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Assignment Two

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COMP8760: Enterprise Application Integration

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1. Introduction

As the worldwide population grows older, the use of AI technology has become more crucial in tackling the distinct challenges that the elderly encounter. With this intent, AWCare aims to provide online urgent care for the elderly by integrating AIACare's AI technologies to enhance the healthcare experience for seniors. The report's primary goal is to outline the redesign of the AS-IS process, incorporating AIACare's AI technologies and addressing potential integration challenges. It contains a comprehensive analysis of the AS-IS process, identification of suitable AIACare products/services for integration, potential integration issues, the design of a proposed TO-BE process model and process performance measures analysis.

2. AS-IS Process Model

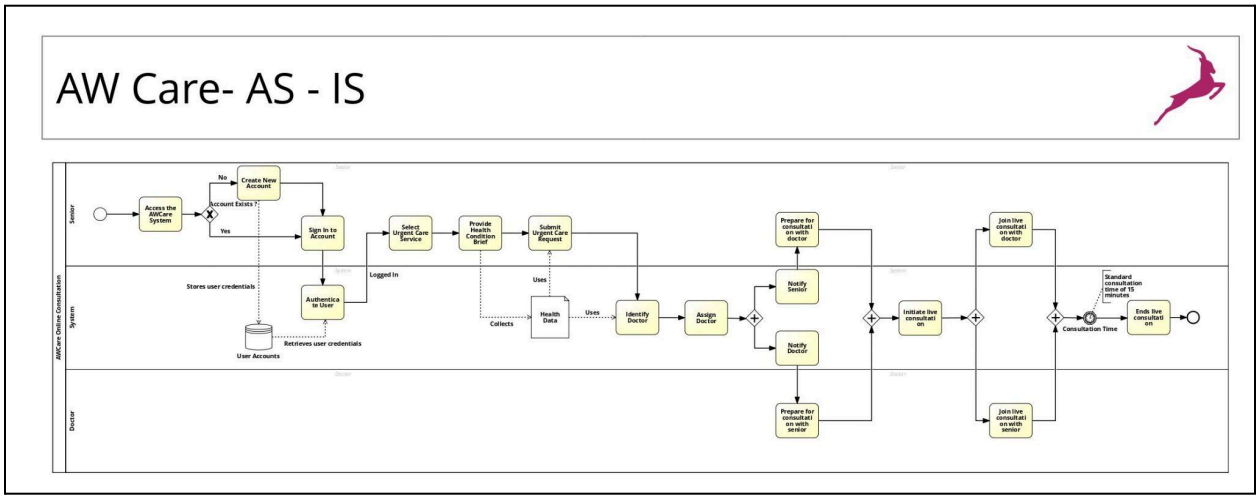


Figure 1: AS-IS Model

3. Identification of AI Technologies

To enhance the AS-IS process for AWCare, integrating AI technologies can address the challenges due to ageing such as hearing loss, speaking difficulty, and visual impairment (Ageing and health, 2022) during online interaction with the doctor. Research (Reddy, 2024) suggests that AI with the use of intelligent decision-making and automated systems has the potential to transform healthcare.

3.1 Enhanced Speech-to-Text and Text-to-Speech Services

3.1.1 Real-Time Subtitling

For those with hearing impairments, AIACare's AI-powered speech-to-text services via AIACare's NLP Engine can provide real-time subtitles (Martin, 2024) of what the doctor is saying during consultations.

3.1.2 Text-to-Speech for Patient Responses

Elderly patients who have difficulty speaking or prefer writing their responses can use AIACare's text-to-speech service via AIACare's NLP Engine to convert their typed words into natural language for the doctor to hear during consultations (Oyucu, 2023).

3.2 AI-Powered Visual Aids

For those with visual impairments, AI-powered visual aids (LLORCA et al., 2023) and visual assistance services via AIACare's Intelligent Reader help to magnify the doctor's image, adjust colors or contrast, identify things and read subtitles shown during the consultation.

4. Potential Application Integration Issues

To support the on-demand specific needs of individual seniors, AWCare, with AIACare being its AI supplier must address several potential application integration issues.

4.1 Real-Time Data Exchange and Processing

Challenge: Facilitating real-time or near-real-time data exchange to meet the on-demand needs of seniors.

Solution: Technologies that reduce latency in communication such as leveraging modern web services or API-based integrations, can enhance the responsiveness of services offered by AWCare through AIACare.

