poll details, and the participants' list. Once the poll has at least 3 participants, the organizer can start the poll, which sets the poll state to STARTED. When the voting period starts, the poll state is set to VOTING and accepts the votes from the participants. Once all the votes have been submitted, the poll state is set to FINISHED. At this point, if the number of votes is 3 or more, the organizer can view and publish the results. Once the results are published, the organizers and the participants receive an email with a hyperlink to view the published results.

The mentioned details have been designed meticulously in the Electronic Voting System by Team India that can be set up and used by following the instructions in this project manual.

2. System setup

2.1 Setup of the system
India electronic voting system is a web application that runs through a web browser.

2.2 Client-side applications
To use the application, the latest Javascript is needed in order to be accessible on the browser.

2.3 Server-side applications
Payara application server is used to host the application. Mail system has been configured with the name mail/evsindia as the JNDI name.
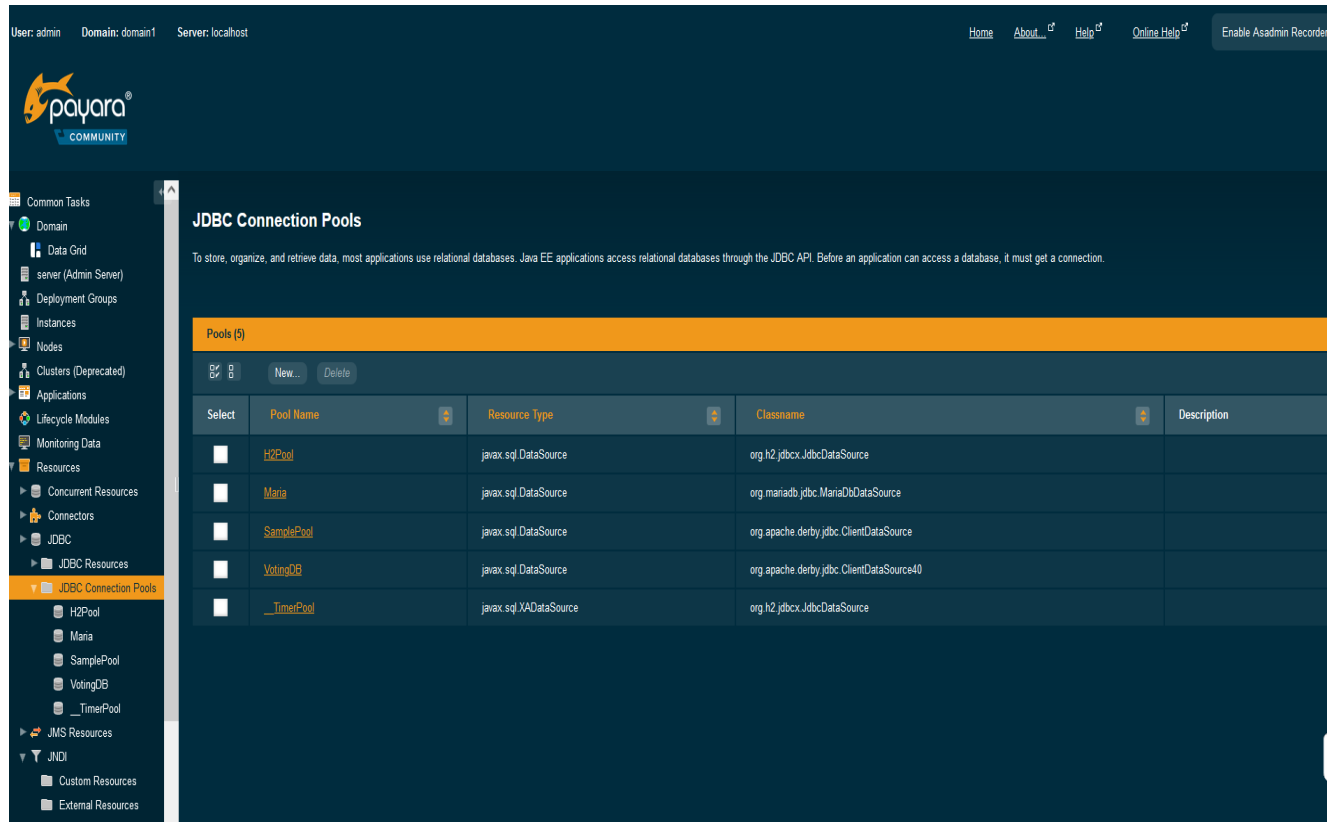
2.4 Database server
Maria DB database server is used to store the application data.

2.5 Java
In the system, Java Development Kit (JDK) must be installed OpenJDK 11.0.2

3. Create a JDBC connection

Payara server can be started from Net Beans

Start the payara server from NetBeans. Then click on JDBC. Then create a new connection pool by clicking new.

1. As shown in the below image. The form will open asking for a pool name. After giving the pool name click next.

   Pool Name : Maria

   Resource Type: javax.sql.DataSource

2. Add the below properties for the connection pool. Then click on the ping button to check if the connection is working.

Edit JDBC Connection Pool

Modify an existing JDBC connection pool. A JDBC connection pool is a group of reusable connections for a particular database.

