Software Engineering Senior Design 2 Plan

Project Title:

SmartStride

Software Team Members:

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Client & Affiliation:

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Client Meeting Times:

Tuesdays and Thursdays 11am-12pm and Fridays 12pm-1pm

Goal & Motivation:

The goal of SmartStride is to create a device that helps with the categorization of a patient's severeness of Idiopathic Toe Walking and help with the rehabilitation process of patients. The software of the project consists of a database and website that acts as a portal to help facilitate the monitoring of patients from home during their rehabilitation process. The database will hold the information collected from the device to display key information about the patients progress through the website. The website will allow both patients and doctors to view a patient's progress and allow for routine check-ins to be done at home.

Approach:

The website will allow patients and doctors to view the progress of patients through their rehabilitation as well as act as a replacement for routine check-ins. Most of the people affected by Idiopathic Toe Walking are young children who have been diagnosed with autism. Allowing the check-ins to be completed at home allows for the child's routine not to be disrupted by going into a doctor's office, which can be a chaotic environment for someone diagnosed with autism. This stress could lead the child to act in different ways than they would normally at home, possibly affecting the results of the patient.

The database is a secure way to collect the patient's data so it can be used to help categorize the severity of a patient's ITW as well as a patient's progress in their rehabilitation. The website also offers a limited communication system for the doctors to write down goals for the patients to work on over a set amount of time. The patients are able to view these goals as well as some understandable results of their rehab process.

Algorithms and Tools:

For this project I will be using Amazon Web Services. More specifically I will be using Amplify to host the website, RDS to host the database, API Gateway to connect Lambda functions to the website, Lambda to carryout actions such as pulling or pushing data from the database, S3 Bucket to collect CSV files from the Raspberry Pi to be sorted and organized into the database, CloudWatch Logs to view all uses and output from Lambda, VCP connections to allow access to the website and database, IAM Roles to assign the VCP access roles, and MySQL Workbench to directly access and view the database. I will also be using Visual Studio Code to program JavaScript, CSS, and HTML files. I will be using two packages that have been uploaded to the AWS Lambda Library consisting of MySQL 2 allowing me to use SQL commands within the Lambda functions as well as BcryptJS package that allows me to encrypt sensitive user data such as patients and doctors account passwords.
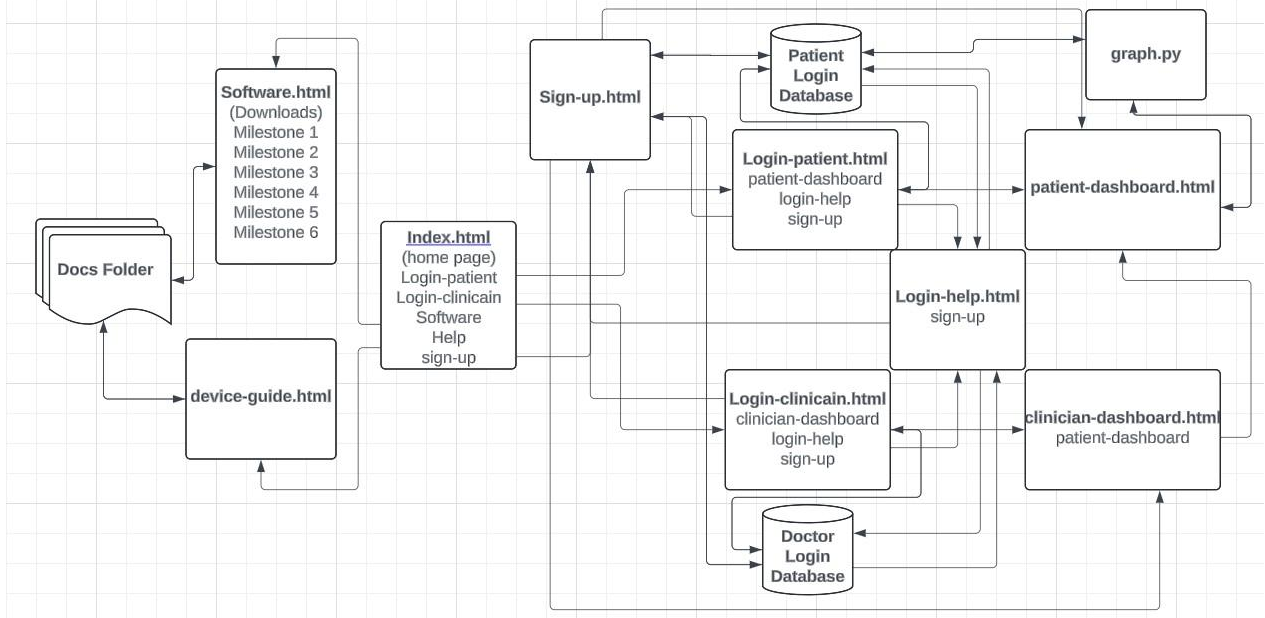
Novel Features:

The novelty of this project comes from patients being allowed to complete rehabilitation check-ins from home. Before this project, patients had to go into a doctor's office and be diagnosed by a doctor viewing a patient's walking. Now with the SmartStride device and website we offer a more quantitative way of diagnosing, categorizing the severeness of their ITW, and an at home rehabilitation check-ins. The website offers a way for patients and doctors to communicate and see results of a patient's physical therapy sessions that can happen at home or in an office giving the patients more flexibility in their everyday life.

Technical Challenges:

Some challenges for this semester include creating a connection between the Raspberry Pi and the AWS website and database. I have never used a Raspberry Pi before so familiarizing myself with the Pi will be challenging but I am confident that it can be done, and I can learn quickly how to use a Pi. Another challenge for this semester is going to be how to organize the data given from the device into the database. The BME team oversees organizing the CSV files and how they are given to the website, but they are still unclear on how they want the data to be presented and what data they would like to present. The challenge will be maintaining a well-organized database while they figure out what data they would like to send. Part of this challenge relies on the machine learning aspect they are trying to complete during this semester.
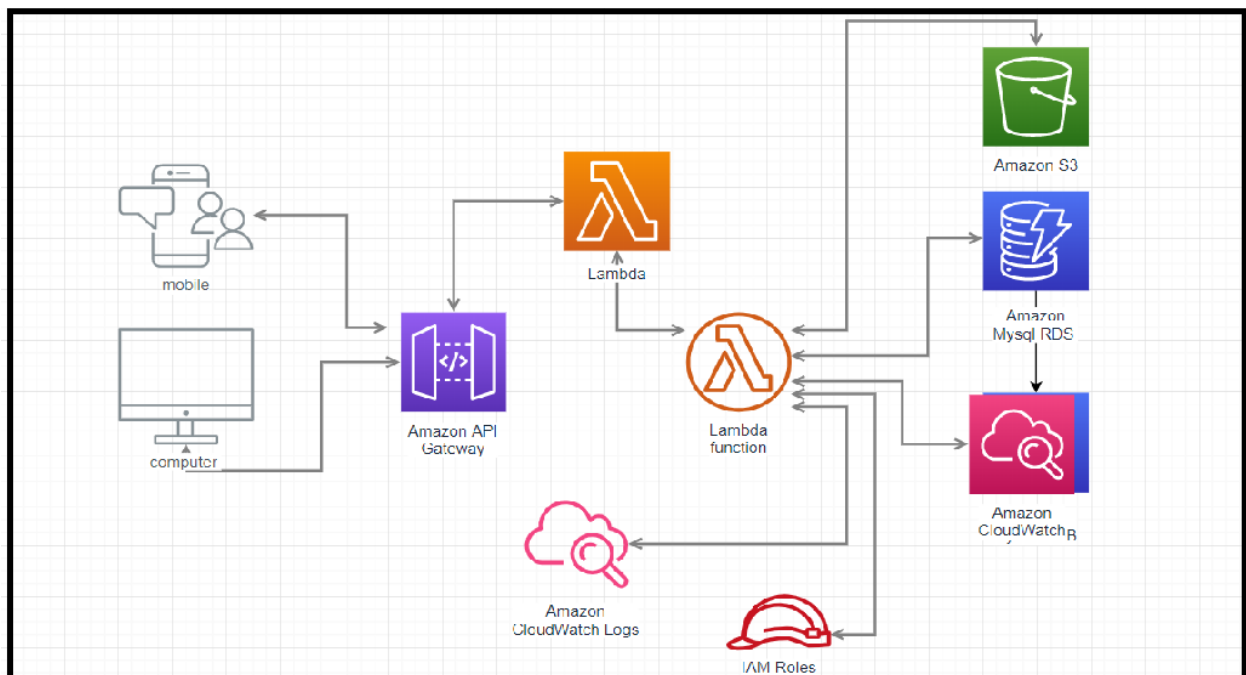
Design:

Basic Website Structure

Structure of S3 Bucket, RDS, CloudWatch, IAM Roles, Lambda, and API Gateway interactions

*Computer and mobile represent the Amplify website being used on mobile or computer

Evaluation:

To evaluate the success of the SmartStride website an evaluation of usability, reliability and accuracy would be the best measurements of success. To measure usability new users would be asked to navigate the website starting from the home page or to complete a task starting from the home page. The amount of time it takes a new user to complete a task as well as a user given rating will be used to evaluate the success of usability. To measure the reliability of the website we would create multiple sample tests to login and upload data and see how many times the action is completed successfully compared to how many times the action was tried. After the reliability test is completed, we can compare the actual results to the sample data to ensure that the data was accurately uploaded into the database under the corresponding individual. We can then compare the results of the correctly inputted data to all the input data to create a measure of accuracy when uploading data into the system.

