Milestone 3

SmartStride

By Cianna Grummer

Milestone 3

Task	Progress	To Do
Connect Logins to profiles	100%	N/A
Add/ Remove Patient Page	100%	N/A
Add/ Remove Patient Functionalities	100%	N/A
Add/ Remove Patient button to Clinician pages	100%	N/A
Use “dummy” data to display information to patients and doctors	100%	N/A

Connecting Logins to Profiles

- When a user logs into account user info is pulled
  - *Treatment goals*
  - *Name*
  - *Doctor information*
  - *Last PT session data*
  - *Patient list*
- Treatment goals table created in database
  - *Only doctors can edit list of goals*
  - *Only patients can have goals*

Clinician vs Patient View

- When doctor views a selected patient's dashboard:
  - *Treatment goals are editable*
  - *"Back to clinician dashboard" button is visible*
  - *EMG analysis visible*
  - *Foot angle analysis visible*
  - *Gait analysis with step classification visible*
- Hidden when a patient logs into their profile

Removing a Patient

- Clinician's patient list now has three dots next to each patient
  - *When clicked a dropdown menu appears with a "remove patient" button*
  - *Confirmation prompt appears when clicked*
  - *If yes patient is removed from doctor's patient list in both website and database*
    - Patient's doctor is also set to null following this action

Adding a Patient

- Clinician's dashboard has an "Add Patient" input field and button
- Enter patient username and click "Add Patient" button
- System checks if patient has a doctor already and is available to assign a new doctor
  - *Must be null*
- If available, patient is added to doctor's patient list and the doctor is assigned to selected patient

Displaying Data Functionality

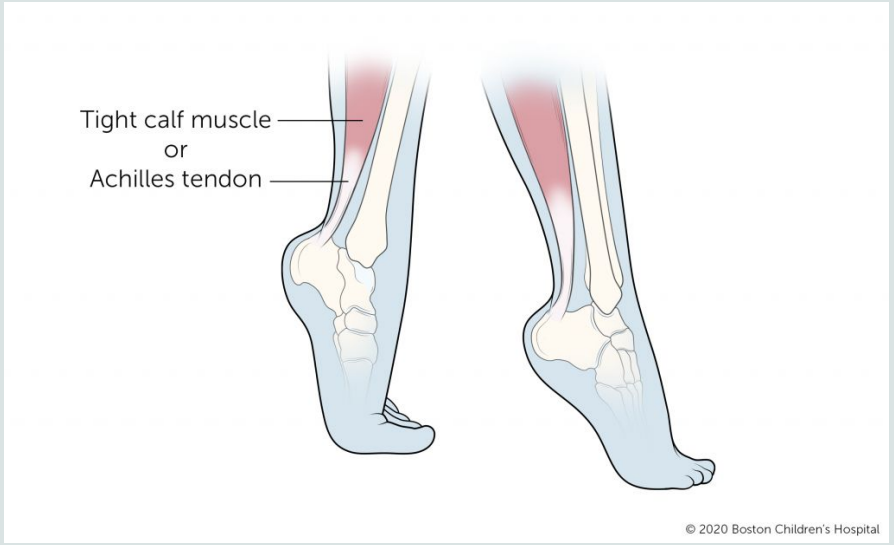
- New table in database patient_session_data
- Holds patient ID, Session ID, Timestamp, Accelerometer 1xyz and 2xyz, Gyroscope 1xyz and 2xyz, and EMG 1, 2, and 3 data
- When a patient or clinician opens patient dashboard a loading wheel appears
  - *Lambda checks the table for patient's data*
  - *Uses every 10th row to create a graph*
    - Over 64,000 rows of data from one session
    - Working with BME team to find the best amount of data that should be collected

Team Feedback

- Display the names instead of usernames
- The format of the patient data collected by the device may change from CSV files to graphs or something else
- Alec is working on creating the graphs to be displayed on the website
  - *ML for step identification process is complete*
- Add gait information, foot angle analysis, and EMG analysis to the website in the patient dashboard
- Add a goals and instructions section of the patient dashboard to facilitate at-home therapy

