

TOY SYSTEM

CS 2310  
FINAL PROJECT REPORT  
TOY SYSTEM

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# CS2310 TOY Project Final Report

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# CS2310 TOY Project Final Report

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## 1. TOY Project Description

The purpose of the TOY Project is to promote intergenerational learning (IG) and create new possibilities for older adults and young children to learn together and benefit from each other's company. This project focuses on TOY scenario that is 'Together Young and Old'.

This handles the scenarios involving a child and a senior citizen.

The application allows enrolment of senior citizens as well as children. The senior citizen can enrol themselves whereas the children are enrolled by their parents. So, the information related to senior citizens will be stored separately and the children information will be stored along with parent contact information separately.

The primary scenario where the senior citizen takes care of the child who is left for some time by the parent at the TOY station is handled in this application.

The super component called 'Activity Component' is present that will handle complex scenarios like for example when the parent does not return by the end of allotted schedule. This super component will communicate with other components as shown in the *Deployment diagram* below to handle such situations.

In application perspective, there will be a UI that contains the required fields to input information related to different components involved. The child-parent information, senior citizen information, schedules available are all shown on the UI. The TOY tool can be used at the TOY Station for a parent to sign up. Similarly the parent can sign up a child.

The logic is performed on this input and the information is used by the application to handle the schedule, handle emergency situation etc. The TOY tool suggests a suitable senior citizen to take care of the child while the parent is away using the logic.

The information is stored in respective database servers for different components. This data will be used to suggest available schedules a parent can choose from and leave the child at the TOY station.

The information regarding the various components involved in the application are shown in detail in the deployment diagram *Figure 1*.

Below is an example of how the scenario would be executed:

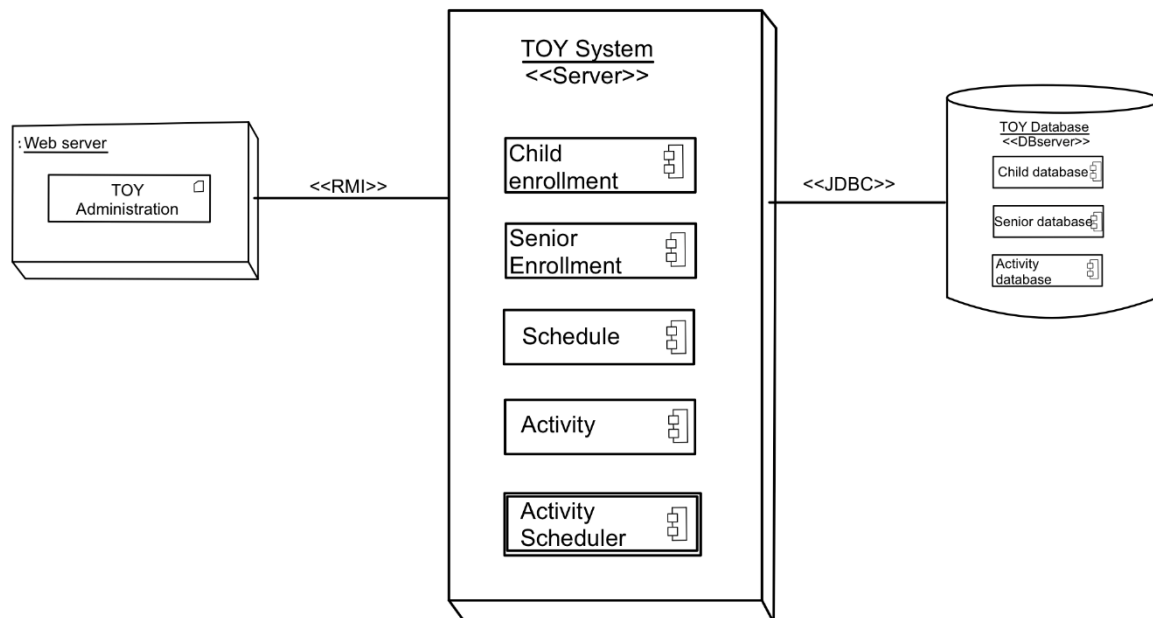
- A senior citizen signs up in the TOY application by inputting data in the UI. This is senior citizen registration. This data will be stored in senior citizen database.
- A parent signs up the child by inputting the child and parent contact information using the UI. This data will be stored in Child database.
- After registration, the TOY station shows the available activities that can be handled at the TOY station. The parent can choose a schedule and enrol to it.
- A schedule will be created containing senior citizen-child information and the activity schedule can be monitored.
- When a parent returns to claim the child, this will end the activity schedule.
- The Activity super component is used to confirm the activity schedule and is helpful to record activity details, schedule start and end times along with senior-child information.

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## 2. Deployment Diagram

Description: This project focusses on building TOY system that deals with TOY(Senior-Child) scenarios. The Deployment diagram below shows various components involved in the system.



**Figure 1. Deployment Diagram**

TOY Administration: is a web server that contains UI with web pages that allow Senior enrolment, Child enrolment, TOY Activity assignment information.

TOY System: This is the server that is responsible for the logic behind TOY Administration. It contains multiple components each dealing with different aspects of the system and allows cross communication within the components.

Child component: Deals with enrolment of a child on a request from the parent. Collects information regarding the child and shows list of available children.

Senior component: Deals with enrolment of a senior. Collects information of the senior including criminal background. 'SafetyRank' is calculated based on the criminal background details entered during registration which is the 'NOVEL' feature. Shows the senior citizens information in the table form ranked based on their safetyRank.

Activity Assignment: Contains logic to assign an activity for the selected senior and child. Has logic to choose an activity from the available resources.

Schedule: Manages the logic to schedule an activity by assigning a child to the senior based on the senior's availability. Provides functionality to 'confirm' a schedule and records start time and end time of the activity

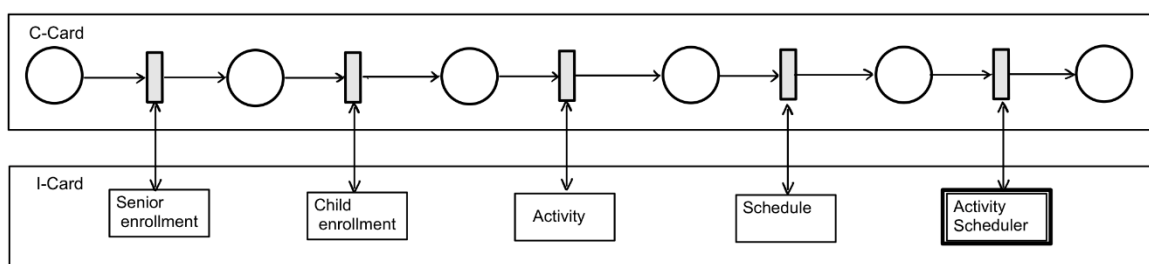
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**Activity Component:** Acts as a supercomponent. Handles different possible scenarios of assigning activities and schedules. This collaborates between above components in TOY system to provide right solution for the situation. For example, the activity component shows all the available schedules created in the TOY station with senior-child and activity information.

**TOY Database:** Contains multiple database components each containing data related to respective components of the TOY system like child, senior, activities. The TOY system uses data from this database to perform logic for the given scenario.

## 3. I-Card and C-Card Diagram:



**Figure 2. I-Card and C-Card Diagram**

C-Card diagram shows the control part of the TOY system for the TOY scenario.

From left to right, each place represents an activity. The corresponding transition handles the input from the place.

I-Card diagram shows the classes that contain information to handle the activity at each transition. The supercomponent Emergency Manager is represented using double edged box.

The I-Card and C-Card are connected to show that they act together to represent the system.

For example, in C-Card, at first place, a senior requests for the enrolment into TOY system. The transition accepts this input and checks with Senior Enrolment class in the I-Card and performs the necessary actions.

## 4. Refinement of Supercomponent

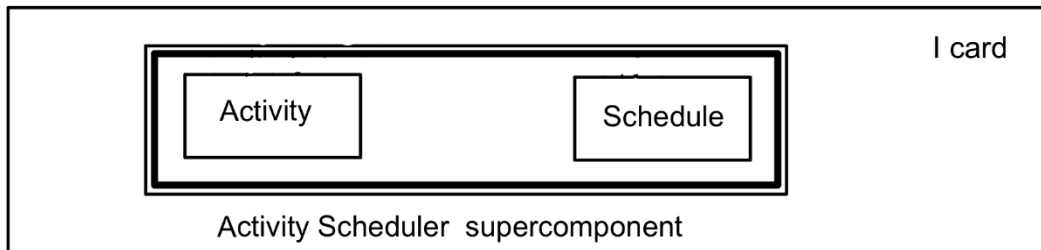
Super components can act as building block in developing slow intelligence systems that is they are capable of improving their performance overtime in a changing environment. Since the super-component enumerates the different solutions by executing different algorithms, the expansion into parallel/serial Petri nets can take on different forms. We can make the execution of the algorithms all serial, all parallel, probabilistic, and so on.

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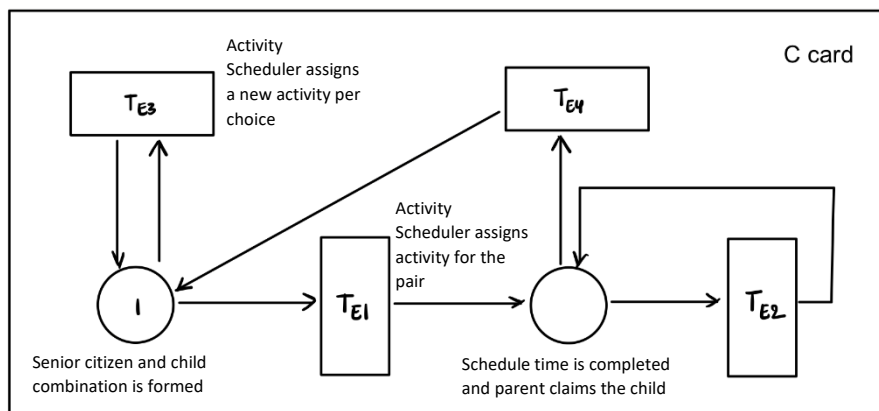
A supercomponent can be used to handle scenarios in different ways like serial, parallel, probabilistic. In a supercomponent multiple components can work together to handle that given scenario.

Below are the diagrams showing supercomponent using I-card and scenarios handled using I-card and C-cards.



**Figure 3. I Card for Emergency super component**

The I card above shows the Information card diagram for Activity super component that contains Activity assignment and Schedule monitor class components to handle different scenarios in TOY project.