Load Defaults   Flush   Ping

* Indicates required field

General Settings

Pool Name:	Maria
Resource Type:	javax.sql.DataSource ▼
	Must be specified if the datasource class implements more than 1 of the interface.
Datasource Classname:	org.mariadb.jdbc.MariaDbDataSource
	Vendor-specific classname that implements the DataSource and/or XADataSource APIs

3. Click on JDBC Resource then click on new and fill in the details and save.

     JNDI Name: jdbc/javaee

     Pool Name: Maria

SMTP setup

4. Installation

1. Clone the project
2. Open the project https://gitlab.uni-koblenz.de/india2021/indiaevs2021.git
3. Build the project.
4. Run the project

5. Challenges faced

1. Creating entities from JTA configuration in the pesitsnce.xml file took us a lot of time.
2. Fetching SMTP server details for sending emails after adding the details in the installed payara server.
3. We face some issues while adding path for the internationalization in the resource folder.
4. Implementing LDAP authentication was quite a challenge because we were having issues while authenticating the user.
5. Wildfly server was hard to configure as there was very less support and documentation available online, so we had to switch to payara server
6. Configuration of organizer and admin role with respect to application was challenging.

6. Project Requirements

The following are the requirements that have to be done for the electronic voting system. The requirements are categorized with their topic and each topic has its features.

The requirements are categorized into two: Functional requirements and non-functional requirements.

6.1 Functional requirements

Polls

ID	Description	Status
PO01	Organizers are able to conduct electronic polls	Completed
PO01.1	Every poll has a unique title	Completed
PO01.2	Every poll has a description	Completed
PO01.3	Every poll has a voting period(Date and time)	Completed
PO02	At least one question in each poll	Completed
PO03	An organizer can group arbitrary many questions into a poll	Completed
(PO04)	Organizers can clone the poll(Period, description, questions, participants)(Optional)	Not done
(PO04.1)	Cannot clone votes from poll(Optional)	Not done
(PO04.2)	Cannot clone results from poll(Optional)	Not done

Questions

ID	Description	Status
QU01	The system must support organizers to add different types of questions to a poll ● SINGLE CHOICE ● MULTIPLE CHOICE ● YES/NO	Completed
QU02	Organizers can define min and max number of choices multiple- questions	Partially completed. Maximum number of choice is given
QU03	Questions of a poll have a title(unique)	Completed
QU04	Items of a question have a short name and optional description	Completed

Poll states

ID	DESCRIPTION	STATUS
PS01	The state of the poll should be one of the following four: ● PREPARED ● STARTED ● VOTING ● FINISHED	Completed
PS02	Description, initial voting period, and participant list of a poll can only be changed in PREPARED state.	Completed
PS03	Participant list can only be changed in PREPARED state	Completed
PS04	The poll state should be set to STARTED as soon as the poll starts	Completed
PS05	The poll state should be set to VOTING as soon as the voting period starts	Completed

Number	Description	Status
PS06	The poll state should be set to FINISHED when all the participants have submitted their votes	Completed
PS07	Organizers can extend (but not shorten) the voting period in state STARTED or VOTING(OPTIONAL)	Completed

Organizers

Number	Description	Status
OR01	All the University employees can act as organizers	Completed
OR01.1	Organizers authenticate themselves with username and password	Completed
(OR01.2)	The application must be able to identify the university employees using the LDAP service provided by the GHRKO computing center (OPTIONAL)	Completed
OR02	Organizers must be able to create arbitrary many polls	Completed
OR02.1	Each poll shall be owned by at least one organizer (the creator is the initial owner)	Completed
OR02.2	Organizers only can work on polls that they own	Completed
(OR03)	organizers will be able to preview their polls in the participant view (OPTIONAL)	Not done
(OR04)	Organizers could add further organizers to a poll. The poll is then owned by each of the organizers (OPTIONAL)	Not done
OR04.1	Organizers can change the organizer list	Not done
OR04.2	The organizer cannot remove herself from the organizer list	Not done

Number	Description	Status
OR05	Organizers could delete a poll (including all votes and results)	Completed
OR05.1	If a poll that is not in PREPARED or FINISHED state, is to be deleted, then the application should send a notification email to all organizers and participants to inform them about the removal.	Completed
OR06	If a poll has at least 3 participants and is in the state PREPARED, then the organizers should be able to start the poll	Completed

Administrators

Number	Description	Status
AD01	Administrators can delete any poll (including all votes and results).	Completed
AD01.1	If a poll that is in PREPARED or FINISHED state, is to be deleted, then the application should send a notification email to all organizers and participants to inform them about the removal.	Completed
AD02	administrators cannot access votes and results of polls that they don't own	Completed
AD03	If LDAP is not used, administrators must be able to manage organizer accounts (see OR01.2).	Not applicable
AD03.1	As soon as an organizer account is deleted, the application shall delete all polls that belong exclusively to that organizer (Polls with multiple organizers are not deleted.)	Not applicable

Participants

Number	Description	Status
PL01	If a poll is in state PREPARED, the application shall provide organizers with the ability to add arbitrary many participants to a poll.	Completed
PL01.1	Each participant shall be identified by a valid email address	Completed
PL01.2	there must be no duplicate entries in the participants of a poll	Completed
(PL02)	Organizers must be able to add participants from outside the university. (OPTIONAL)	Completed
PL03	If a poll is in state PREPARED, organizers will be able to delete participants from the participants of a poll.	Completed
PL03.1	If the poll is not in state PREPARED, then the participants of the poll cannot be changed.	Completed
PL04	As soon as a poll is started by an organizer, a notification email to each participant should be sent (using dummy/test SMTP server provided with the task)	Completed
PL04.1	The notification email must contain the poll title, description, voting period, the participant's voting token, and a hyperlink to the voting page.	Completed
(PL04. 2)	The notification email should contain a hyperlink that already contains a pre-filled token of the participant so that the participant can immediately begin to vote (OPTIONAL)	Completed