4.2 Scalability and Adaptability

Challenge: Scaling the integration solution to accommodate increasing users as AWCare expands its services and customer base.

Solution: As the demand for elderly care services grows, the system should handle a higher volume of users & transactions without degradation in performance. Researchers (Al-Said Ahmad and Andras, 2019) identified that this may require scalable cloud solutions or dynamic allocation of resources.

4.3 Security and Privacy

Challenge: Maintaining the confidentiality, integrity, and availability of seniors' health and personal information during data transmission between AWCare and AIACare.

Solution: Given the sensitive nature of healthcare data, robust encryption and secure communication channels (e.g., using AS2 protocols for secure data transport (Hasan and Ali, 2019)) are essential.

4.4 Interoperability and Standards Compliance

Challenge: Ensuring seamless data exchange between AWCare's and AIACare's systems, using different EDI standards or message formats (HL7 for healthcare).

Solution: AWCare must guarantee that seniors' healthcare data is accurately and efficiently exchanged with AIACare. This includes compatibility with healthcare-specific protocols like HL7 for transmitting patient data securely and effectively (Lubamba and Bagula, 2017).

5. TO-BE Process Model

The To-Be model of the AWCare system is proposed with enhancements from AIACare's products and services to address the challenges faced during online interaction. The steps related to AI, provided by AIACare, are clearly defined as follows: The new tasks are highlighted in blue.

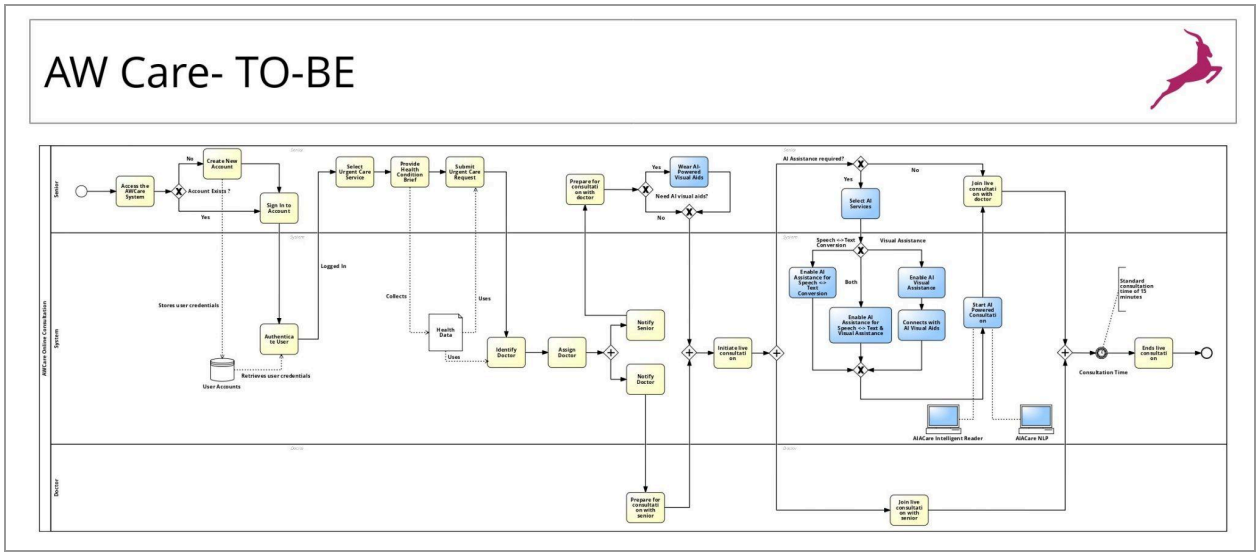


Figure 2: TO-BE Model

1. **Visual Impairment Check**

   When a senior with potential visual impairment access the service, the system prompts them to determine if AI visual aids are needed.

2. **AI Hearing Aid Placement**

   If visual assistance is required, the senior is instructed to use an AI hearing aid, which is integrated with the visual assistance feature of the system.

3. **AI Service Selection During Consultation**

   At the start of a real-time consultation, the user is presented with options to enable AI support. They can choose speech-to-text conversion, visual assistance, or both.

4. **Activation of AIACare Features**

   Based on the user's choice, AIACare's corresponding functionalities—speech recognition for converting spoken words into text, and visual aids for assisting with visual impairments are activated.

