ProWalker

AIAP Technologies Pte Ltd

Contents

Motivation

ProWalker

- **Prosthetic rehabilitation is a complex task that ideally requires input from a transdisciplinary rehabilitation team.**
  (not tailored, costly, inconvenient, poorly tracked)

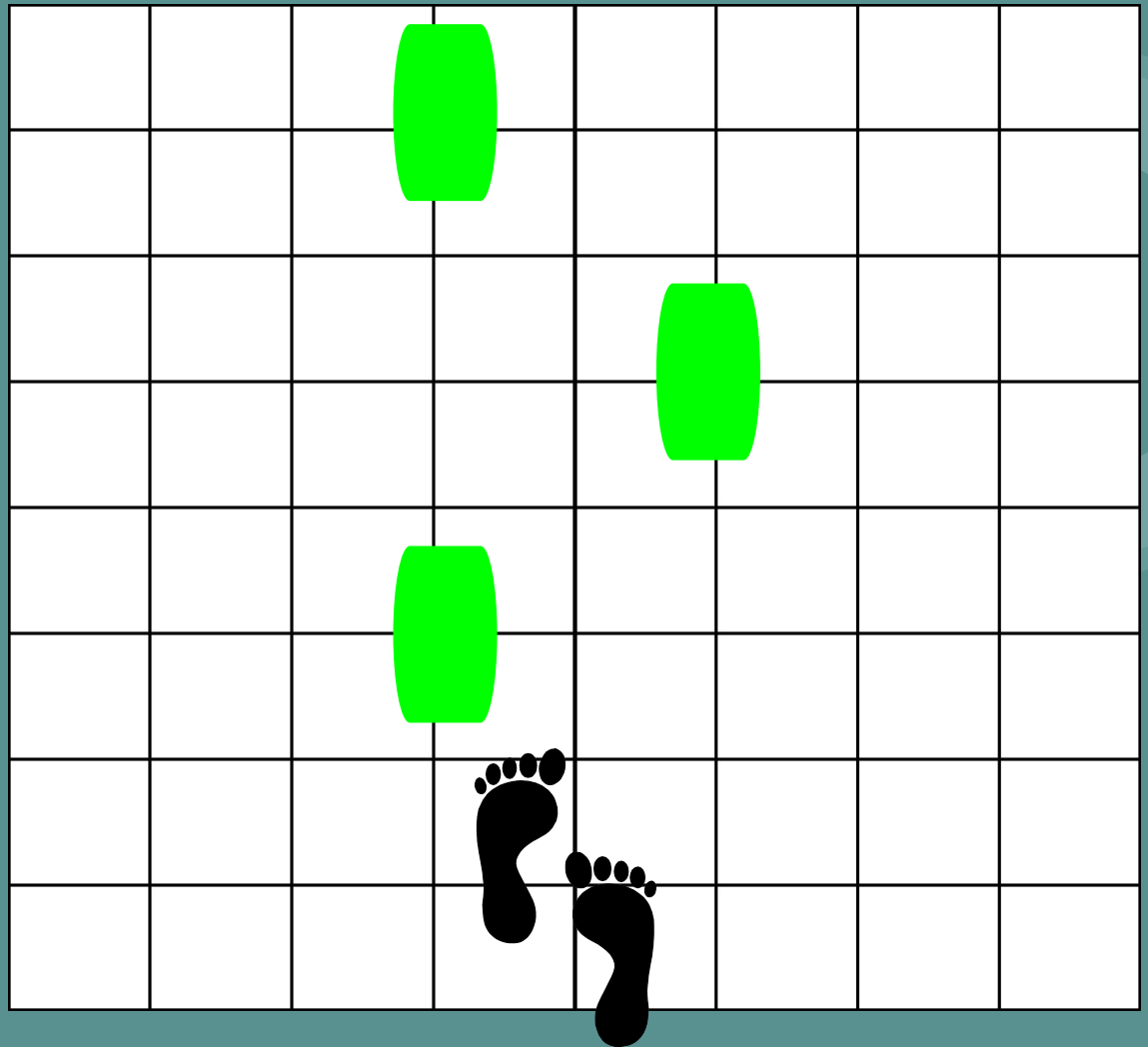
- **And that's why we want to simplify the process.**