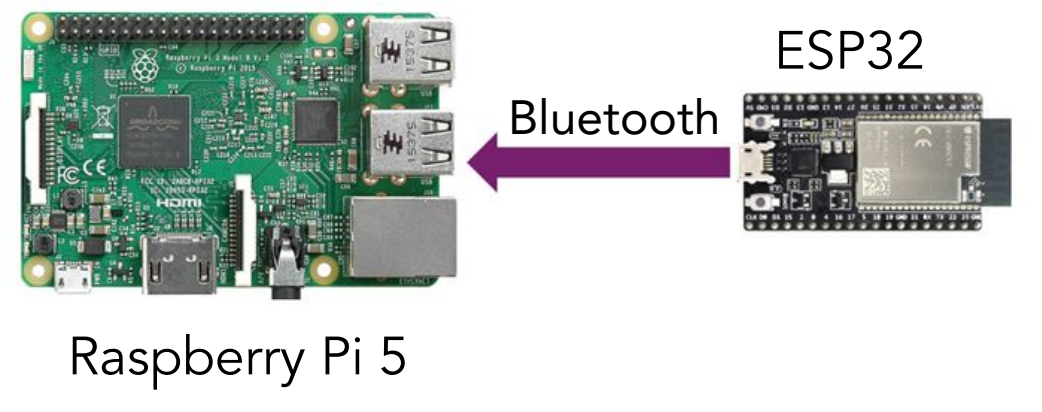
ITW and its Complicating Factors

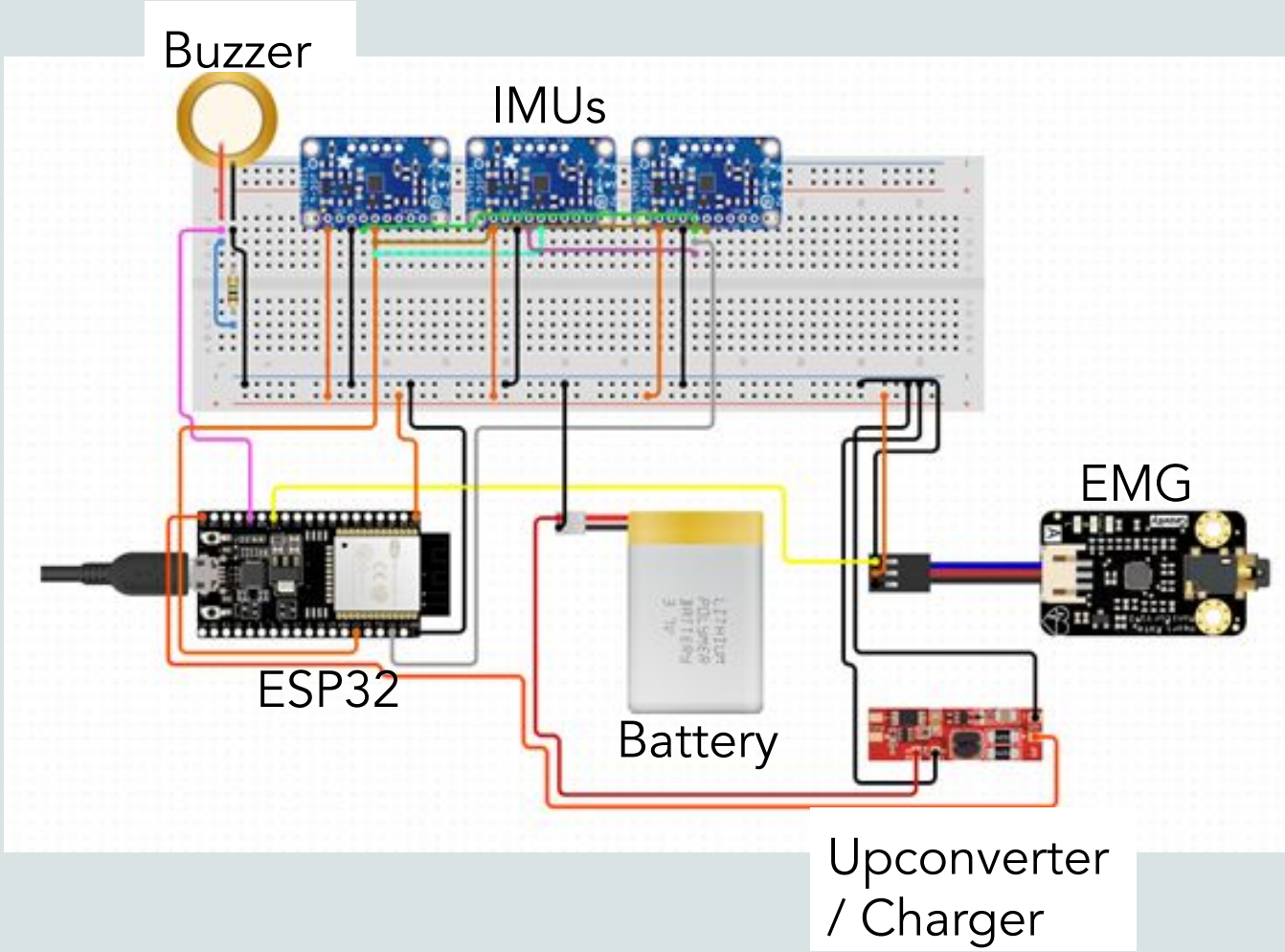
- ITW or Idiopathic Toe Walking is a condition that causes one to walk on their toes.
- In most cases kids outgrow it by 5 but it lingers in patients with other disorders
- It requires intensive physical therapy and multiple follow ups in order to be monitored
- Typical treatments include hard cast braces, specialized shoes, and individualized physical therapy
- Long term it can cause muscle to stop growing and permanent tendon damage only corrected by surgery