(PL05)	Organizers should be able to comfortably create participant lists, e.g. by pasting email addresses from other applications such as spreadsheets or KLIPS(OPTIONAL)	Completed
(PL06)	Storing participant lists for easy reuse in subsequent polls (OPTIONAL)	Completed
(PL06. 1)	The stored participant lists are private to each organizer (OPTIONAL)	Completed
(PL06. 2)	Unique name for each participant list (OPTIONAL)	Not done

Tokens

Number	Description	Status
TO01	Assigning a random token to each participant of a poll as soon as poll started	Completed
TO02	all tokens are unique in the scope of the whole system.	Completed
TO03	a token that was previously issued can never be regenerated.	Completed
TO04	The length of the tokens shall be equal to or greater than 16 characters. (to avoid forging or guessing)	Completed

Anonymity

Number	Description	Status
AN01	It must be impossible to identify which participant submitted which vote and the same for polls that even have participant tracking (to ensure anonymity)	Completed
AN02	a token must not be associated with a vote.	Completed

Participation tracking

Number	Description	Status
(PT01)	Organizers may have to track the participants for a poll. (OPTIONAL)	Completed
(PT02)	If participant tracking is enabled, then organizers with the ability to activate automatic reminders to participants who didn't vote. (OPTIONAL)	Not done

Submitting a vote

Number	Description	Status
SV01	As long as a poll is in state VOTING, the application shall provide a web page to submit a vote.	Completed
SV02	an input field for a participant's token in the voting page	Completed
SV02.1	The token input field should be pre-filled if the voting page is opened via notification mail	Completed
SV03	Display of questions and items after the token is verified	Completed

SV04	Button to submit a vote	Completed
SV05	Invalidate the token as soon as the vote was submitted (to avoid re-use)	Completed
SV06	Participants cannot change the vote after submission	Completed
SV07	Participants can cancel voting by browser or by clicking the cancel button and the same token can be reused later	Completed
SV08	All the choices have to be discarded in case a participant cancels the voting	Completed
(SV09)	Subsequent participants using the same browser window cannot restore previous choices(OPTIONAL)	Completed
SV10	Participants can abstain from voting (for each question)	Completed
SV11	Participants can abstain from voting (for complete poll)	Completed

Results

Number	Description	Status
RS01	If the number of submitted votes are at least 3 after the poll is FINISHED then the organizer should be able to view the result	Completed
RS02	If it is less than 3, then no one can view the result	Completed
RS03	No one can view the result until the poll is FINISHED	Completed
RS04	If the number of submitted votes are at least 3 after the poll is FINISHED, then the organizer should be able to publish the result	Completed
RS05	A notification email should be sent to all the participants and the organizers as soon as the results are published.	Completed
RS06	The result notification email should contain a hyperlink to the results page	Completed
RS07	The length of the random part of the result hyperlink shall be equal to or greater than 16 characters	Completed
RS08	The resulting view must show the number of votes for each item of each question, the number of abstentions, and participations	Completed
(RS09)	Result display in graphical form (e.g-pie chart) (OPTIONAL)	Completed

6.2 Non- functional requirements

User interface

Number	Description	Status
UI01	Application implementation using the JSF technology (not to use JavaScript frameworks like Angular or React)	Completed
(UI02)	Using third-party CSS libraries (OPTIONAL)	Completed
(UI03)	Using third-party JSF components (e.g. bootsFaces, myFaces, richFaces).	Completed
UI04	Using advanced technologies to enhance user experience (OPTIONAL)	Not done
UI05	Browser supportability (Chrome, Firefox	Completed
UI06	Mobile device browser supportability (OPTIONAL)	Completed

Internationalization

Number	Description	Status
IN01	Switching of UI language should be possible	Completed
IN01.1	Language switch either by URL prefix or user request or by detecting the client browser's language setting,	Completed
IN01.2	If the language switch is done on user request, the application should remember the user's language setting.	Completed
IN03	At least two interface languages	Completed

IN04	Support English as user interface language	Completed
IN05	Support German as user interface language.	Completed
(IN06)	The multilingual text is also in the data items (e.g., title, short name, description of polls, questions, and items) in order for the participants to view their options in their preferred language (OPTIONAL)	Completed
(IN07)	notification and reminder emails to participants in their preferred language (OPTIONAL)	Not done

Architecture

Number	Description	Status
AR01	Layered architecture and architecture rules must be followed	Completed
AR02	Contains one modules as informed in the latest email i.e Web module	Completed
AR03	No usage of third-party libraries that were not presented in the lecture. Libraries that may be used without prior consent are: PrimeFaces, RichFaces, BootsFaces, Redirect, Bootstrap CSS, JQuery	Completed
AR04	Database servers(MariaDB/MySQL (preferred), PostgreSQL, or JavaDB/ Derby)	Completed
AR05	Naming conventions for projects, JavaEE modules, database connection pools, databases, and other files and resources shall be followed	Completed
AR06	Prefix all global names with their team name e.g. project name, context path (root URL), database name, persistence units, server resources, etc.	Completed

AR07	Naming conventions for Java should be followed	Completed

Security

Number	Description	Status
SE01	If LDAP is not used, all passwords are stored in hashed/encrypted form.	N/A
SE02	Encrypted network communication with users (administrators, organizers, participants) (HTTPS protocol).	Completed
SE03	Encrypted network communication with the database server	Completed
SE04	Access to polls is only granted to the related organizers and administrators. Administrators may see only the poll title, voting period, and the organizers.	Completed