**Figure 4. C card illustration for super component**

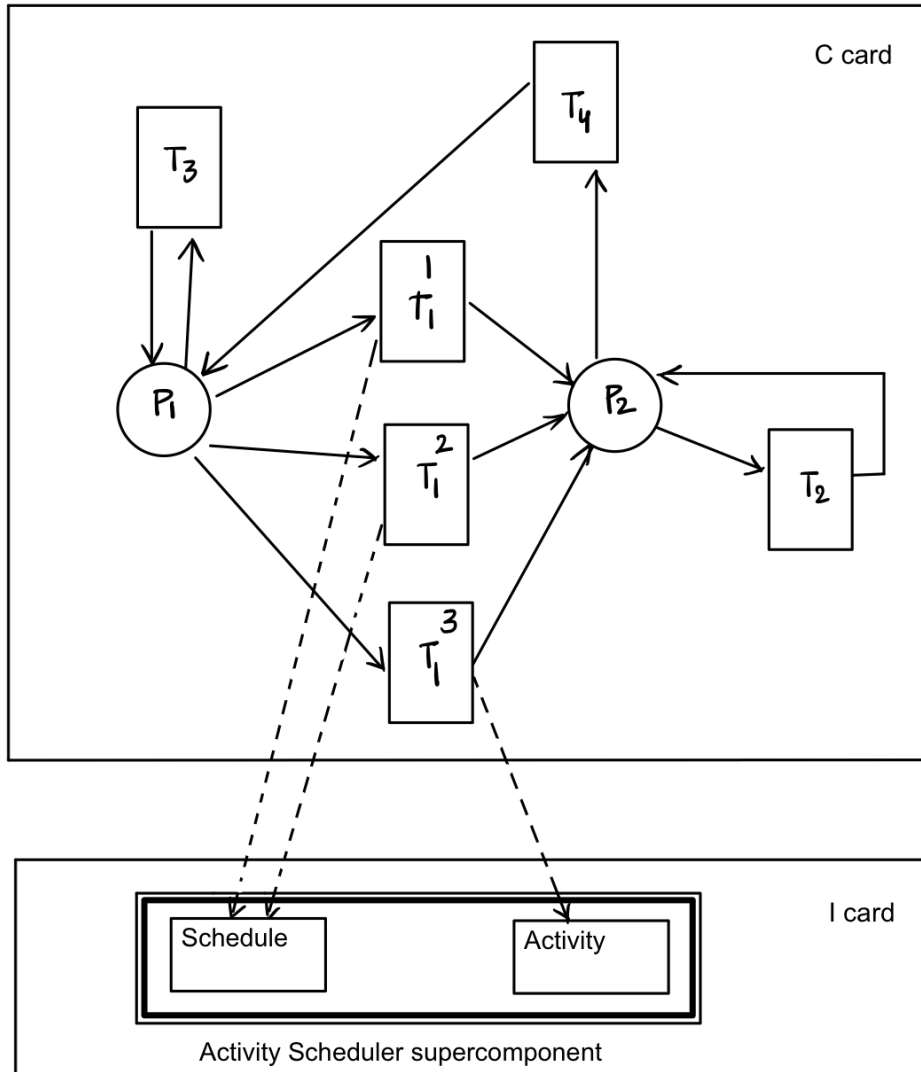
The C card diagram shows control flow of an activity using super component. After the senior citizen and child information is registered, a schedule can be picked to assign activity. Transition 1 handles normal situation where the Emergency handler supercomponent assigns the activity for the pair.

Once the schedule time is completed, the parent comes back and claims the child which is shown in place 2. A parent can redo the schedule for next hour which is handled by transition 4. This again repeats transition 1 internally.

Below diagrams illustrate the communication between I card and C card where the control takes help of the information to handle different scenarios. As discussed above, the diagrams also show situations using enumeration types like parallel and serial.

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**Figure 5. I card C card super component with parallel enumeration**

Parallel Enumeration can be handled by super component by expanding the petri net. Following the scenario described in the C card diagram in Figure 4, a super component can assign multiple activities for multiple senior citizen-child pairs parallelly using the activity assignment class in the Emergency supercomponent. Parallelly, it can handle input from transition T4 i.e., redo the schedule of activity by updating the schedule monitor which is shown using Transition T1 marked as 3.

Serial enumeration can be handled by super component by expanding the petri net. Referring to scenario in Figure 4, the Emergency super component can handle a scenario that happens in sequence of steps one after the other. As shown in the below diagram, Place P1 is when the senior-child pair is created. Transition T1 1 with the help of Activity assignment class assigns the activity for the pair. The schedule for this pair is ended which is shown by P2. Transition T1 2 handled the end of schedule by checking with Schedule monitor class. This is when the parent does not visit the TOY station to claim the child shown as P3. The transition T1 3 with help of activity assignment creates new activity for the next schedule.

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P4 is when the parent finally returns to claim the child OR wants to extend the child time in the station by creating new schedule. Now that the same senior has already taken care of the child for 2 hours, a new senior-child pair will be created. This is one by Transition T4.

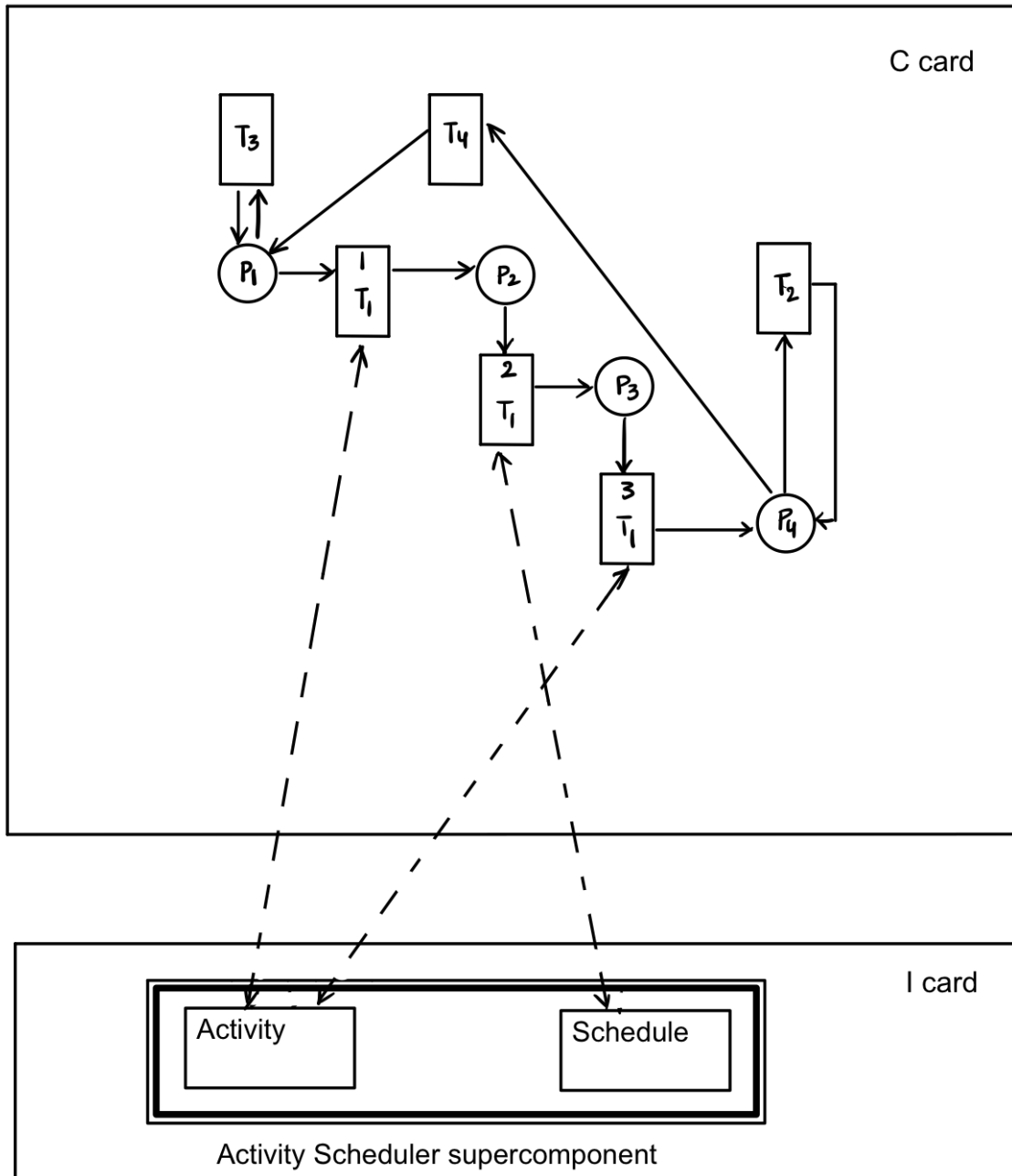


Figure 6. I card C card super component with serial enumeration



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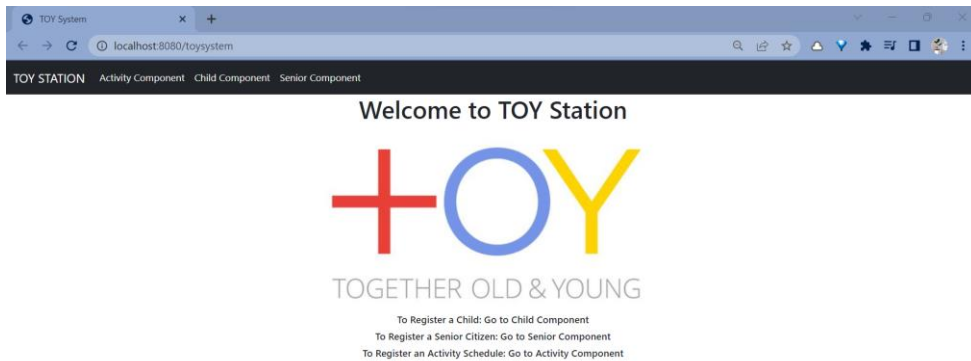
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## 5. Detailed Scenario for base-line components:

This TOY Station contains the following components:

### Home Screen with access to all components:

Provides instructions about the task that can be performed by a component.