5. **Live Consultation with AI Enhancement**

   The user then enters a live consultation session. This session is augmented with AIACare technologies, specifically:

- AIACare Intelligent Reader:

  This system assists by interpreting visual information, helping visually impaired seniors to understand visual cues.

- AIACare NLP:

  The Natural Language Processing feature aids in comprehending and processing spoken language, making the consultation more accessible for users with hearing impairments.

6. Process Performance Measures Analysis

This section evaluates the To-Be process model for AWCare by analyzing it through various performance dimensions such as time, cost, quality, and flexibility using Process Performance Measures. The model is simulated in the Signavio Process Manager Tool for the two scenarios.

Assumptions:

Simulation duration for both cases = 1 day.

Cost, Duration, Frequency and Resource values are randomly given for simplicity and analysis.

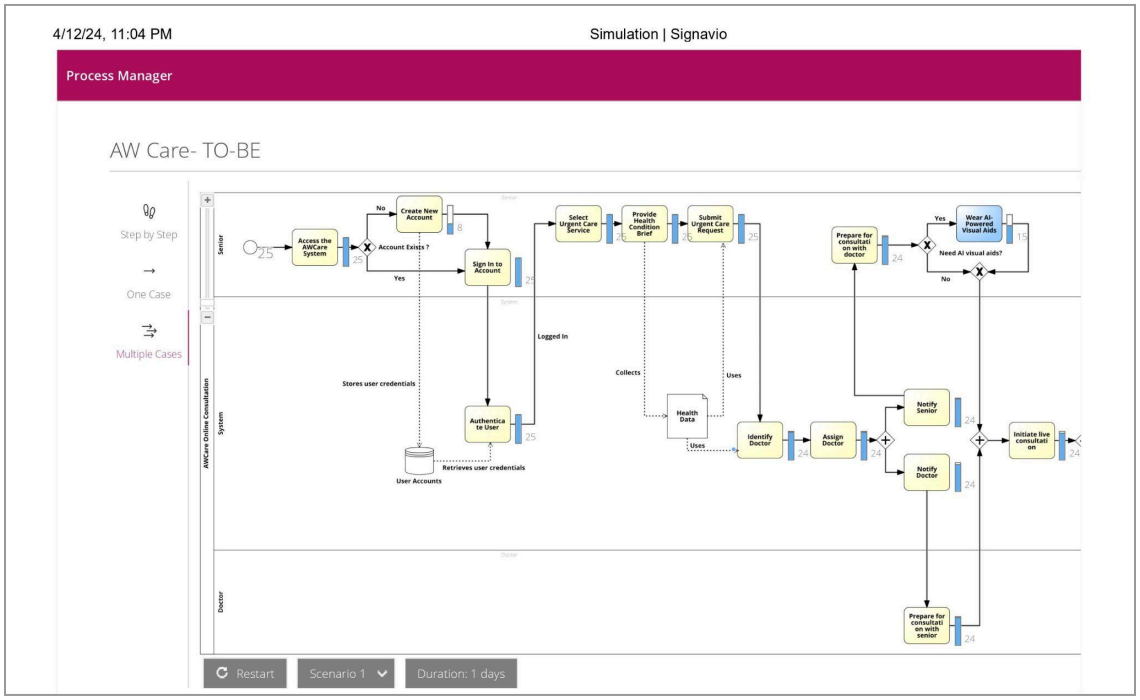


Figure 3: AWCare To-Be process simulation, Scenario 1

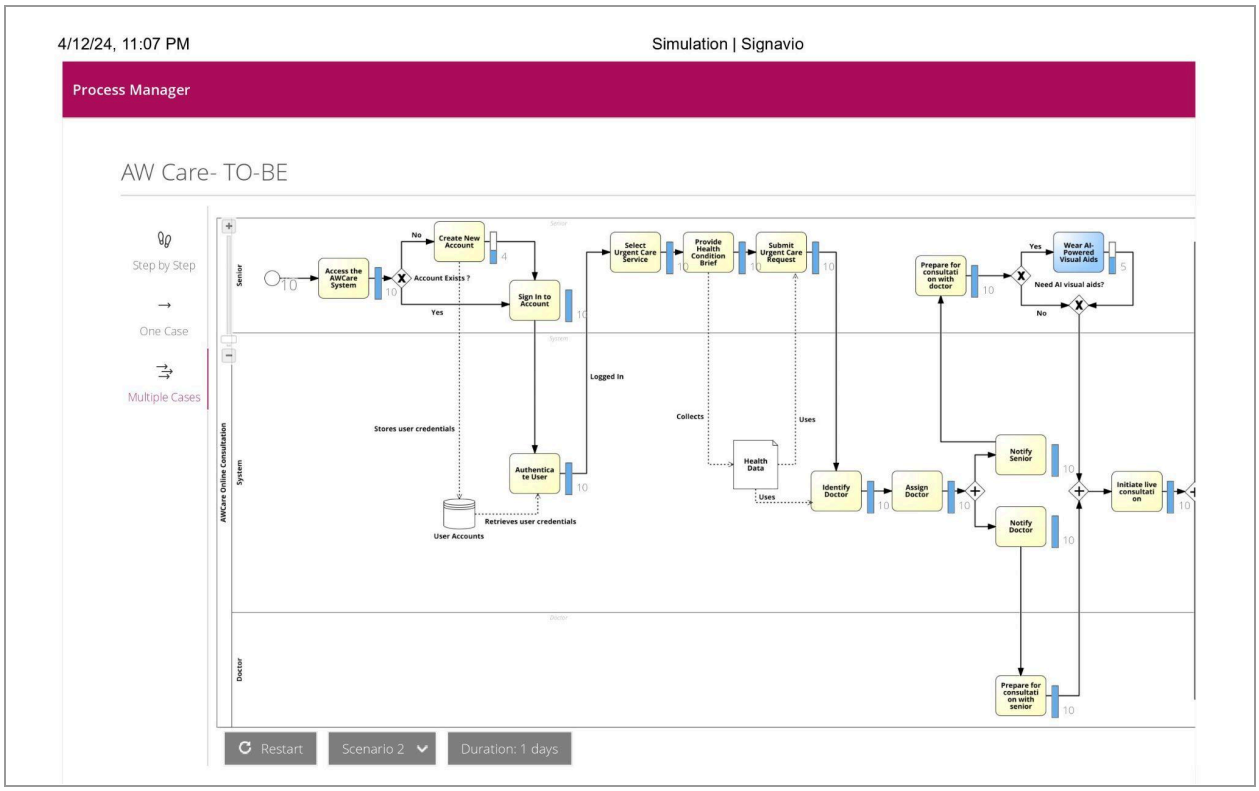


Figure 4: AWCare To-Be process simulation, Scenario 1

- **<u>Scenario 1</u>**

  Daily frequency of the process = 25

  Below are the process parameters for the Scenario 1 simulation.

Costs and Duration		
Task	**Execution costs**	**Execution time**
Access the AWCare System	1.00	00h 00m 10s
Create New Account	1.00	00h 05m
Sign In to Account	1.00	00h 02m