7. User Manual

Login screen

Login as an organizer

Creating poll

Poll created by an organizer

#	Title	Description	Start Date	End Date	Status	Action
204	Student Election	Student election for the AsTa 2021	11/01/2021 05:54 AM	11/04/2021 11:53 AM	PREPARED	Edit Items Edit Delete Preview Start
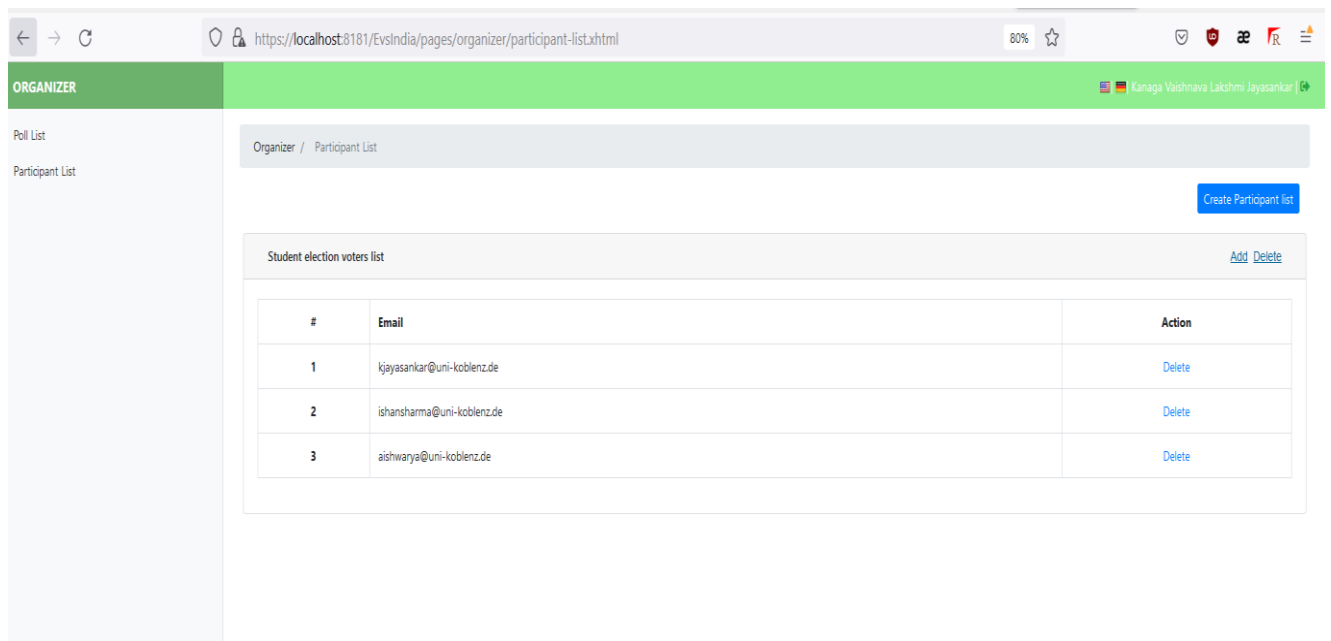
#	Title	Description	Start Date	End Date	Status	Action
204	Student Election	Student election for the AsTa 2021	10/31/2021 12:17 PM	11/04/2021 11:53 AM	FINISHED	Results Delete
308	Picnic event	Place selection for picnic	10/31/2021 01:46 PM	11/01/2021 01:45 PM	PREPARED	Edit Items Edit Delete Preview Start