- **Senior Citizen component:**

### Welcome Screen:

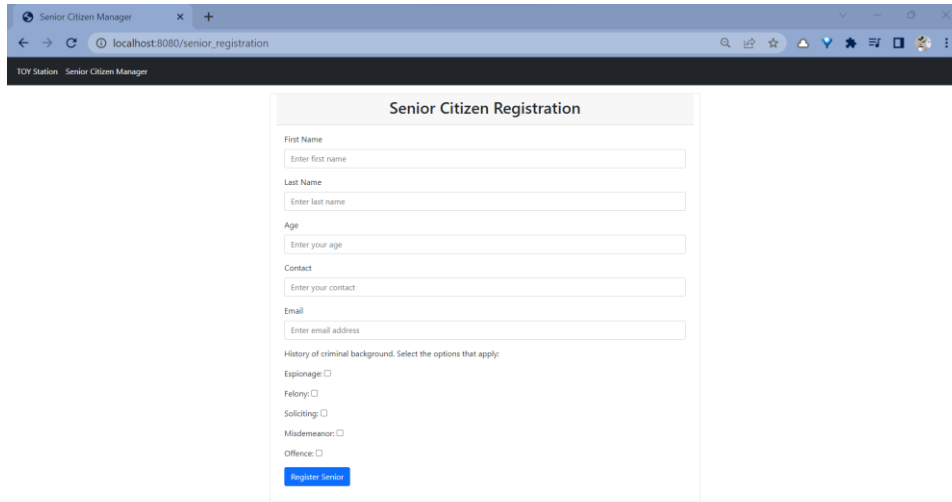


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- Allows a senior citizen to register  
Asks for the criminal background information:

Crime level goes from high severity to low from top to bottom order:



Senior Citizen Registration

First Name  
Enter first name

Last Name  
Enter last name

Age  
Enter your age

Contact  
Enter your contact

Email  
Enter email address

History of criminal background. Select the options that apply:

Espionage:

Felony:

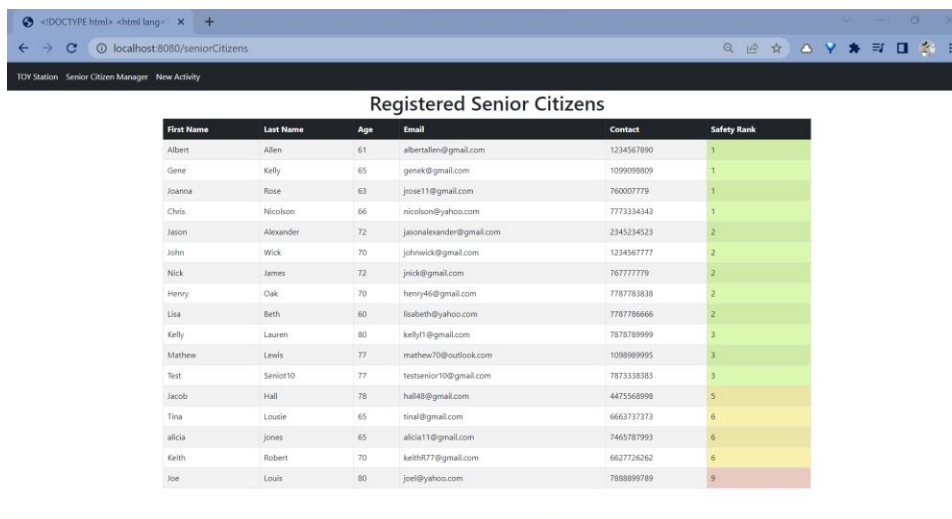
Soliciting:

Misdemeanor:

Offense:

[Register Senior](#)

- Ranks the senior citizen based on crime background questions answered during registration. This is the senior's **Safety Rank**.
- Shows the list of Registered senior citizens.



Registered Senior Citizens

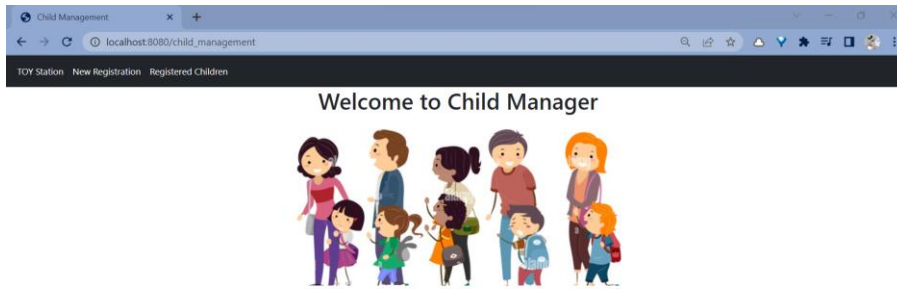
First Name	Last Name	Age	Email	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1234567890	1
Gene	Kelly	65	genek@gmail.com	1099098909	1
Joanna	Rose	63	jrose11@gmail.com	760007779	1
Chis	Nicolson	66	nicolson@yahoo.com	777333434	1
Jason	Alexander	72	jasonalexander@gmail.com	2345234523	2
John	Wick	70	johnwick@gmail.com	1234567777	2
Nick	James	72	nick@gmail.com	767777779	2
Henry	Oak	70	henry46@gmail.com	7767783838	2
Lisa	Beth	60	lisabeth@yahoo.com	778786666	2
Kelly	Lauren	80	kelly1@gmail.com	787899999	3
Mathew	Lewis	77	mathew70@outlook.com	1098989995	3
Test	Senior10	77	testsenior10@gmail.com	7873338983	3
Jacob	Hall	78	hall48@gmail.com	4475568998	5
Tina	Lousie	65	tina@gmail.com	6663737373	6
alicia	Jones	65	alicia11@gmail.com	7465787993	6
Keith	Robert	70	keithr77@gmail.com	6627726262	6
Joe	Louis	80	joel@yahoo.com	7888899789	9

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- **Child component:**

## Welcome Screen:



- Allows a parent to register a child.

The screenshot shows a web browser window with the URL localhost:8080/child\_registration. The page has a dark header with navigation links: TOY Station and Child Manager. The main content area features the heading "Child Registration" above a form with the following fields:

- First Name: Enter first name
- Last Name: Enter last name
- Child Age: Enter child's age
- Parent Contact: Enter parent contact
- Parent Email: Enter email address

A blue "Register Child" button is located at the bottom of the form.

- Shows the list of Registered children.

The screenshot shows a web browser window with the URL localhost:8080/children. The page has a dark header with navigation links: TOY Station, Child Manager, and New Activity. The main content area features the heading "Registered children" above a table with the following data:

First Name	Last Name	Age	Email	Contact
Bill	Dana	6	dana77@gmail.com	8098098888
Bethy	Dana	7	dana78@gmail.com	8878878787
Diana	Ross	7	rossD@gmail.com	7657654444
John	Ray	9	ray665@gmail.com	7654887652
Pete	Rose	5	rose28@yahoo.com	4567775678
Baby	Kelly	7	kelly676@outlook.com	1198898989
Kate	Wilson	5	wilson467@outlook.com	3363367777
Haider	Ali	7	ali337@gmail.com	8898898989
Ben	Jones	7	jones6@outlook.com	7797786464
Baby	Andrew	7	andrew998@yahoo.com	1176672727

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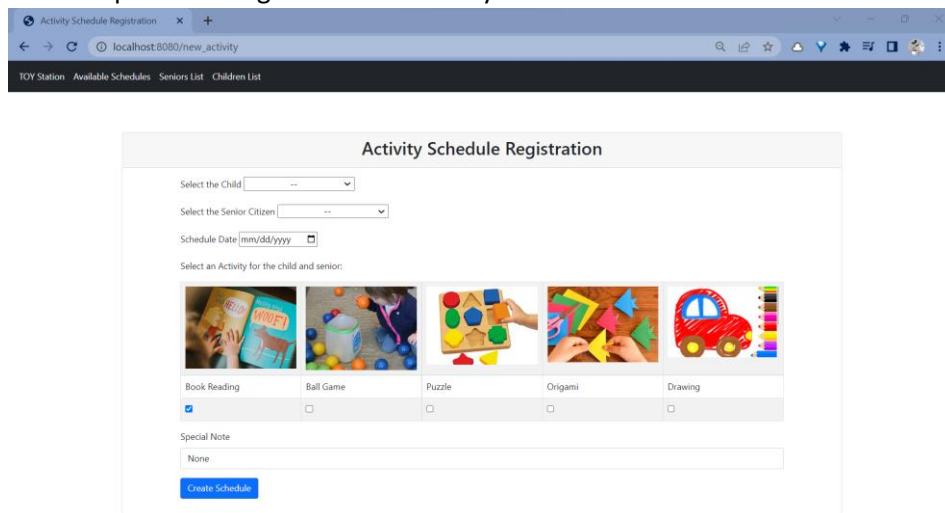
Kavya Sree Kilari (kak435@pitt.edu)

## 6. Detailed Scenario for Activity component: (Super component)

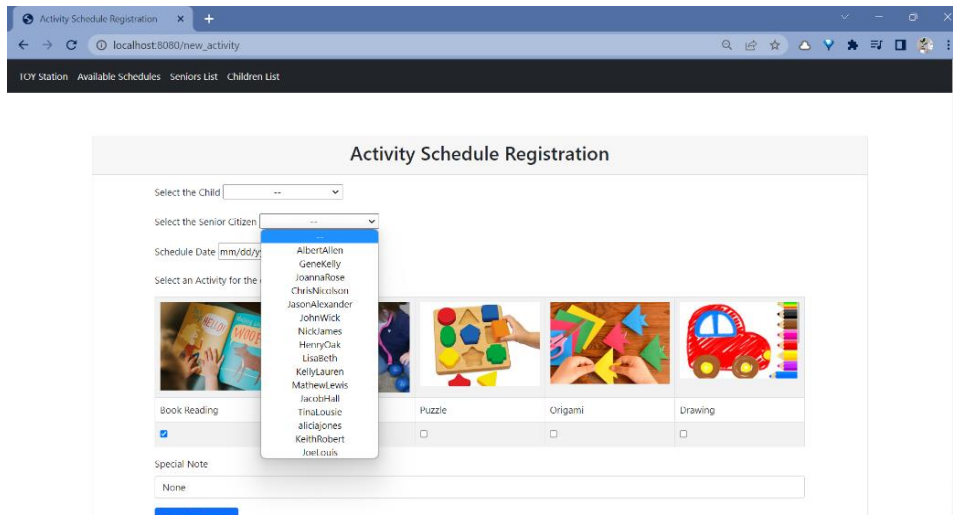
Welcome screen:



- Allows a parent to register a new activity schedule.



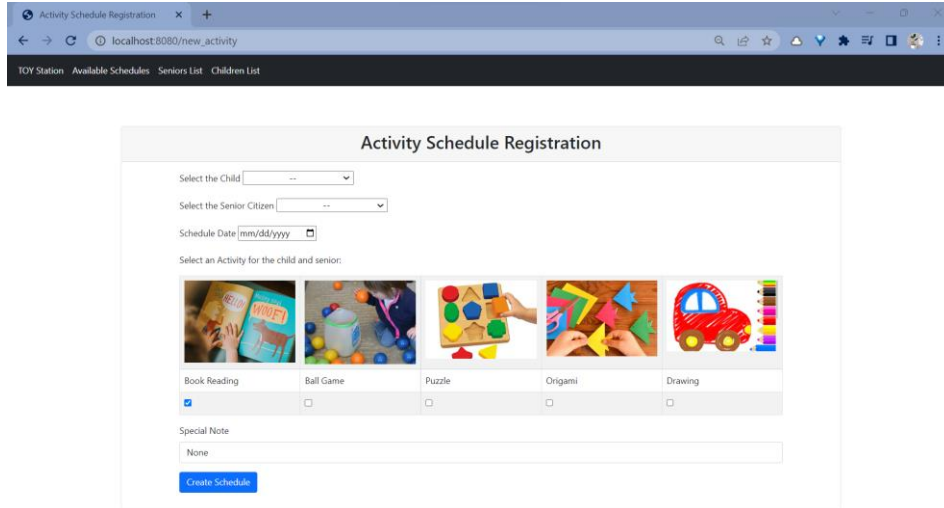
- Senior can be selected from the list.