From Device to the Raspberry Pi

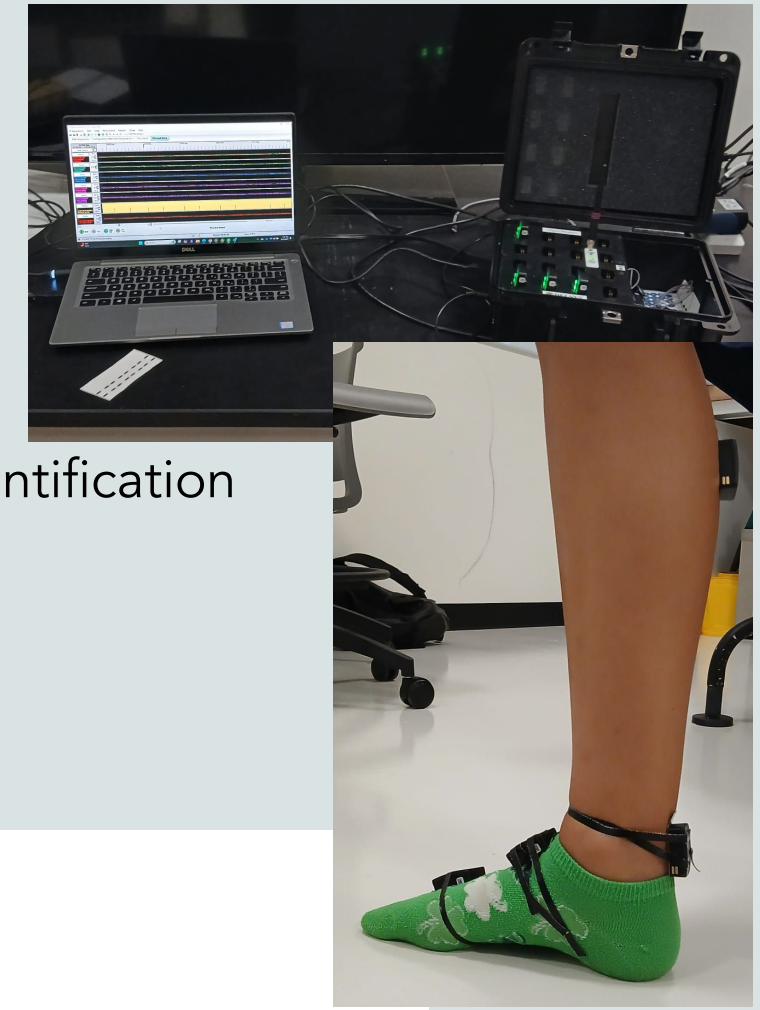
- Sensors:
  - *3 IMUs (Inertial Measurement Unit)*
  - *1 Myoware Module 2.0 (*
    - *EMG - Electromyography)*
  - *Haptic Feedback Buzzer*