Creating participant list

Participant list created by an organizer

Starting the poll

Adding a question to the poll
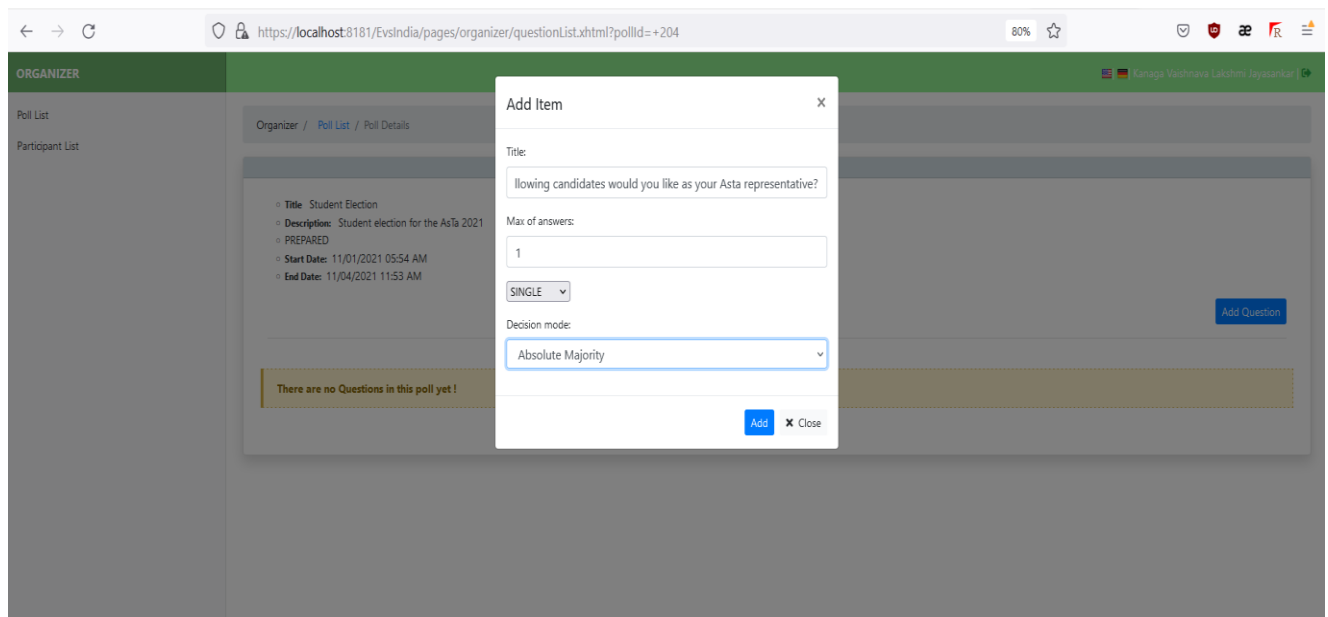
Adding options to the earlier question
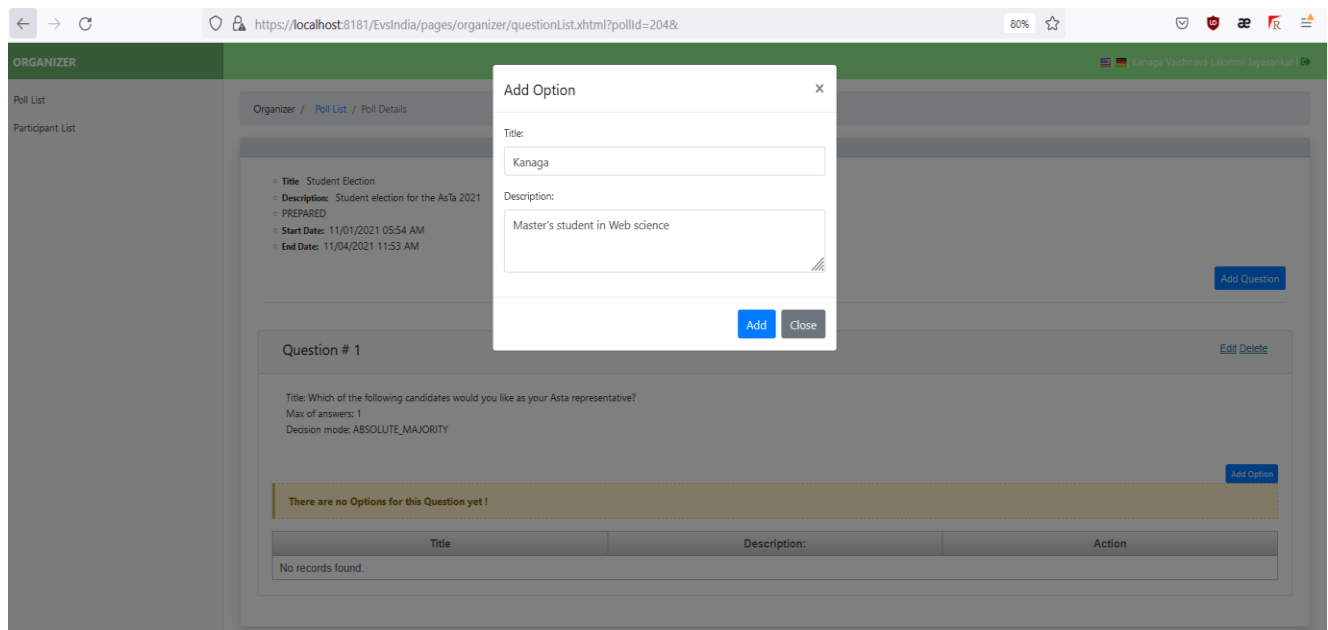
Poll details