Progress Summary:

Task	Progress	To Do
Create Database Structure	100%	N/A
Create Lambda for Login	100%	N/A
Create Lambda for Sign Up	100%	N/A
Create Lambda for Password Help	100%	N/A
Create Website Structure	100%	N/A
Create Patient Login	100%	N/A
Create Doctor Login	100%	N/A
Create Forgot User Login Help	100%	N/A
Create Sign Up Page	100%	N/A
Create Website Structure	100%	N/A
Connect the logins to individual patient and practitioner pages	100%	N/A
Add patient button to practitioner page	100%	N/A
Add patient page	100%	N/A
Add patient functions	100%	N/A
Use "Dummy" data to be displayed to patient and practitioner	100%	N/A
Setup AWS's IoT or S3	20%	Research and set up IoT or S3 to connect to amplify
Connect Raspberry Pi to lambda function	30%	Research and download AWS packages on pi
Create a new webpage for drag and drop	0%	Create the webpage and design GUI

Create drag and drop functionalities	0%	Create the lambdas to process the data and upload it to the patient's session data table in RDS database
Connect device to website	35%	Work with Bela to make the ESP 32 connect to the pi to collect data to be sent to the website

Milestone 4 (Feb 24) / Description:

Implement, Test and Demo…

   S3 Bucket:

     Need to set up the S3 Bucket within AWS and make the proper IAM roles and VCP connections to allow the S3 to send data to the lambda functions to upload into the database. Demo will be showing a collection of data uploaded from the S3 Bucket into the database.

   Raspberry Pi to AWS S3 Bucket Connection:

     Need to create a connection from the Raspberry Pi to the S3 Bucket within AWS. Research has shown that I will need to install an AWS Services package onto the Pi in order to make the connection.

   New Webpage for Drag and Drop Feature:

     Will need to create a new HTML file to create the webpage. Need to decide best ways to navigate into the webpage. Once the file is chosen to be uploaded it will need to be sent to the lambda function.

   Drag and Drop Functionalities:

     This will consist of the API and Lambda functions associated with the Drag and Drop page. Will allow the user to accurately upload data from a CSV file into the database

   Connect Device to website:

     Finally establishing a full connection from the SmartStride device to the Raspberry Pi then to the S3 Bucket to its final destination of the database. These will be all parts of the project coming together and working in union to provide the first version of the final project.

Milestone 5 (March 26):

Implement, Test and Demo…

Update Database Structure:

The current structure of the database is outdated, and changes have been made to how the data is collected on the hardware side causing the tables to be changed. Future discussions with my group will provide the details of these changes as they have not finalized how the data will be delivered to the Pi and website.

Update the Graphs displayed to both patients and doctors:

Since the data is changing on the hardware side the graphs displayed to the patient and doctors will need to be changed as well. So far, the changes include renaming of current graphs to be more user friendly and the addition of a pie chart showing the percentage of normal, mild, severe ITW steps taken in a current month of testing.

New page for past results:

A new webpage containing all the past pie chart results separated by months of testing will be created for both patients and doctors to view. More information may be included in the month-by-month display. More discussion is needed to gather the details of the information included on the page.

Milestone 6 (April 26):

Implement, Test and Demo…

Updating User Guide:

The user guide for the device will be updated in the user device guide page so all users will be able to properly use the device. It will also be updated with the user guide to the website for both patients and practitioners.

Updating the About Us Page:

The About Us Page will be updated to include more information about the BME and SE team that created the device and website as well as some background information on why the SmartStride device was created.

Testing and demoing the entire system will be completed during Milestone 6

Conduct Evaluation of usability, reliability, and accuracy of the system will be completed.

Creation of a User Manual for patients and practitioners.

Creation of a demo video.

1. Approval from Faculty Advisor

    o "I have discussed with the team and approve this project plan. I will evaluate the progress and assign a grade for each of the three milestones."

    o Signature: _____ Date: _____