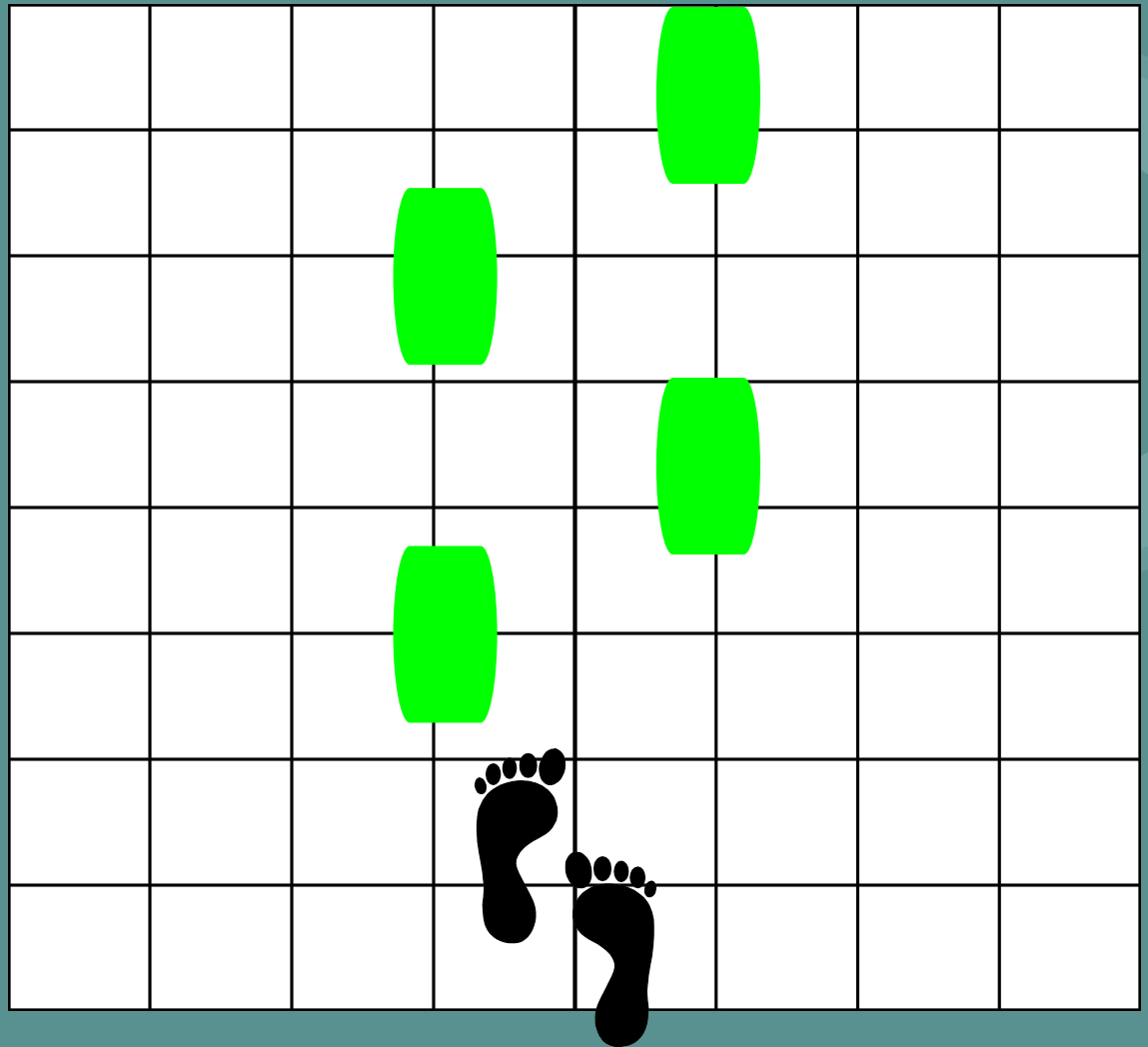
ProWalker

We’ll create a AI physiotherapy with the help of AR and machine learning.

System (limbs, rails and AR+speech)
AR provides visual aid to Anne where to land her feet. Speech will guide Anne when to take the next step and correct her mistake. The rails will determine the distance and position of Anne. There are 5 sensors attached on the prosthetic limb which will capture the data required for us to calibrate the prosthetic limb according to Anne’s behavior.


Next Step





Hardware

- Gridded Mat + IR camera
- AR goggles
- Prosthetic limb with 5 sensors (accelerometer and gyroscope)
- Smartphone

Software

- Application to connect hardware to computer
- Cloud database
- Mobile App

Marketability

ProWalker

Market Size

185,000 new lower extremity amputations each year in US.