Poll list for an organizer

Invitation for vote as soon as the poll started

Invitation to vote

Sunday, October 31, 2021 12:13 CET

kanagasavithri@gmail.com

To
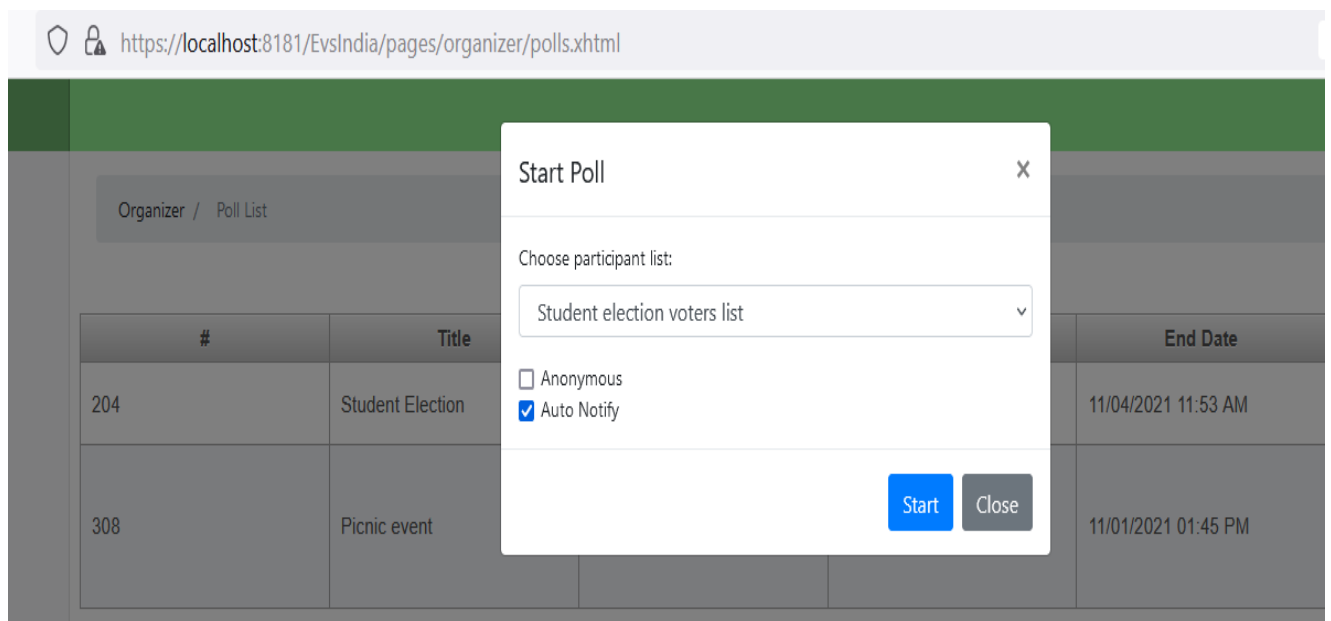
kjayasankar@uni-koblenz.de

Hello,

You are invited to participate in a poll : **Student Election** on our site.
The start date of vote is **11/01/2021 05:54 AM** and end date is **11/04/2021 11:53 AM**.
Your unique token is **91052d71-1de9-4f7c-ba6d-d6b12f720698**.
Total number of participants are **3**.

Please click on link to below to Vote.

Vote now

Participant page for voting

Enter your token:

91052d71-1de9-4f7c-ba6d-d6b12f720698

Enter Token

#1 Which of the following candidates would you like as your Asta representative? (Please choose one answer)

☐ Kanaga

☐ Ishan shhrama

☐ Aishwarya saravanan

Cancel   Submit

Success message after submission and token is used and cannot be used again.

Status of the poll has been changed to voting

Status of the poll has been changed to Finished since all the participants has voted
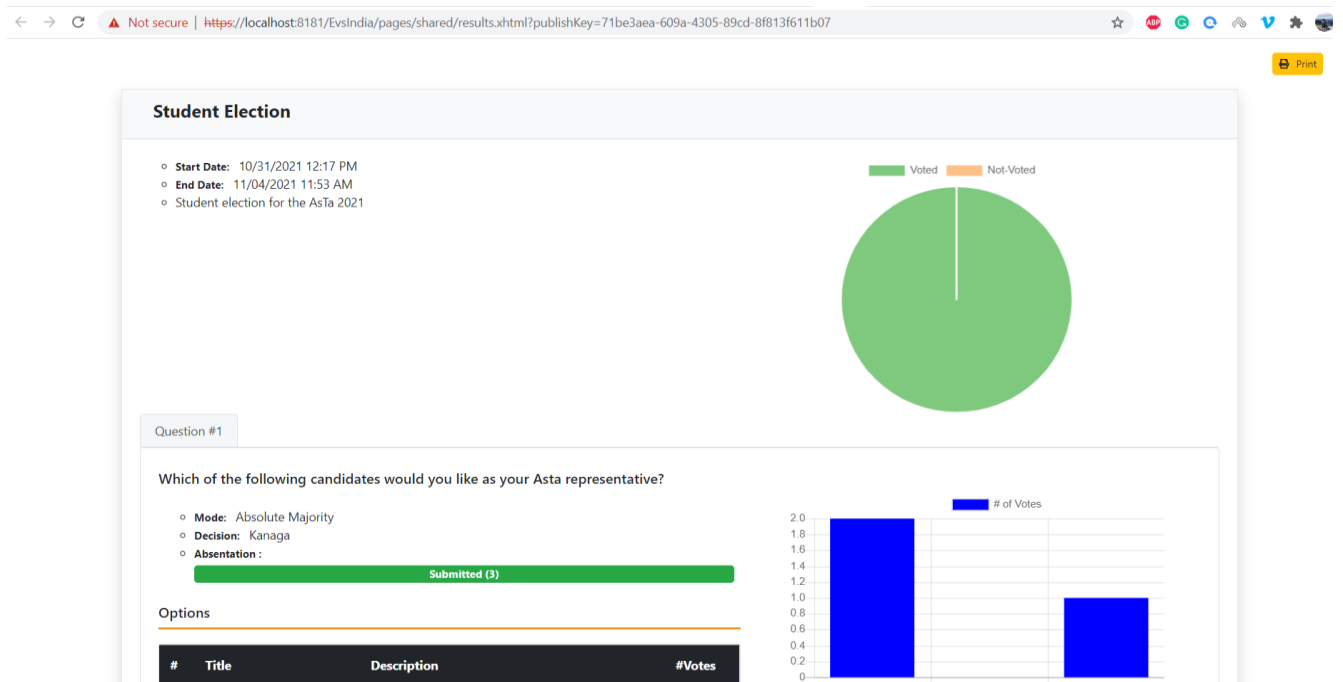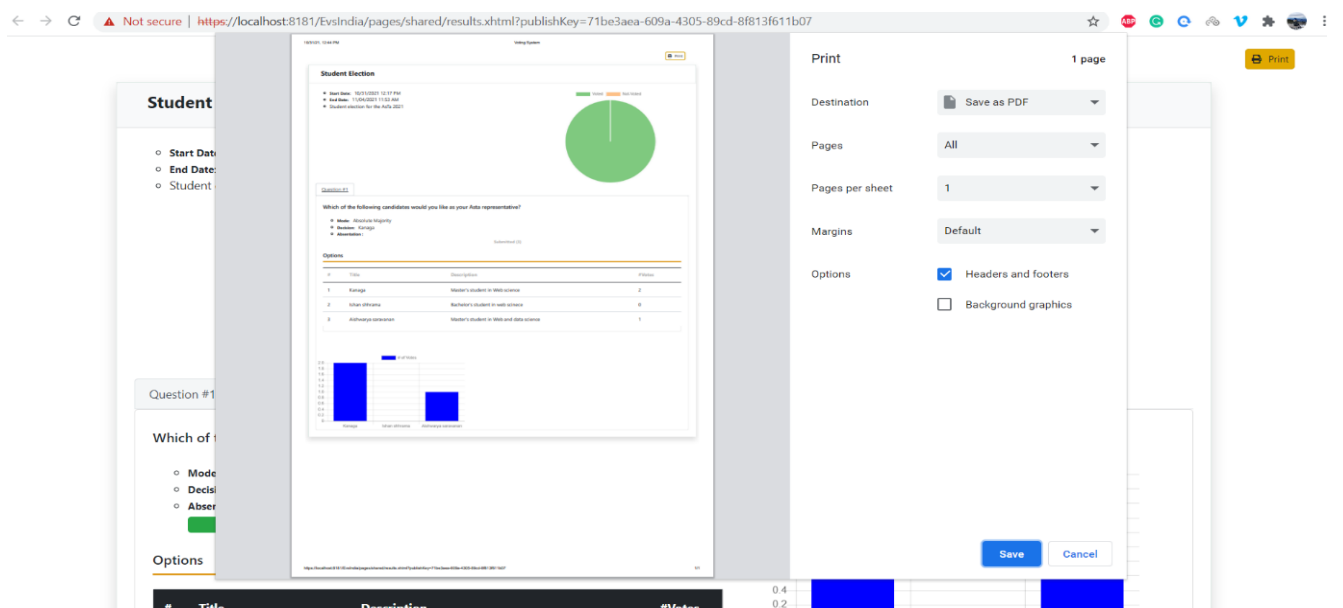
Poll results