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- Activity can be picked from the images represented for each activity:



- Once the details are selected, schedule can be confirmed.



- Shows the list of Registered activity schedules.

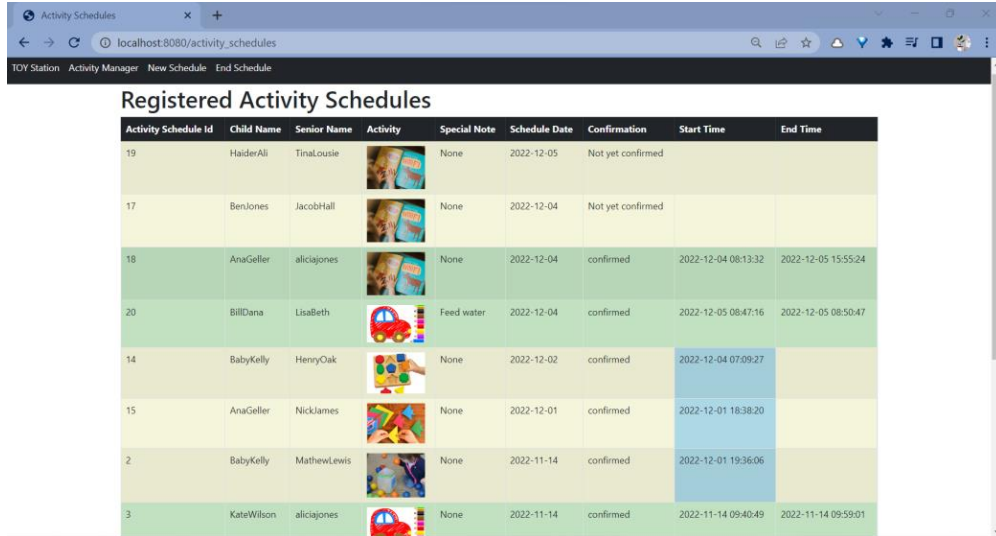
The screenshot shows a web browser window with the URL localhost:8080/admin\_activity\_schedules. The page title is "Available Activity Schedules". It displays a table with the following data:









Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
19	HaiderAli	TinaLouise		None	2022-12-05	click to confirm
17	BenJones	JacobHall		None	2022-12-04	click to confirm
18	AnaGeller	aliciajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed
3	KateWilson	aliciajones		None	2022-11-14	confirmed

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- Confirmation begins the schedule and start time is recorded shown in 'Start Time' column:



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
19	HaiderAli	TinaLouise		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	2022-12-05 15:55:24
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed	2022-12-05 08:47:16	2022-12-05 08:50:47
14	BabyKelly	HenryOak		None	2022-12-02	confirmed	2022-12-04 07:09:27	
15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01

- Parent returns to claim the kid, schedule can be ended using the End schedule option.



Registration and Login System

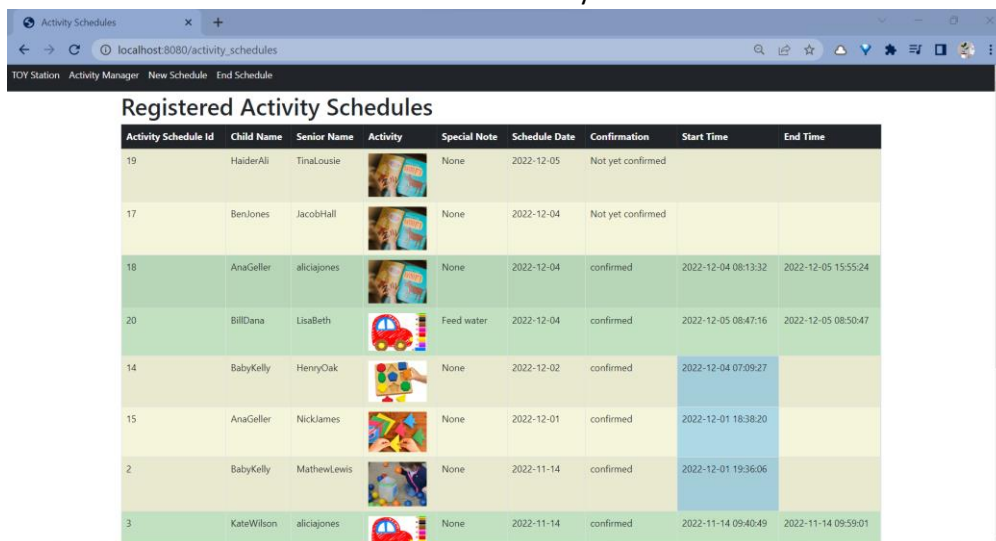
localhost:8080/end\_schedule









TOY Station Activity Manager New Schedule All Activities

### Scheduled Activity

Activity Schedule id:

- End schedule records the end time of the activity schedule shown in 'End Time' column:



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
19	HaiderAli	TinaLouise		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	2022-12-05 15:55:24
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed	2022-12-05 08:47:16	2022-12-05 08:50:47
14	BabyKelly	HenryOak		None	2022-12-02	confirmed	2022-12-04 07:09:27	
15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01

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## 7. URL link to a zip file of all source codes

The application is built in Java using Spring Boot and is a web application.

The database used is MySQL.

The UI is built using Thymeleaf.

The *GITHUB* URL link: [https://github.com/kavyasreekilari/TOY\\_System](https://github.com/kavyasreekilari/TOY_System)

Download the code, unzip it.

- Open the project using IDE like IntelliJ.
- Modify the application.properties file available in the below location:  
Change the database URL and password according to your local MySQL database settings.

[TOY\\_System/springboot-backend/src/main/resources/](#)

- Import all the MAVEN dependencies as pointed in pom.xml
- Run the project by running the ToyToolApplication.java file available in the location:  
[TOY\\_System/springboot-backend/src/main/java/com/toyproject/springbootbackend/](#)

On starting the application, the endpoint url can be accessed from the console - Open the URL:  
<http://localhost:8080/toysystem>

The welcome page contains the URLs to access the various components available in the TOY system.



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## 8. Visualizations

Extreme Visual Languages are visual languages that can communicate an integrated/holistic meaning of a domain or a universe in a single visual expression deployed along the spatial/temporal/conceptual dimensions.

In the project, I have used canonical deployments of XVLs.

After adding the visualizations, the project looks like this:

### Child Component:



Figure i Icon representing parent with a child

### Senior Component:



Figure ii Icon representing senior citizens



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## Activity Component:



Figure iii Icon representing activity for a child

## Visualization 1: Senior Safety Rank represented by colors:

Registered Senior Citizens:

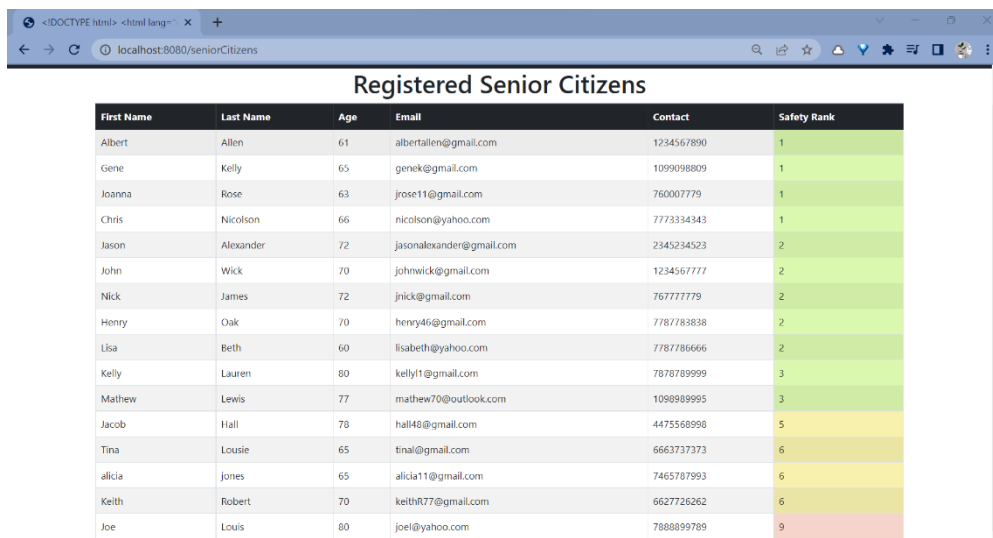
The below Table representation shows list of seniors ordered by their Safety Rank. Here the level of safety(calculated using criminal background options while senior registration) is represented by the color.

In SafetyRank column,

*Green color* represents the senior is safest (has minimal or no criminal background)

*Yellow color* represents the senior is Moderately safe (has moderate criminal background in low risk crimes)

*Red color* represents the senior is not safe. (criminal background in high risk crimes)



First Name	Last Name	Age	Email	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1234567890	1
Gene	Kelly	65	genek@gmail.com	1099098809	1
Joanna	Rose	63	jrose11@gmail.com	760007779	1
Chris	Nicolson	66	nicolson@yahoo.com	7773334343	1
Jason	Alexander	72	jasonalexander@gmail.com	2345234523	2
John	Wick	70	johnwick@gmail.com	1234567777	2
Nick	James	72	jnick@gmail.com	767777779	2
Henry	Oak	70	henry46@gmail.com	7787783838	2
Lisa	Beth	60	lisabeth@yahoo.com	7787786666	2
Kelly	Lauren	80	kelly1@gmail.com	7878789999	3
Mathew	Lewis	77	mathew70@outlook.com	1080908995	3
Jacob	Hall	78	hall48@gmail.com	4475568990	5
Tina	Lousie	65	tinal@gmail.com	8663737373	6
alicia	Jones	65	alicia11@gmail.com	7465787993	6
Keith	Robert	70	keithr77@gmail.com	6627726262	6
Joe	Louis	80	joel@yahoo.com	7888899789	9

Figure iv Table with list of senior citizens in the order of their safety Rank

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## Visualization 2: Activities represented by images/ icons

New Activity:

Visual representation using Icons to show different activities to select from.

This helps the parent to understand what is done in the activity.

A default selection is available – While creating a new activity, ‘Book Reading’ is selected by default. The parent is given the option to change it.