Authenticate User	1.00	00h 00m 15s
Select Urgent Care Service	1.00	00h 00m 10s
Provide Health Condition Brief	1.00	00h 05m
Submit Urgent Care Request	1.00	00h 00m 10s
Identify Doctor	1.00	00h 00m 05s
Assign Doctor	1.00	00h 00m 05s
Notify Senior	1.00	00h 00m 02s
Prepare for consultation with doctor	1.00	00h 01m
Wear AI-Powered Visual Aids	1.00	00h 01m
Notify Doctor	1.00	00h 00m 02s
Prepare for consultation with senior	1.00	00h 01m
Initiate live consultation	1.00	00h 00m 05s
Select AI Services	1.00	00h 00m 30s
Enable AI Visual Assistance	1.00	00h 00m 02s
Connects with AI Visual Aids	1.00	00h 00m 10s
Enable AI Assistance for Speech <-> Text Conversion	1.00	00h 00m 02s
Enable AI Assistance for Speech <-> Text & Visual Assistance	1.00	00h 00m 02s
Start AI Powered Consultation	1.00	00h 00m 10s
Join live consultation with doctor	1.00	00h 00m 10s
Join live consultation with senior	1.00	00h 00m 10s
Frequency and probabilities		
Start event	**Frequency**	
Start event	On Mon; overall 25 times	
Gateway	**Decision**	**Probability**
Account Exists ?	No	40.00%
	Yes	60.00%
Need AI visual aids?	No	30.00%
	Yes	70.00%
AI Assistance required?	No	30.00%
	Yes	70.00%
Gateway	Visual Assistance	40.00%
	Both	20.00%
	Speech <-> Text Conversion	40.00%
Resources		
Role	**Work schedules**	**Costs/hour**
Doctor	10 employees; 400 hours per week	75.00
Senior	10 employees; 80 hours per week	0.00
System	1 employees; 8 hours per week	100.00

Figure 5: Process parameters used for Scenario 1 simulation.