E-mail sent after the results are published with the link to view the result
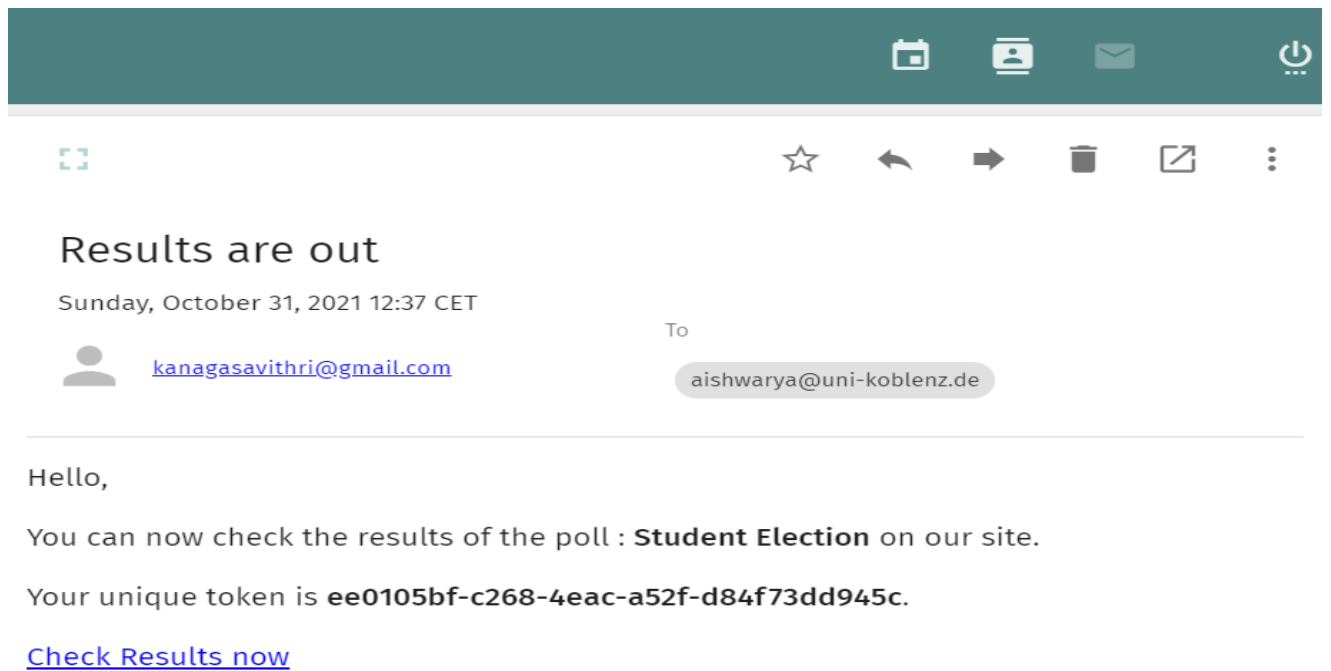
Results viewed using the link from e-mail