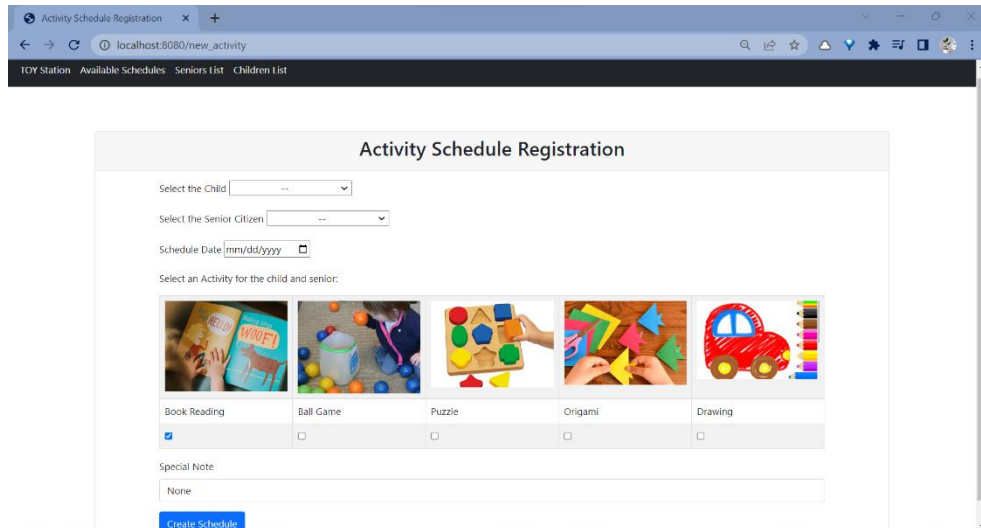


Figure v. Activity component with activity options

Schedule Activity:

On creating the schedule, the selected activity and its respective image is populated in the table as shown below:

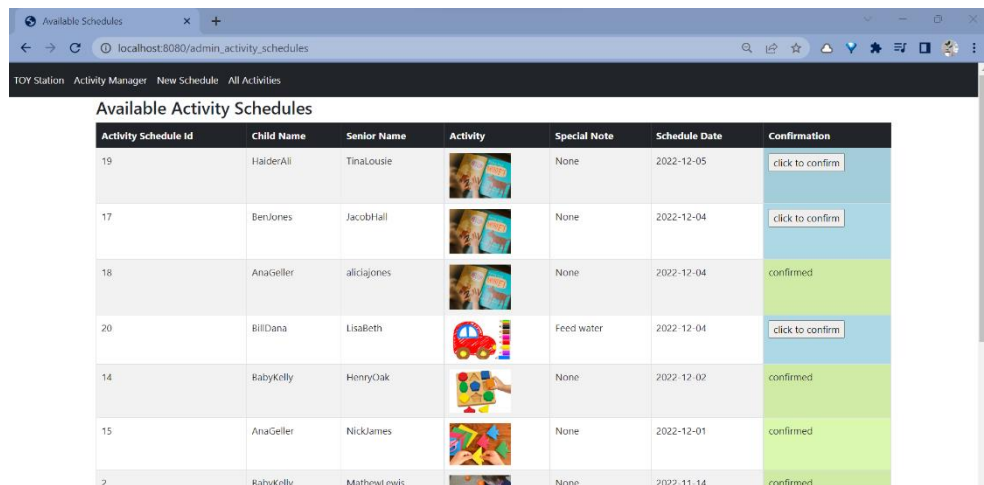
Table representation of activity and its schedule.

Selected activity is represented by icon in the Activity column.

Color in Confirmation column represents state of schedule –

*Blue* represents Not confirmed. ‘Click to confirm’ enables confirmation.

*Green* represents Confirmed.










Activity Schedule id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
19	HaiderAli	TinaLousie		None	2022-12-05	click to confirm
17	BenJones	JacobHall		None	2022-12-04	click to confirm
18	AnaGeller	alicajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	click to confirm
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed

Figure vi. Confirmation details of Activity schedule

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## Visualization 3: Activity schedule status represented by colored rows:

Registered Activity Schedules:

Register activity schedules page contains information about Activity Schedules.

Activity column contains Icons to represent the selected activity.

Color of the Row in table representation represents state of the activity schedule:

*Yellow* means Schedule is Not yet confirmed/ Not Begun.

*Blue* in start time column means Schedule has started and **currently active**.

*Green* represents Activity Schedule is completed successfully.

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
19	HaiderAli	TinaLouise		None	2022-12-05	Not yet confirmed		
17	BenJONES	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	2022-12-05 15:55:24
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed	2022-12-05 08:47:16	2022-12-05 08:50:47
14	BabyKelly	HenryOak		None	2022-12-02	confirmed	2022-12-04 07:09:27	
15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01

Figure vii. Scheduled activities with start time and end time

15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01
4	HaiderAli	JoeLouis		None	2022-11-14	confirmed	2022-11-14 09:58:18	2022-12-01 19:35:45
7	HaiderAli	KellyLauren		None	2022-11-14	confirmed	2022-11-14 10:44:27	2022-11-14 10:45:08
9	AnaGeller	KeithRobert		None	2022-11-14	confirmed	2022-12-04 07:14:25	2022-11-14 11:29:21
10	BabyKelly	NickJames		None	2022-11-14	confirmed	2022-11-14 15:43:27	2022-11-14 15:43:50
1	JohnRay	AlbertAllen		None	2022-11-13	confirmed	2022-11-13 23:29:04	2022-11-13 23:36:52

**NOTE:** Detailed enumeration scenarios for the visualization are shown in Appendix 1 section below.

# CS2310 TOY Project Final Report

Kavya Sree Kilari (kak435@pitt.edu)

## Appendix I

### An explanation of the principle on how the different visualizations correspond to enumerations in SIS Abstract Machines.

Visualizations work according to the scenario performed. Different scenarios that can be performed and their respective visualizations can be seen below:

Visualization 1: Senior Safety Rank represented by colors

#### Scenario 1: Safety Rank Green

New Senior Registration:

No option is selected under criminal background section. Meaning the senior has no history of criminal background and is the safest.

Senior Citizen Registration

First Name: Charlie

Last Name: Mills

Age: 71

Contact: 9898989822

Email: charlie22@yahoo.com

History of criminal background. Select the options that apply:

Espionage:

Felony:

Scolding:

Misdemeanor:

Offence:

Register Senior

Senior is registered successfully and Registered Seniors page below contains the information for the registered senior 'Charlie Mills'. The safety Rank is 1 and is represented by Green color as seen below:

Registered Senior Citizens

First Name	Last Name	Age	Email	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1234567890	1
Gene	Kelly	65	genek@gmail.com	109909809	1
Joanna	Rose	63	jrose11@gmail.com	760007779	1
Chris	Nicolson	66	nicolson@yahoo.com	7773334343	1
Charlie	Mills	71	charlie22@yahoo.com	9898989822	1
Jason	Alexander	72	jasonalexander@gmail.com	2345234523	2
John	Wick	70	johnwick@gmail.com	1234567777	2
Nick	James	72	jnick@gmail.com	767777779	2
Henry	Oak	70	henry46@gmail.com	7787783838	2
Lisa	Beth	60	lisabeth@yahoo.com	7787786666	2
Kelly	Lauren	80	kelly11@gmail.com	7878789999	3
Mathew	Lewis	77	mathew70@outlook.com	1098989995	3
Test	Senior10	77	testsenior10@gmail.com	7873338383	3
Jacob	Hall	78	hall48@gmail.com	4475568998	5
Tina	Louise	65	tinal@gmail.com	6663737373	6
alicia	jones	65	alicia11@gmail.com	7465787993	6
Keith	Robert	70	keithR77@gmail.com	6627726262	6
Joe	Louis	80	joel@yahoo.com	7888899789	9

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## Scenario 2: Safety Rank Yellow

New senior registration:

Under criminal background section, moderate level risk crimes are selected:

Senior Citizen Registration

First Name: Henry

Last Name: Oats

Age: 76

Contact: 6637736363

Email: Enter email address

History of criminal background. Select the options that apply:

Espionage:

Felony:

Self-driving:

Misdemeanor:

Offence:

[Register Senior](#)

Senior is registered successfully and Registered Seniors page below contains the information for the registered senior 'Henry Oats'. The safety Rank is 7 and is represented by Yellow color as seen below:

First Name	Last Name	Age	Email	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1234567890	1
Gene	Kelly	65	genek@gmail.com	1099098809	1
Joanna	Rose	63	jrose11@gmail.com	760007779	1
Chris	Nicolson	66	nicolson@yahoo.com	7773334343	1
Charlie	Mills	71	charlie22@yahoo.com	9898989822	1
Jason	Alexander	72	jasonalexander@gmail.com	2345234523	2
John	Wick	70	johnwick@gmail.com	1234567777	2
Nick	James	72	jnick@gmail.com	767777779	2
Henry	Oak	70	henry46@gmail.com	778783838	2
Lisa	Beth	60	lisabeth@yahoo.com	778786666	2
Kelly	Lauren	80	kelly11@gmail.com	7878789999	3
Mathew	Lewis	77	mathew70@outlook.com	109899995	3
Test	Senior10	77	testsenior10@gmail.com	7873338383	3
Lisa	Peter	73	lisap@gmail.com	7736437373	4
Jacob	Hall	78	hall40@gmail.com	4475568998	5
Tina	Louise	65	tinal@gmail.com	6663737373	6
alicia	jones	65	alicia11@gmail.com	7465787993	6
Keith	Robert	70	keith877@gmail.com	6627726262	6
Henry	Oats	76	henryoats@outlook.com	6637736363	7
Joe	Louis	80	joel@yahoo.com	788889789	9

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## Scenario 3: Safety Rank Red

New senior registration:

Under criminal background section, high risk and multiple crime types are selected:

Senior Citizen Registration

First Name  
Kathy

Last Name  
Wilson

Age  
72

Contact  
747474262628

Email  
kathy@yahoocom

History of criminal background. Select the options that apply:

Espionage

Felony

Soliciting

Misdemeanor

Offence

Register Senior

Senior is registered successfully and Registered Seniors page below contains the information for the registered senior 'Kathy Wilson'. The safety Rank is 11 and is represented by Red color as seen below:

First Name	Last Name	Age	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1
Gene	Kelly	65	genek@gmail.com	1
Joanna	Rose	63	jrose11@gmail.com	1
Chris	Nicolson	66	nicolson@yahoo.com	1
Charle	Mills	71	charlie22@yahoo.com	1
Jason	Alexander	72	jasonalexander@gmail.com	2
John	Wick	70	johwick@gmail.com	2
Nick	James	72	jnick@gmail.com	2
Henry	Oak	70	henry46@gmail.com	2
Lisa	Beth	60	lisabeth@yahoo.com	2
Kelly	Lauren	80	kelly11@gmail.com	3
Mathew	Lewis	77	mathew70@outlook.com	3
Test	Senior10	77	testsenior10@gmail.com	3
Lisa	Peter	73	lisa@gmail.com	4
Jacob	Hall	78	hall48@gmail.com	5
Tina	Louise	65	tinal@gmail.com	6
afcia	Jones	65	afcia11@gmail.com	6
Keith	Robert	70	keith877@gmail.com	8
Henry	Oats	76	henryoats@outlook.com	7
Johnson	Min	72	johnsonm@gmail.com	8
Joe	Louis	80	joel@yahoo.com	9
Kathy	Wilson	72	kathy@yahoocom	11

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Visualization 2: Activities represented by images/ icons

## Scenario 1: 'Book Reading' activity

New Activity registration: Child – Beth Dana, Senior – Jason Alexander

'Book Reading' activity checkbox is selected in the activity section:






Activity Schedule Registration

Select the Child:

Select the Senior Citizen:

Schedule Date:

Select an Activity for the child and senior:

				
Book Reading	Ball Game	Puzzle	Origami	Drawing
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>