- **Scenario 2**

  Daily frequency of the process = 10.

  Below are the process parameters for the Scenario 2 simulation.

Costs and Duration		
Task	**Execution costs**	**Execution time**
Access the AWCare System	1.00	00h 00m 10s
Create New Account	1.00	00h 05m
Sign In to Account	1.00	00h 02m
Authenticate User	1.00	00h 00m 15s
Select Urgent Care Service	1.00	00h 00m 10s
Provide Health Condition Brief	1.00	00h 05m
Submit Urgent Care Request	1.00	00h 00m 10s
Identify Doctor	1.00	00h 00m 05s
Assign Doctor	1.00	00h 00m 05s
Notify Senior	1.00	00h 00m 02s
Prepare for consultation with doctor	1.00	00h 01m
Wear AI-Powered Visual Aids	1.00	00h 01m
Notify Doctor	1.00	00h 00m 02s
Prepare for consultation with senior	1.00	00h 01m
Initiate live consultation	1.00	00h 00m 05s
Select AI Services	1.00	00h 00m 30s
Enable AI Visual Assistance	1.00	00h 00m 02s
Connects with AI Visual Aids	1.00	00h 00m 10s
Enable AI Assistance for Speech <-> Text Conversion	1.00	00h 00m 02s
Enable AI Assistance for Speech <-> Text & Visual	1.00	00h 00m 02s
Start AI Powered Consultation	1.00	00h 00m 10s
Join live consultation with doctor	1.00	00h 00m 10s
Join live consultation with senior	1.00	00h 00m 10s
Ends live consultation	1.00	00h 10m
Frequency and probabilities		
Start event	**Frequency**	
Start event	On Mon; overall 10 times	
Gateway	**Decision**	**Probability**
Account Exists ?	No	40.00%
	Yes	60.00%
Need AI visual aids?	No	30.00%
	Yes	70.00%
AI Assistance required?	No	30.00%
	Yes	70.00%
Gateway	Visual Assistance	40.00%
	Both	20.00%
	Speech <-> Text Conversion	40.00%
Resources		
Role	**Work schedules**	**Costs/hour**
Doctor	10 employees; 400 hours per week	75.00
Senior	10 employees; 80 hours per week	10.00
System	1 employees; 8 hours per week	100.00

Figure 6: Process parameters used for Scenario 2 simulation

1. Cycle Time

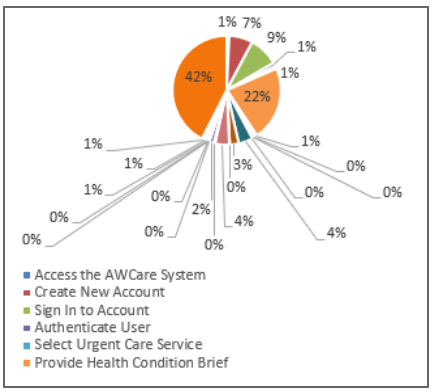
The figure below displays the duration of a process instance, measured from its start to its completion:

Used scenario	Duration in days	Average	Minimum	Maximum	Total cycle time
Scenario 2	1	0h:32m 09s	0h:29m 56s	0h:35m 12s	5h:21m 32s
Scenario 1	1	0h:37m 15s	0h:30m 54s	0h:43m 15s	14h:17m 06s

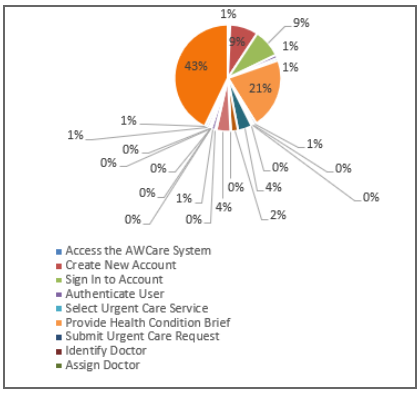
Figure 7: Cycle Time for Scenario 2 & 1

Time charts

Scenario 1:



Scenario 2:



2. Cost

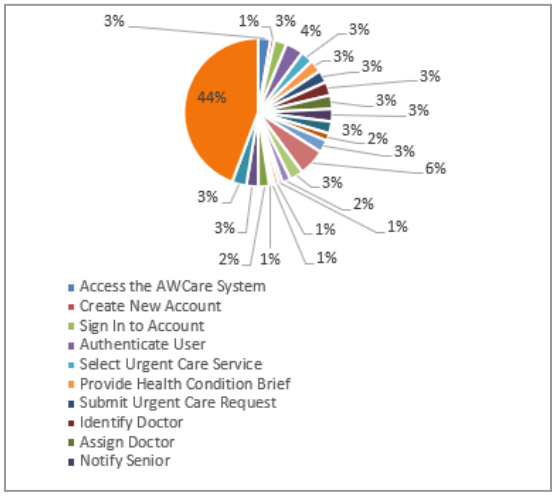
The table below presents the execution costs of a process instance, which include both fixed activity costs and resource costs, along with the total sum of all costs.:

Used scenario	Duration in days	Average	Minimum	Maximum	Total costs
Scenario 2	1	€ 38.10	€ 37.07	€ 40.68	€ 380.97
Scenario 1	1	€ 38.63	€ 37.07	€ 40.68	€ 920.03

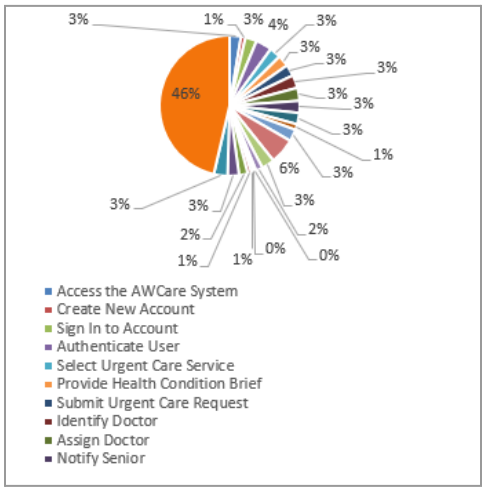
Figure 8: Costs for Scenario 2 & 1

Total cost charts:

Scenario 1:



Scenario 2:



3. Resource Consumption

The table below displays the workload of all resources involved in executing activities in your scenario:

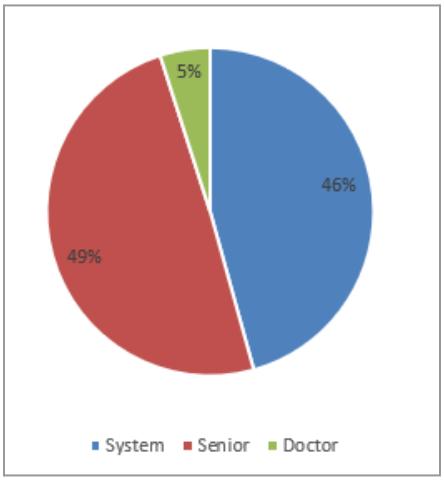
Resources	Used scenario	Duration in days	Consumed time	Workload
System	Scenario 2	1	1h:47m 02s	22.91%
	Scenario 1	1	4h:18m 25s	53.84%
Senior	Scenario 2	1	1h:54m 40s	2.45%
	Scenario 1	1	4h:39m 00s	5.81%
Doctor	Scenario 2	1	0h:11m 40s	0.25%
	Scenario 1	1	0h:28m 00s	0.58%

Figure 9: Resource Consumption for Scenario 2 & 1

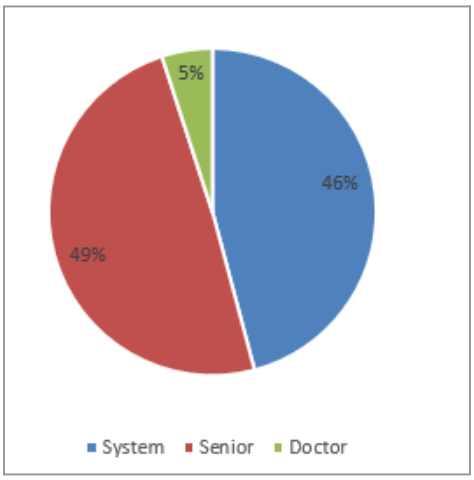
Legend	Legend
All values are relative to the highest value	
Latest run	Previous run
100%	100%
>87.5%	>87.5%
>75%	>75%
>62.5%	>62.5%
>50%	>50%
<=50% or smallest	<=50% or smallest

