

PreciseDose

Interactive Nurse Training & Dosage Simulator

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Introduction to data structure and algorithms
Mathematics for Intelligent Systems 2

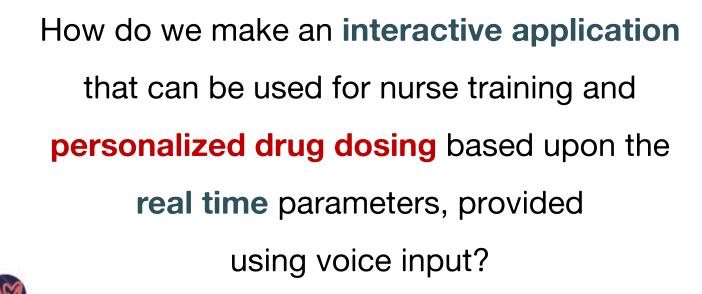
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PRESENTATION LAYOUT

- Problem Statement
- Project Goals
- Progress till first review
- Interface Building
- Dataset generation and modelling
- Flow of simulation
- Future Goals
- Timeline



PROBLEM STATEMENT





- PROJECT GOALS

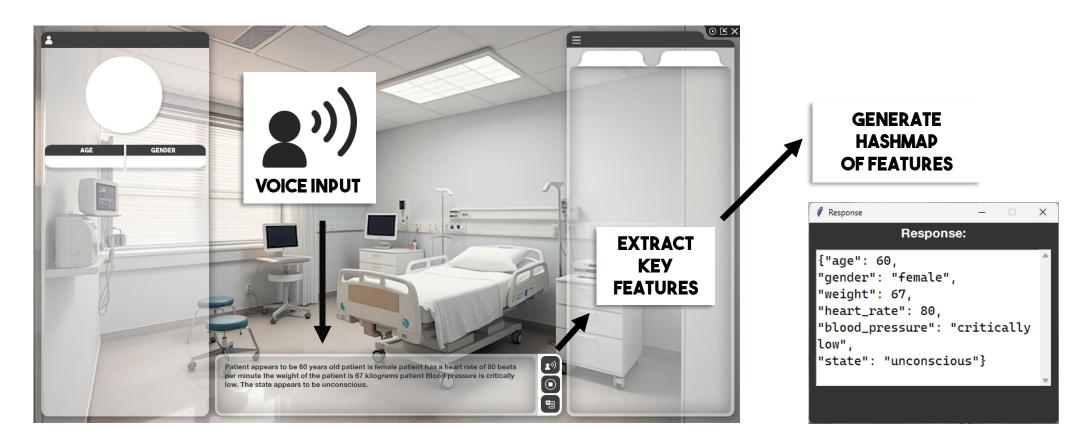
1 To make an interactive user interface than comprises of different cases and their drugs data.

To make the user practice for the drugs used in the taken medical cases.

To provide **external parameters via voice input** incorporated in the interface.

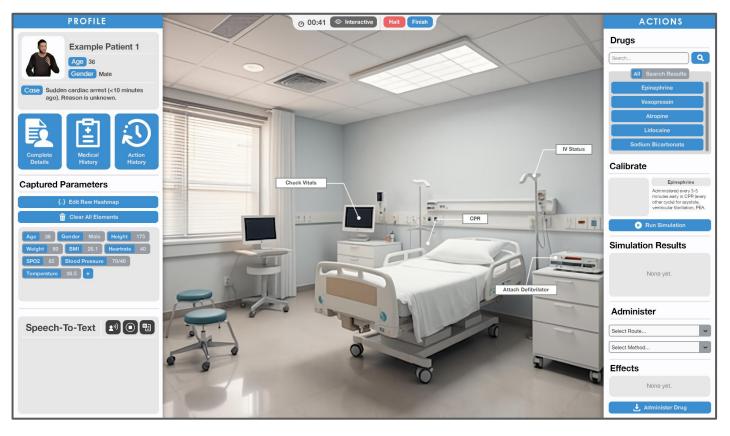
- To calibrate the drug dosage using the external inputs provided and the standard dosages prescribed by CDSCO and provide way of administration.
- Overall, to make a simulation which can help medical practitioners practice the drugs to be administered and provide calibrated drug dosage for their training.