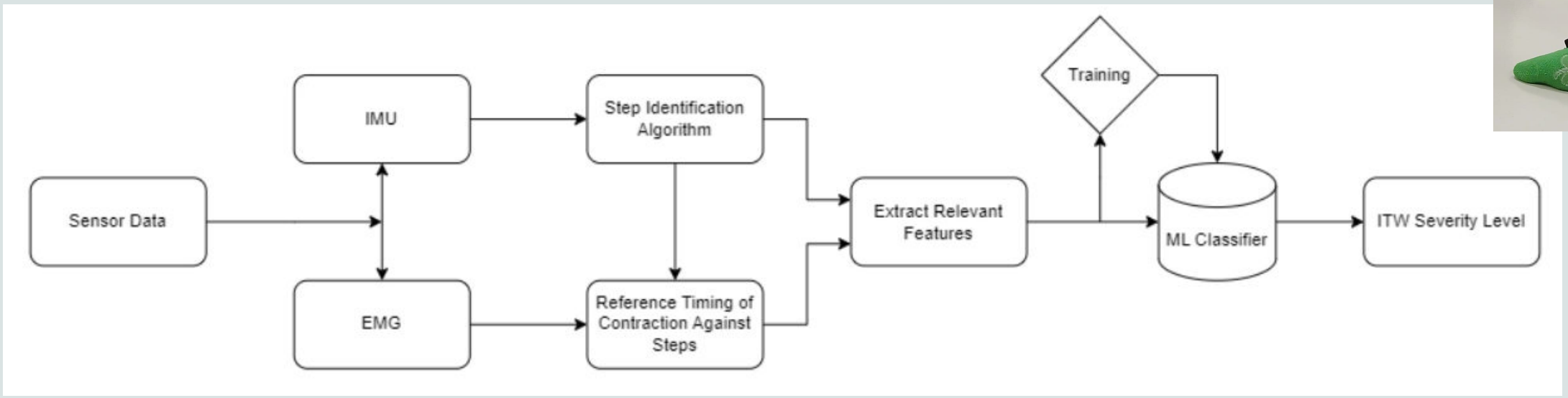




Machine Learning

- EMG+IMU training data collected for multiple subjects
- Generated step library for template-matching based step identification
- Step detection implemented into Raspberry Pi for testing
- ITW Classification implemented into Raspberry Pi for testing



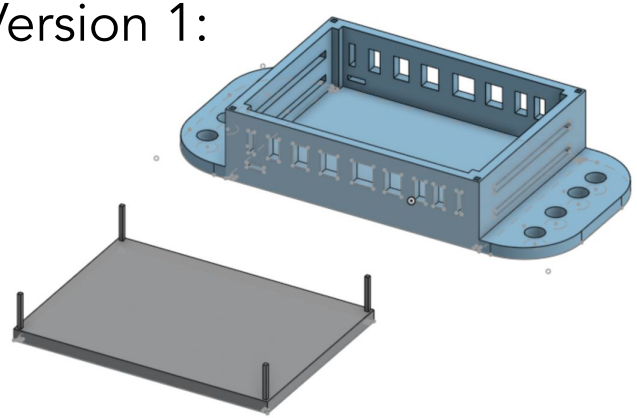


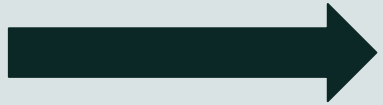
BME Semester Update Continued

3D Models:

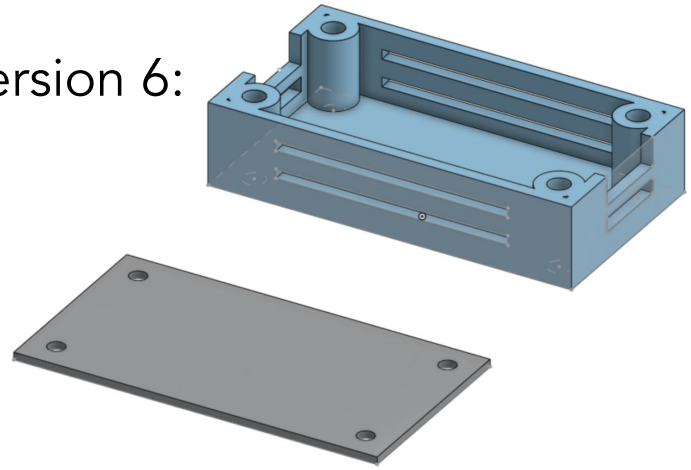
- Created through onshape software.
- Have moved through several different versions of sensor case models.
- Created these cases to be able to attach the different sensor electronics to the compression sock.

Version 1:





Version 6:



IMU Cases

Milestone 4

Task	Progress	To Do
Setup AWS's IoT or S3	10%	Research and set up IoT or S3 to connect to amplify
Connect Raspberry Pi to lambda function	0%	Research and download AWS packages on pi
Create a new webpage for drag and drop	30%	Create the webpage and design GUI
Create drag and drop functionalities	0%	Create the lambda's to process the data and upload it to the patient's session data table in RDS database
Connect device to website	5%	Work with Bela to make the ESP 32 connect to the pi to collect data to be sent to the website

Raspberry Pi

- Collects data from device
- Set up AWS IoT packages on Raspberry Pi
  - *IoT and S3 allows devices to connect to AWS services like RDS or Lambda*
  - *Will connect to a lambda function to process CSV files*
    - Must add patient's username and session ID to each row
  - *Inputs CSV file's data to patient_session_data table*
    - Use this data to create graphs on patient dashboard

Raspberry Pi IoT Connection Workflow

- Raspberry Pi collects data from device as CSV file
- Pi then publishes CSV processed rows to AWS IoT Core as MQTT messages
- IoT Core receives messages and processes them with the IoT Rule Engine
- Lambda then parses and cleans data and uploads it to the RDS database

•*Can upload data to an S3 Bucket as well*

Raspberry Pi S3 Connection Workflow

- Raspberry Pi Uploads CSV file to an S3 Bucket using AWS SDK
  - *AWS SDK will have to be downloaded on Pi*
- Triggers S3 Event Notification when file is uploaded
  - *Event invokes AWS Lambda function*
- Lambda will parse and clean the CSV file
- Data will then be uploaded to the RDS database

S3 Connection vs IoT connection

- IoT Core is good for…
  - Continuous connection
  - Small data uploads
  - Supporting many devices
- Cons of IoT…
  - Message size limit of 128kb
  - Needs continuous connection to work effectively

- S3 Buckets are good for…
  - *Better support for large data uploads up to 5Tb*
  - *Can handle thousands of file uploads at once*
  - *Cost effective*
    - Only pay for what you upload
- Cons of S3 Buckets…
  - *Can create latency*
  - *Cannot handle continuous data streaming*
  - *Managing IAM roles can be cumbersome*

Drag and Drop Upload

- Backup method to collect data from patients
- Should take a CSV file and process the data
  - *Add patient ID and session ID to every row*
- In case the raspberry pi does not work, or patients have collected data already they can upload said data
- Create new page that is accessed through patient dashboard
  - *"Add new data" button*

Questions?