Resource Consumption Charts:

Scenario 1:



Scenario 2:



4. Bottlenecks

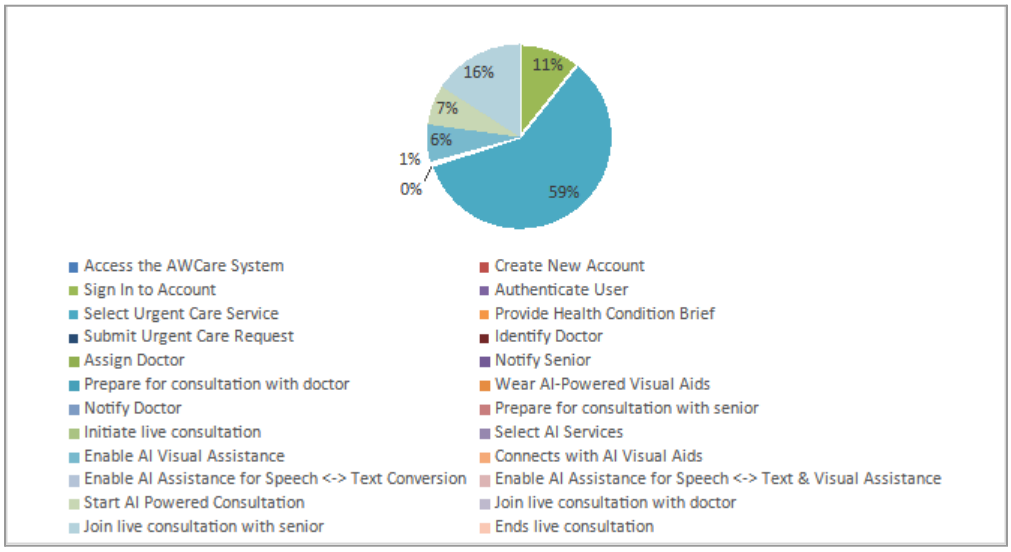
The following table illustrates the activities that experienced delays in a process instance due to resource shortages, occurring when an activity was ready for execution but all resources were already allocated:

Resources	Task	Used scenario	Duration in days	Total waiting time	Instances waiting at termination
System	Notify Senior	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Ends live consultation	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:15m 24s	0
	Identify Doctor	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	1h:25m 30s	1
	Notify Doctor	Scenario 2	1	0h:00m 20s	0
		Scenario 1	1	0h:00m 48s	0
	Enable AI Assistance for Speech <-> Text &	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Start AI Powered Consultation	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Enable AI Visual Assistance	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Connects with AI Visual Aids	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Initiate live consultation	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:09m 18s	0
	Enable AI Assistance for Speech <-> Text	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:00m 00s	0
	Assign Doctor	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:10m 00s	0
	Authenticate User	Scenario 2	1	0h:00m 00s	0
		Scenario 1	1	0h:22m 55s	0

Legend	
All values are relative to the highest value	
Latest run	Previous run
100%	100%
>87.5%	>87.5%
>75%	>75%
>62.5%	>62.5%
>50%	>50%
<=50% or smallest	<=50% or smallest

Figure 10: Bottlenecks in the process simulation

Bottleneck Chart:



7. Conclusion

Studies suggest that (Amjad et al., 2023), AI in healthcare is crucial for enabling doctors to make real-time, data-driven decisions, thereby improving patient experiences and health outcomes. The report on integrating AIACare's technologies in AWCare's healthcare services for the elderly describes an exhaustive change in their current system. By incorporating advanced AI technology tools such as real-time subtitling, text-to-speech services, and visual aids, the As-Is process model aims to address specific challenges faced by seniors, such as hearing loss, speech difficulties, and visual impairments. The report pinpoints potential integration issues, including real-time data handling, scalability, and security, proposing solutions for each. Overall, the redesigned process promises to significantly improve the healthcare experience for elderly users by leveraging AI to meet their unique needs efficiently.

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