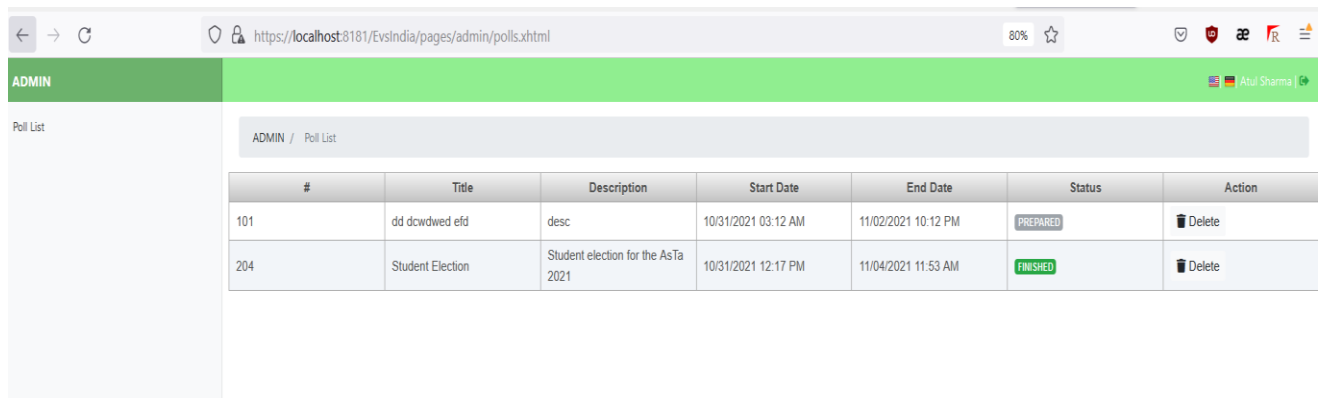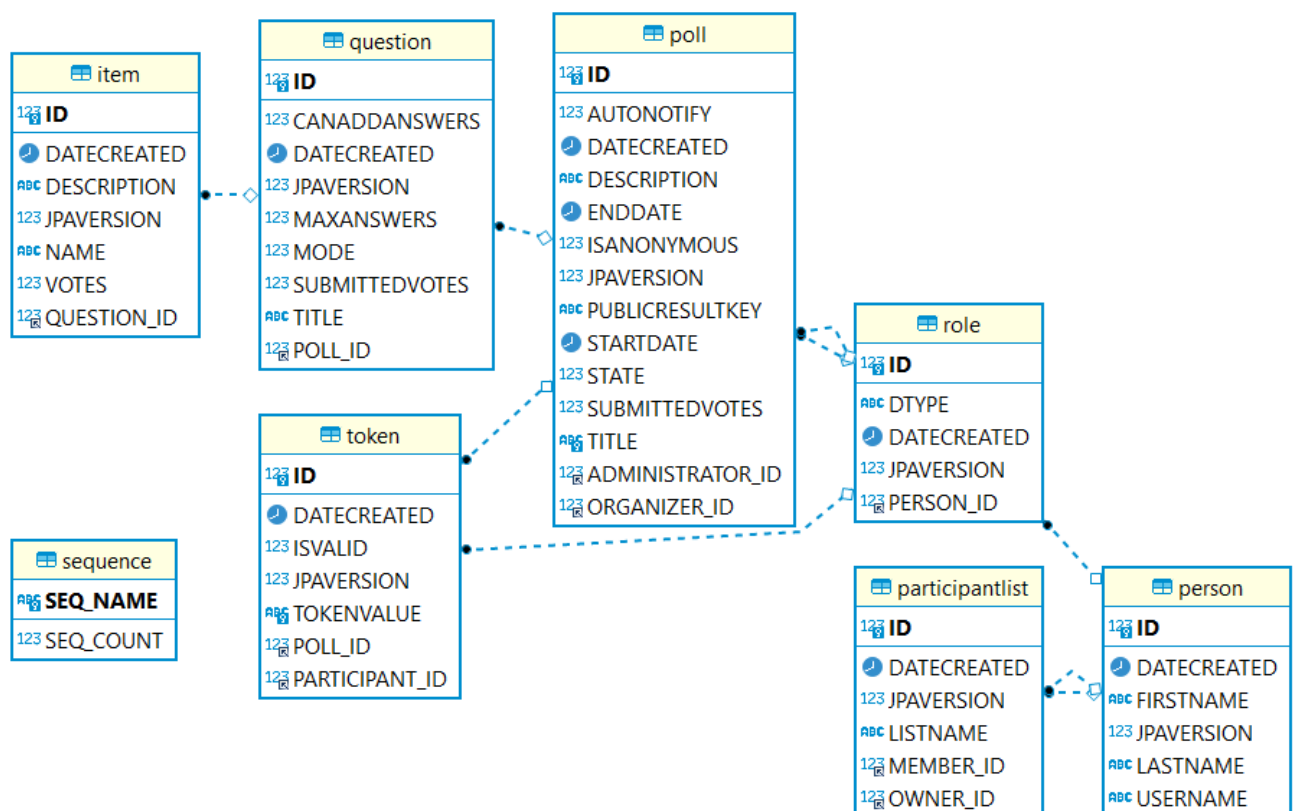# Results can be printed

Admin page with the list of polls

The default administrator role is set to Dr Volker Riediger with the email id
riediger@uni-koblenz.de

ER Diagram of database used

8. Glossary

Administrator: An administrator can delete polls and results. The default administrator role is set to Dr Volker Riediger with his mail id riediger@uni-koblenz.de

Organizer: Any employee of the university who manages the poll.

An organizer can

- Manage participant list
- Create polls
- Edit polls
- Manage participant list
- Manage organizers list
- Tracking of the participants
- Invite participants for voting
- Publish Results

Participant: Any person who is registered with an email id. A participant can:

- Participate in voting
- View results after it is published by Organizer

All three members of the team have contributed equally to various functionalities and set up to develop the project.