PROGRESS TILL FIRST REVIEW



- We had implemented the **speech-to-text model** that takes voice input from the user.
- The model also parses it through LLAMA 3.2 which returns a HashMap of the key considerations.
 - We made considerable progress in the UI and are were working on it's final design.
 - Interface was partially coded with some interactive elements.

INTERFACE BUILDING



Patient information						
irst name: Last name:						
Date of birth:	te of birth: Gender:					
Section one						
Are you pregnant or tryi	ng to get pregnant?		Yes	No		Not applicable
Are you taking oral cont	raceptives?		Yes	No		Not applicable
Are you taking any medication?			Yes			No
Do you use any tobacco	2		Yes			No
Jo you use any tobacco	r		105			140
Do you use any controlle			Yes	ou have be	nen takir	No na them:
Do you use any controlle			Yes	ou have be	nen takir	
Do you use any controlle	ed substances?		Yes	ou have be	nen takir	
Do you use any controlle	ed substances? It types of substances you take, I		Yes	ou have be	een takir	
Do you use any controlli I yes, please explain what Do you have any allergie I yes, please explain what	ed substances? It types of substances you take, I	how often, a	Yes and how long yo Yes	ou have be	een takir	ng them:
Do you use any controlli If yes, please explain what Do you have any altergite If yes, please explain what Section two	ad substances? Types of substances you take, 197 197 190 190 190 190 190 190	how often, a	Yes and how long yo Yes	ou have be	een takir	ng them:
Do you use any controlling tyes, please explain what you have any allergie tyes, please explain what yes, please explain what have you have, or have yo boy ou have, or have yo boy ou have, or have yo	and substances? I types of substances you take, I type of substances you take, I type of type of the following?	how often, a	Yes Yes Yes Yes			ng them:
Do you use any controlli If yes, please explain what Do you have any altergite If yes, please explain what Section two	ad substances? Types of substances you take, 197 197 190 190 190 190 190 190	how often, a	Yes and how long yo Yes		Psychia	ng them:



- We have done a complete re-design of the UI since the first review to improve versatility.
- Interface is fully coded. We have used a variety of data structures: Graphs, Arrays, Linked Lists and HashMaps
 - Most of the elements are functional and interactable as of now.
 - We have also interfaced MatLab through Python together to perform the dosage simulations.

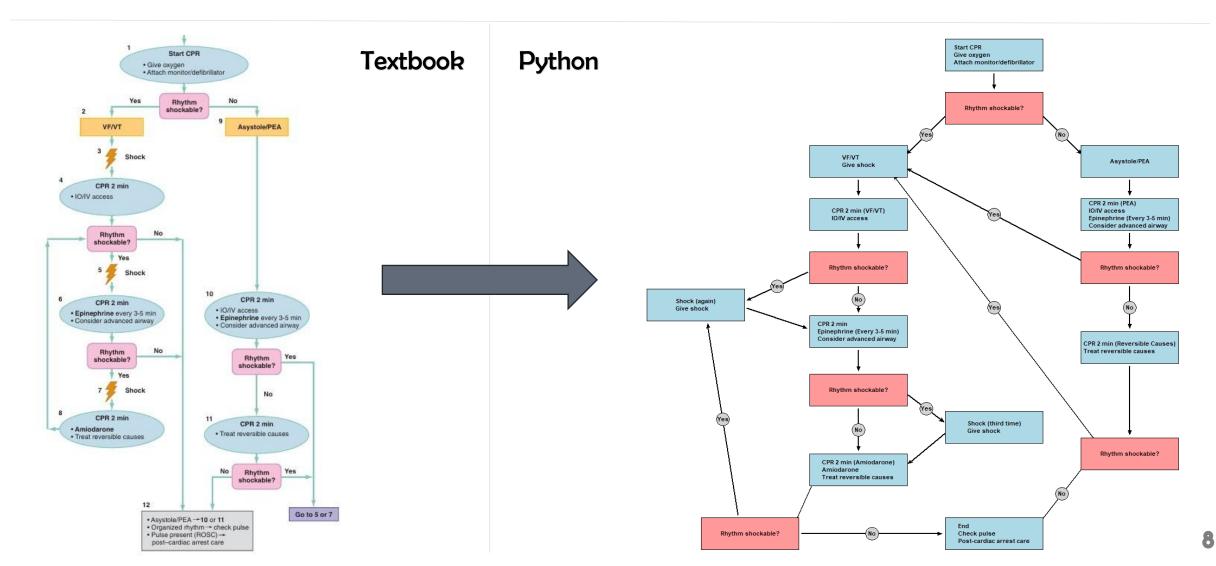
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DATA STRUCTURES USED