Special Note

[Create Schedule](#)

The newly created activity is shown on the top in Available activity schedules page

The activity with id '21' for Beth Dana & Jason Alexander has 'Book Reading' icon populated in Activity column as shown below:

Available Activity Schedules

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethDana	JasonAlexander		None	2022-12-14	<a href="#">click to confirm</a>
19	HaiderAli	TinaLousie		None	2022-12-05	<a href="#">click to confirm</a>
17	BenJones	JacobHail		None	2022-12-04	<a href="#">click to confirm</a>
18	AnaGeller	aliciajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed

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## Scenario 2: 'Ball Game' activity

New Activity registration: Child – Baby Andrew, Senior – Albert Allen

'Ball Game' activity checkbox is selected in the activity:






Activity Schedule Registration

Select the Child

Select the Senior Citizen

Schedule Date

Select an Activity for the child and senior:

				
Book Reading	Ball Game	Puzzle	Origami	Drawing
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>









Special Note

[Create Schedule](#)

The newly created activity is shown in Available activity schedules page

The activity with id '22' for Baby Andrew & Albert Allen has 'Ball Game' icon populated in Activity column as shown below:

Available Activity Schedules

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethyDana	JasonAlexander		None	2022-12-14	<a href="#">click to confirm</a>
22	BabyAndrew	AlbertAllen		None	2022-12-14	<a href="#">click to confirm</a>
19	HaiderAli	TinaLousie		None	2022-12-05	<a href="#">click to confirm</a>
17	BenJones	JacobHall		None	2022-12-04	<a href="#">click to confirm</a>
18	AnaGeller	alicajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed



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## Scenario 3: 'Puzzle' activity

New Activity registration: Child – Kate Wilson, Senior – John Wick

'Puzzle' activity checkbox is selected in the activity section:






Activity Schedule Registration

Select the Child:

Select the Senior Citizen:

Schedule Date:

Select an Activity for the child and senior:









				
Book Reading	Ball Game	Puzzle	Origami	Drawing
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Special Note

The newly created activity is shown in Available activity schedules page

The activity with id '23' for Kate Wilson & John Wick has 'Puzzle' icon populated in Activity column as shown below:

Available Activity Schedules

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethyDana	JasonAlexander		None	2022-12-14	<input type="button" value="click to confirm"/>
22	BabyAndrew	AlbertAllen		None	2022-12-14	<input type="button" value="click to confirm"/>
23	KateWilson	JohnWick		None	2022-12-14	<input type="button" value="click to confirm"/>
19	HaiderAli	TinaLousie		None	2022-12-05	<input type="button" value="click to confirm"/>
17	BenJones	JacobHall		None	2022-12-04	<input type="button" value="click to confirm"/>
18	AnaGeller	alicajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed
14	BabyKelly	HenryOak		None	2022-12-02	confirmed

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## Scenario 4: 'Origami' activity

New Activity registration: Child – Bethy Dana, Senior – Gene Kelly

'origami' activity checkbox is selected under activity section:






Activity Schedule Registration

Select the Child

Select the Senior Citizen

Schedule Date

Select an Activity for the child and senior:

				
Book Reading	Ball Game	Puzzle	Origami	Drawing
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>









Special Note

[Create Schedule](#)

The newly created activity is shown in Available activity schedules page

The activity with id '24' for Bethy Dana & Gene Kelly has 'Origami' icon populated in Activity column as shown below:

Available Activity Schedules

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethyDana	JasonAlexander		None	2022-12-14	<a href="#">click to confirm</a>
22	BabyAndrew	AlbertAllen		None	2022-12-14	<a href="#">click to confirm</a>
23	KateWilson	JohnWick		None	2022-12-14	<a href="#">click to confirm</a>
24	BethyDana	GeneKelly		None	2022-12-14	<a href="#">click to confirm</a>
19	HaiderAli	TinaLousie		None	2022-12-05	<a href="#">click to confirm</a>
17	BenJones	JacobiHall		None	2022-12-04	<a href="#">click to confirm</a>
18	AnaGeller	aliciajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed

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## Scenario 5: 'Drawing' activity

New Activity registration: Child – John Kelly, Senior – Joanna Rose

'Drawing' activity checkbox is selected under activity section:

Activity Schedule Registration

Select the Child: JohnRay

Select the Senior Citizen: JoannaRose

Schedule Date: 12/14/2022

Select an Activity for the child and senior:

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Special Note: None

Create Schedule

The newly created activity is shown in Available activity schedules page

:The activity with id '25' for John Kelly & Joanna Rose has 'Drawing' icon populated in Activity column as shown below:

Available Activity Schedules

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethyDana	JasonAlexander		None	2022-12-14	click to confirm
22	BabyAndrew	AlbertAllen		None	2022-12-14	click to confirm
23	KateWilson	JohnWick		None	2022-12-14	click to confirm
24	BethyDana	GeneKelly		None	2022-12-14	click to confirm
25	JohnRay	JoannaRose		None	2022-12-14	click to confirm
19	HaiderAli	TinaLouise		None	2022-12-05	click to confirm
17	BenJones	JacobHall		None	2022-12-04	click to confirm
18	AriaGeller	aliciajones		None	2022-12-04	confirmed

This helps identify the type of activity chosen for the given activity id, senior, child.

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Visualization 3: Activity schedule status represented by colored rows:

## Scenario 1: New activity schedule is created

New activity schedule registration:

Activity Schedule Registration

Select the Child: Betty/Dana

Select the Senior Citizen: Jason/Alexander

Schedule Date: 12/14/2022

Select an Activity for the child and senior:

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Special Note: None

[Create Schedule](#)

The activity with id '21' for Beth Dana & Jason Alexander has 'Book Reading' icon populated in Activity column as shown below:

The confirmation is not yet done. So the 'Click to confirm' button is available.

Blue color of the 'Confirmation' column cell represents Action is needed for the activity:

Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BettyDana	JasonAlexander		None	2022-12-14	<a href="#">click to confirm</a>
22	BabyAndrew	AlbertAllen		None	2022-12-14	<a href="#">click to confirm</a>
23	KateWilson	JohnWick		None	2022-12-14	<a href="#">click to confirm</a>
24	BettyDana	GeneKelly		None	2022-12-14	<a href="#">click to confirm</a>
25	JohnRay	JoannaRose		None	2022-12-14	<a href="#">click to confirm</a>
19	HaiderAli	TinaLouise		None	2022-12-05	<a href="#">click to confirm</a>
17	BenJones	JacobHall		None	2022-12-04	<a href="#">click to confirm</a>
18	AnaGeller	aliciajones		None	2022-12-04	confirmed

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## Scenario 2: Activity schedule is Confirmed









Click to confirm button is clicked and the confirmation page is shown as below:



Upon clicking save, the activity is confirmed successfully.

In Available Activity Schedules page, the Confirmation column for Activity '21' turned Green. This represents no more action is needed in terms of Activity confirmation.



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
21	BethyDana	JasonAlexander		None	2022-12-14	confirmed
22	BabyAndrew	AlbertAllen		None	2022-12-14	<a href="#">click to confirm</a>
23	KateWilson	JohnWick		None	2022-12-14	<a href="#">click to confirm</a>
24	BethyDana	GeneKelly		None	2022-12-14	<a href="#">click to confirm</a>
25	JohnRay	JoannaRose		None	2022-12-14	<a href="#">click to confirm</a>
19	HaiderAli	TinaLousie		None	2022-12-05	<a href="#">click to confirm</a>
17	BenJones	JacobHall		None	2022-12-04	<a href="#">click to confirm</a>
18	AriaGeller	aliciajones		None	2022-12-04	confirmed

On clicking 'All activities' page in the above screen, the 'Registered Activity Schedules' page is displayed. This page contains Schedule information for all activities.

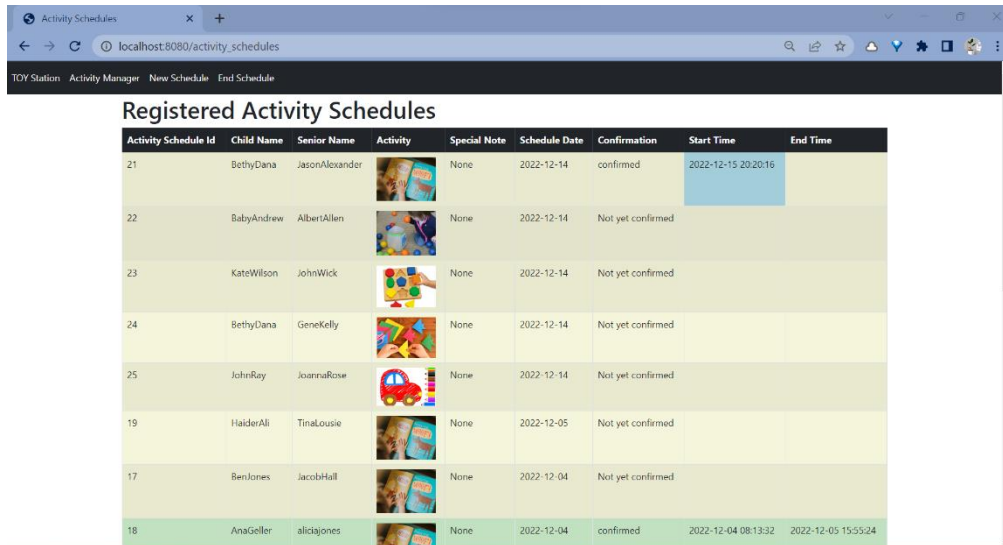
The activity '21' has 'confirmed' status in Confirmation column.









Upon confirmation, the Schedule has begun. The 'Start Time' column is populated.

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Blue color in 'Start Time' column represents that the activity is currently active and ongoing.



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
21	BethyDana	JasonAlexander		None	2022-12-14	confirmed	2022-12-15 20:20:16	
22	BabyAndrew	AlbertAllen		None	2022-12-14	Not yet confirmed		
23	KateWilson	JohnWick		None	2022-12-14	Not yet confirmed		
24	BethyDana	GeneKelly		None	2022-12-14	Not yet confirmed		
25	JohnRay	JoannaRose		None	2022-12-14	Not yet confirmed		
19	HaiderAli	TinaLousie		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	2022-12-05 15:55:24

Yellow color row without start time values represent Schedule is not yet confirmed. Confirmation column shows the 'Not yet confirmed' status.