Data Structure	Purpose
Graphs	 Used to store the operational procedure that is expected from the user. This includes all the possibilities from start to end of the simulation, therefore requiring heavy branching and looping.
Linked List	 Used to store the decisions that are made by user during simulation. Faster indexing times and they grow in size more naturally than dynamic arrays.
HashMaps	 Used to store Key:Value pairs. E.g: Patient details, drug parameters, settings, etc. Dictionaries are Python's native implementation of HashMaps.
Fixed-Length Arrays	 Used to store non-modifiable and ordered sequence of data For example, the list of drugs and administration methods that are available in the software is always constant and stored and displayed as an ordered list

FLOW OF SIMULATION

- We used a custom Graph object to replicate the workflow of resuscitation in Python.
- The user inputs will be compared to this graph and the simulation will stop when the user deviates or makes a mistake.



DATASET GENERATION & MODELLING

- Synthetic data has been generated for modeling.
- Parameters taken: Blood pressure, SpO2, weight, height, BMI, temperature, gender, age.

```
precisedose_dataset.mlx * X | nnsem2_project.mlx X | drugdose.mlx X | untitled.mlx X | +
Name -
                Value
samp_age
                1000x1 double
                                                 % generate the synthetic dataset for Precise dose.
samp_bloodp... 1000x1 double
                                                 % parameters taken : blood pressure, SpO2, weight, height, bmi,
samp bloodp... 1000x1 double
                                                 % temperature, gender, age.
samp bmi
                1000x1 double
samp_dataset 1000x9 double
                                                 samp temp= randi([97,105],1000,1); % in Farehnheits
samp_drugdo... 1000x1 double
                                                 samp age=randi([1,12],1000,1); % in years
samp_gender
               1000x1 double
                                                 samp_Sp02=randi([88,100],1000,1); % in percentage
samp_height
                1000x1 double
                                                 samp_height= randi([60,158],1000,1); % in centimeters
samp_height_...
               1000x1 double
                                                 samp_weight= randi([5,54],1000,1); % in kilograms
samp_SpO2
                1000x1 double
                                                 samp height meters= samp height./100; % in meters
samp_temp
                1000x1 double
                                      11
                                                 samp bmi= samp weight./((samp height meters).^2);
               1000x1 double
samp_weight
                                      12
                                                 samp_gender= randi([0,1],1000,1); % 0 for males, 1 for females
                                      13
                                                 samp bloodpressure systolic=randi([90,140],1000,1); % in mmHg
                                      14
                                                 samp bloodpressure diastolic=randi([60,90],1000,1); % in mmHg
                                      15
                                                 % sample drug dose based upon the prevailing parameters
                                      16
                                                 samp drugdosage=randi([10,25],1000,1); % in mL
                                      17
                                                 samp dataset=[samp gender, samp age, samp bloodpressure diastolic, samp bloodpressure systolic, samp weight, samp height, samp bmi, samp temp,samp Sp02];
```

- Using polynomial curve fitting, to find the relation between drug dosage and all the other parameters.
- Currently, we have included a simple dosing calculator in the interface.

FUTURE GOALS

- ☐ Finding the relation between the parameters using polynomial curve fitting.
- □ Based upon that equation, to model the drug dosage calibration model using MatLab and Simbiology.
- ☐ To integrated the interface and the model.
- ☐ To expand the project to more cases and be more thorough about cases.
- ☐ To improve versatility of the interface by adding more interactive elements that affect the simulation.

PROPOSED TIMELINE