### Scenario 3: Activity Schedule is ended

In the same page as above, End schedule button takes to 'End schedule' page:



Registration and Login System

localhost:8080/end\_schedule

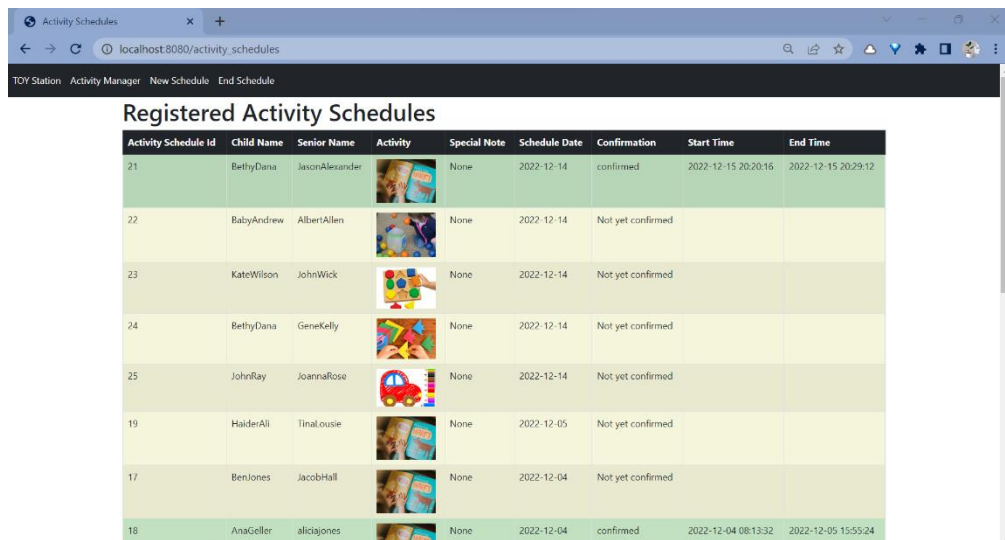
TOY Station Activity Manager New Schedule All Activities









### Scheduled Activity

Activity Schedule id:

After entering the activity schedule id and click 'End' the schedule is ended successfully. This takes to Registered Activity Schedules page.

The row for Activity Schedule 21 turned Green and the 'End Time' column is populated. This represents the schedule is completed successfully:



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
21	BethyDana	JasonAlexander		None	2022-12-14	confirmed	2022-12-15 20:20:16	2022-12-15 20:29:12
22	BabyAndrew	AlbertAllen		None	2022-12-14	Not yet confirmed		
23	KateWilson	JohnWick		None	2022-12-14	Not yet confirmed		
24	BethyDana	GeneKelly		None	2022-12-14	Not yet confirmed		
25	JohnRay	JoannaRose		None	2022-12-14	Not yet confirmed		
19	HaiderAli	TinaLousie		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	2022-12-05 15:55:24

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## Visualization 4: Conceptual Computation – Initial Conceptual Graph

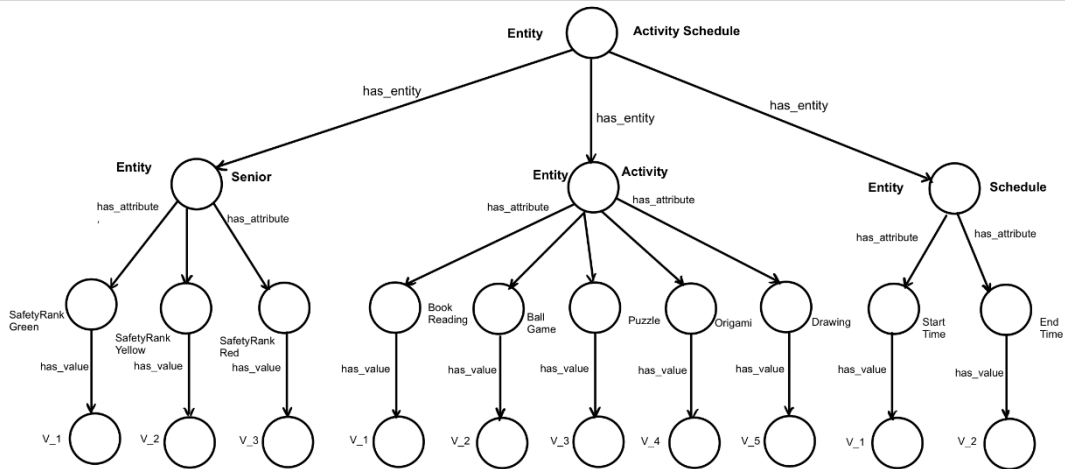


Figure viii - enum() for activity schedule

enum() for activity schedule shows multiple enumerations possible with different combinations of senior, activity, schedule entity options as shown in figure viii.

## Visualization 5: Conceptual Computation – Resultant Conceptual Graph

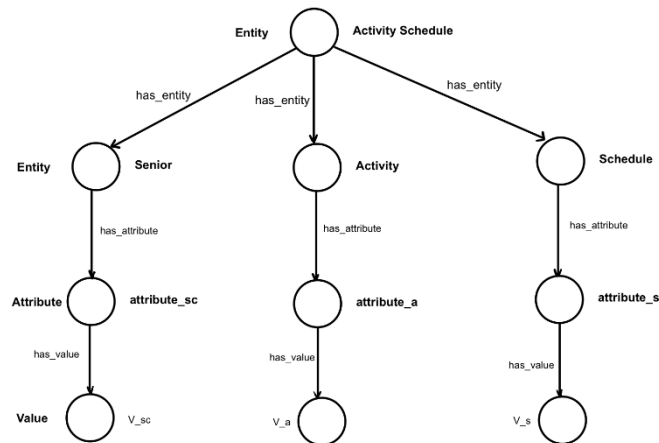


Figure ix - elim() for activity schedule

elim() for activity schedule helps filter out the necessary activity schedule for the selected attribute values as shown in figure ix.

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## SIS Abstract Machine Explanation:

Selecting senior based on safety rank:

cycle1: [guard1,1] P0 -enum< P1 >elim- P2

The enum() function maps a predecessor element  $x(v1)$  with safety Rank Green to produce two successor elements  $x1(v1+1)$  and  $x2(v1+1)$  with safety Rank Green.

The elim() function eliminates all elements whose safety Rank is not Green – can be Yellow or Red.

As an example, suppose  $P0 = \{ \text{Amanda}(\text{Green}), \text{Wilson}(\text{Green}) \}$ .

$P1 = \text{enum}(P0) = \{ \text{Amanda1}(\text{Red}), \text{Amanda2}(\text{Green}), \text{Wilson1}(\text{Yellow}), \text{Wilson2}(\text{Green}) \}$ .

$P2 = \text{elim}(P1) = \{ \text{Amanda2}(\text{Green}), \text{Wilson2}(\text{Green}) \}$ .

The machine will halt with the above P2 being the solution set.

Selecting activity based on activity option:

cycle1: [guard1,1] P0 -enum< P1 >elim- P2

The enum() function maps a predecessor element  $x(v1)$  with activity 'Book Reading' to produce two successor elements  $x1(v1+1)$  and  $x2(v1+1)$  with activity 'Book Reading'.

The elim() function eliminates all elements whose activity is not 'Book Reading' – can be 'Ball Game', 'puzzle', 'origami', 'drawing'.

As an example, suppose  $P0 = \{ \text{Schedule1}(\text{Book Reading}), \text{Schedule2}(\text{Book Reading}) \}$ .

$P1 = \text{enum}(P0) = \{ \text{Schedule1}(\text{'Book Reading'}), \text{Schedule2}(\text{'Book Reading'}), \text{Schedule3}(\text{'Origami'}), \text{Schedule4}(\text{'Puzzle'}) \}$ .

$P2 = \text{elim}(P1) = \{ \text{Schedule1}(\text{'Book Reading'}), \text{Schedule2}(\text{'Book Reading'}) \}$ .

The machine will halt with the above P2 being the solution set.



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## Appendix II

### Detailed scenario(s) on how the visualization works.

- TOY System contains multiple components



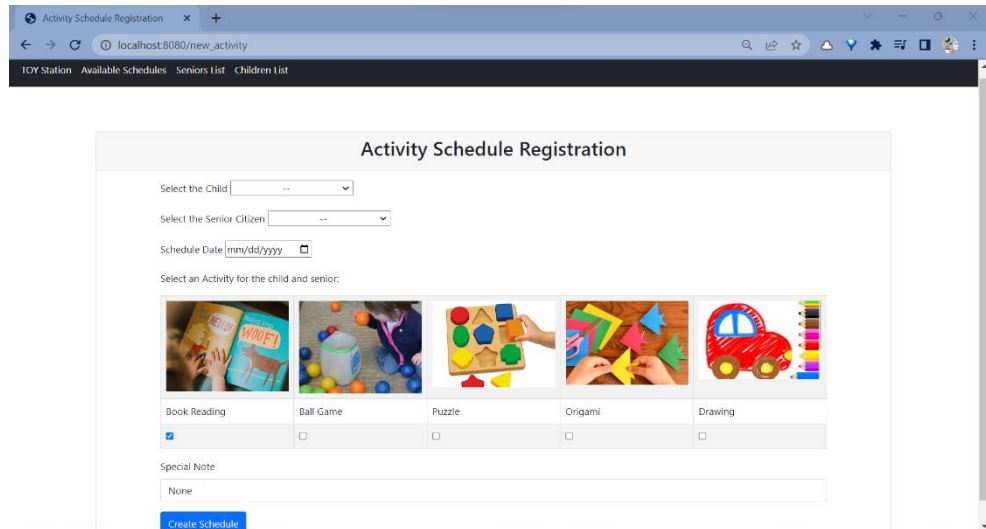
- **A parent wants to schedule and activity:**  
Activity Component helps with this



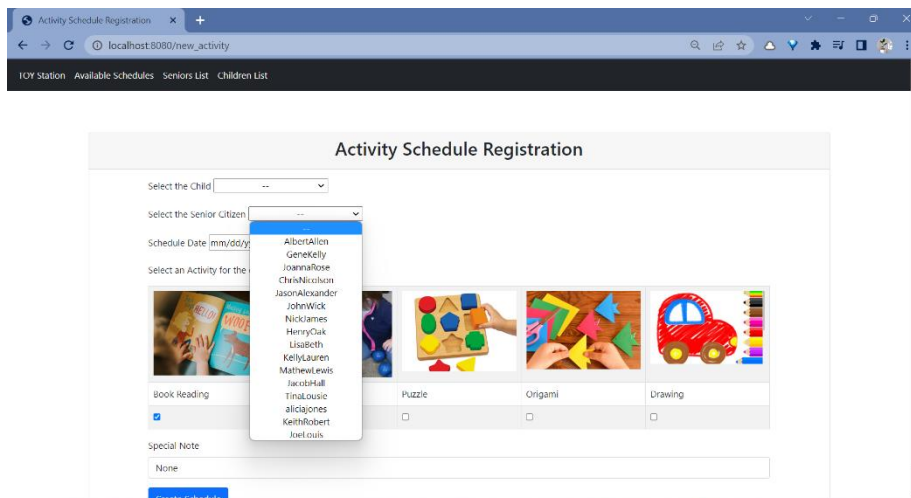
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- New Activity page shows the options to select from to create an activity:



The 'Select the senior citizen' dropdown shows list of senior citizens sorted by their safety rank:



The 'Seniors List' option in the navigation bar can be clicked to see more details of the seniors. This helps see the safetyRank level of the senior represented by color:

The screenshot shows a web browser window with the URL localhost:8080/seniorCitizens. The page title is "Registered Senior Citizens". It displays a table with the following columns: First Name, Last Name, Age, Email, Contact, and Safety Rank. The table contains 18 rows of data, with the Safety Rank column highlighted in a color gradient from green (rank 1) to red (rank 9).

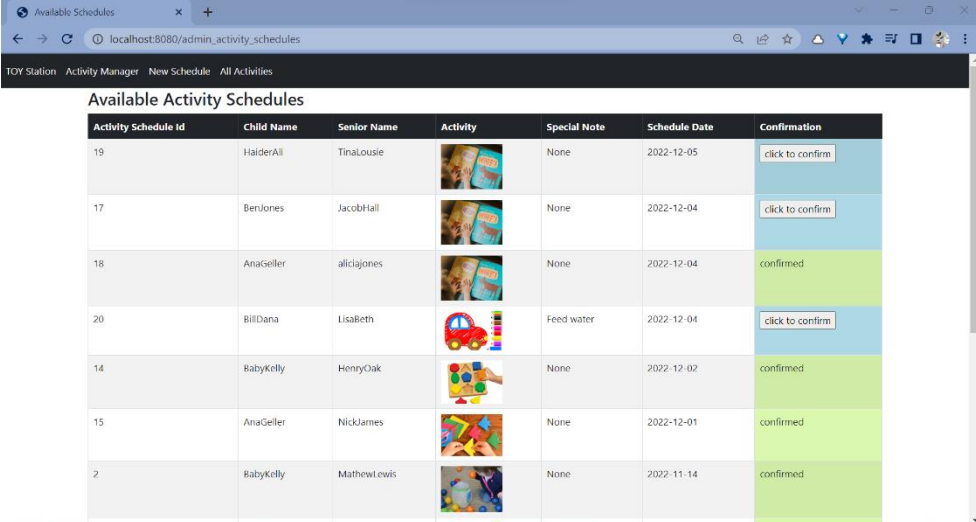
First Name	Last Name	Age	Email	Contact	Safety Rank
Albert	Allen	61	albertallen@gmail.com	1234567890	1
Gene	Kelly	65	genek@gmail.com	1099098809	1
Joanna	Rose	63	jrose11@gmail.com	780007779	1
Chris	Nicolson	66	nicolson@yahoo.com	7773334343	1
Jason	Alexander	72	jasonalexander@gmail.com	2345234523	2
John	Wick	70	johnwick@gmail.com	1234567777	2
Nick	James	72	nickj@gmail.com	767777779	2
Henry	Oak	70	henry46@gmail.com	7787783838	2
Lisa	Beth	60	lisabeth@yahoo.com	7787786666	2
Kelly	Lauren	80	kelly1@gmail.com	7878789999	3
Mathew	Lewis	77	mathew70@outlook.com	1098989995	3
Jacob	Hall	78	hall48@gmail.com	4475568908	5
Tina	Lousie	65	tinal@gmail.com	6667737373	6
alicia	jones	65	alicia11@gmail.com	7455787993	6
Keith	Robert	70	keithr77@gmail.com	662776262	6
Joe	Louis	80	joel@yahoo.com	788899789	9








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The 'New Activity' option in this page takes back to the page where new activity can be created.

After selecting the necessary options in the 'New Activity' page, 'create schedule' button creates the new activity schedule. This takes to Available Activity Schedules page:

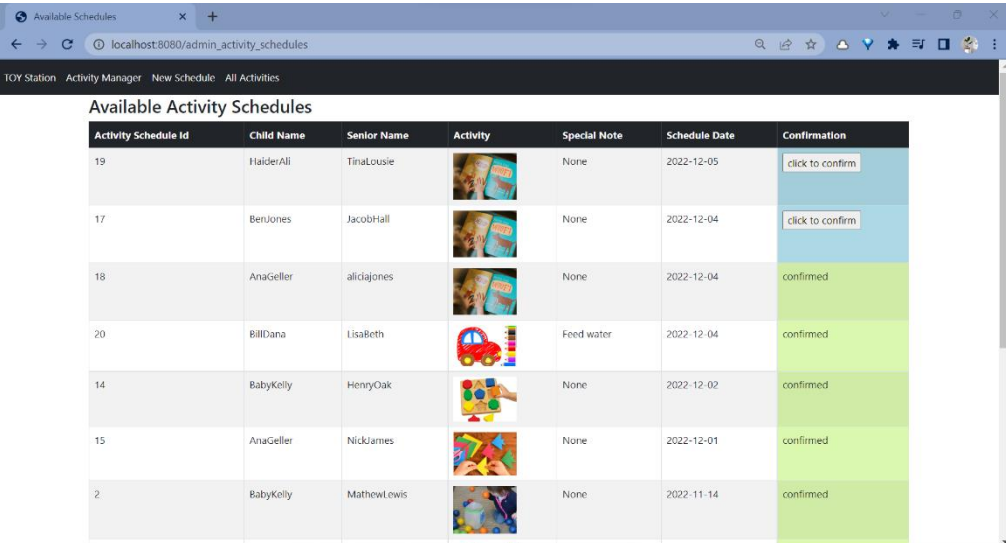









Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
19	HaiderAli	TinaLousie		None	2022-12-05	click to confirm
17	BenJones	JacobHall		None	2022-12-04	click to confirm
18	AnaGeller	aliciajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	click to confirm
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed

The activity column shows the image representing the Activity we selected.

The newly created activity is shown based on latest date in 'Schedule Date' column. The Confirmation column shows the status of the schedule represented by blue color. Once the schedule is confirmed, the Confirmation cell turns green.

For example, in the above image Activity Schedule id '20' is currently blue. After confirmation, it turns green like below:



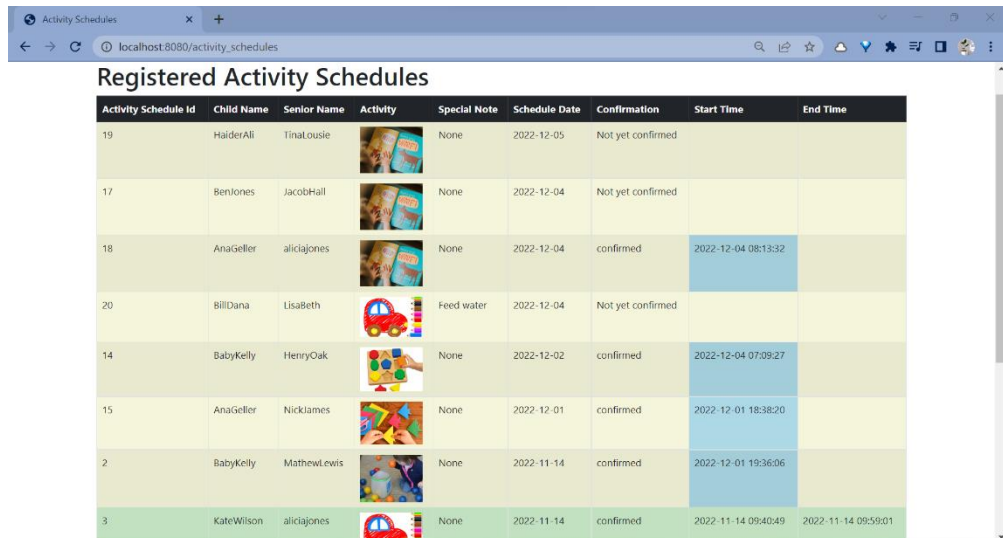
Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation
19	HaiderAli	TinaLousie		None	2022-12-05	click to confirm
17	BenJones	JacobHall		None	2022-12-04	click to confirm
18	AnaGeller	aliciajones		None	2022-12-04	confirmed
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed
14	BabyKelly	HenryOak		None	2022-12-02	confirmed
15	AnaGeller	NickJames		None	2022-12-01	confirmed
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed









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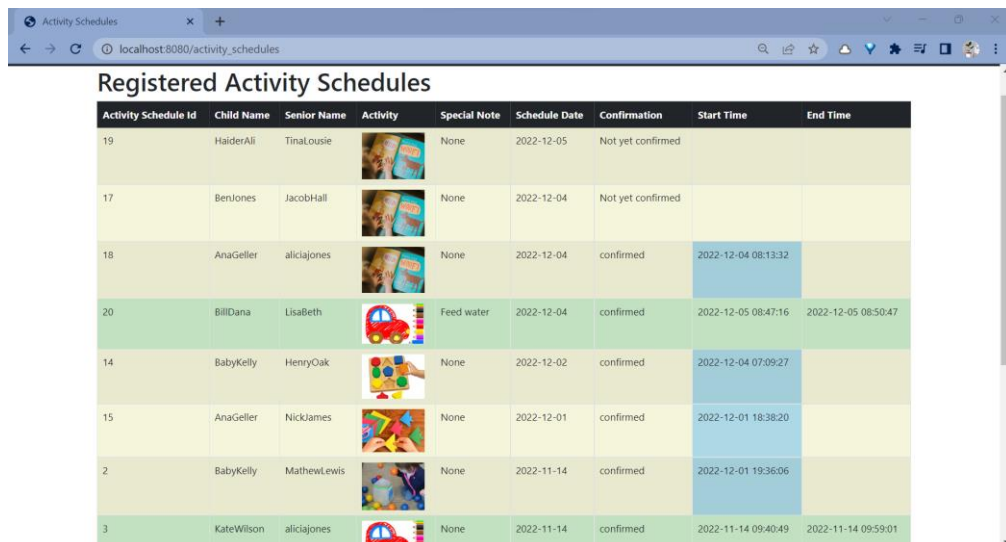
'All activities' page shows all the information about the activities:









After confirming the schedule for Activity Schedule id '20', start date is populated in blue color:



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
19	HaiderAli	TinaLousie		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	
20	BillDana	LisaBeth		Feed water	2022-12-04	Not yet confirmed		
14	BabyKelly	HenryOak		None	2022-12-02	confirmed	2022-12-04 07:09:27	
15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01

'End schedule' option takes to a page where activity can be ended. After selecting 'End' the row with Activity Schedule id turns green and end time is populated:



Activity Schedule Id	Child Name	Senior Name	Activity	Special Note	Schedule Date	Confirmation	Start Time	End Time
19	HaiderAli	TinaLousie		None	2022-12-05	Not yet confirmed		
17	BenJones	JacobHall		None	2022-12-04	Not yet confirmed		
18	AnaGeller	aliciajones		None	2022-12-04	confirmed	2022-12-04 08:13:32	
20	BillDana	LisaBeth		Feed water	2022-12-04	confirmed	2022-12-05 08:47:16	2022-12-05 08:50:47
14	BabyKelly	HenryOak		None	2022-12-02	confirmed	2022-12-04 07:09:27	
15	AnaGeller	NickJames		None	2022-12-01	confirmed	2022-12-01 18:38:20	
2	BabyKelly	MathewLewis		None	2022-11-14	confirmed	2022-12-01 19:36:06	
3	KateWilson	aliciajones		None	2022-11-14	confirmed	2022-11-14 09:40:49	2022-11-14 09:59:01