60 min Physiotherapy Session = US$150

3 sessions per week for average of 10 weeks = $4,500

Market size of US$832m / year

Median Salary of Physiotherapist = US$85,000

ProWalker Estimated Cost

AR Device	$400
IR Camera	$500
Prosthetic Sensors	$100
Total	**$1,000**

Amputee Rehabilitation

1. Pre Operative
2. Surgery/ Reconstruction
3. Acute post-surgical
4. Pre prosthetic
5. Prosthetic Prescription
6. Prosthetic Training
7. Community Integration
8. Vocational Rehabilitation
9. Follow up

Only these two phases will be converted to AI

AI to assess the rehabilitation progress

Shorter Treatment duration

Personalized Rehabilitation

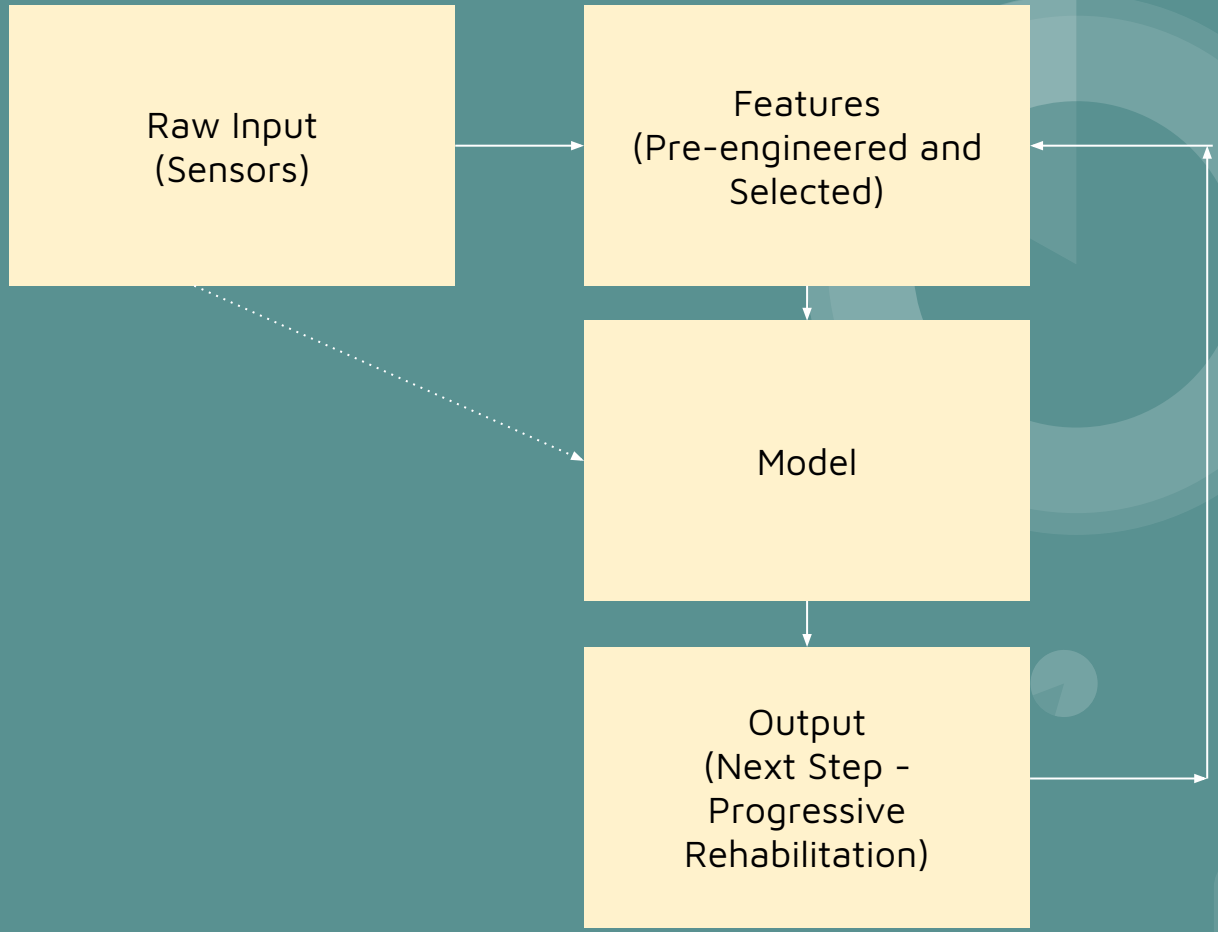
Increased Strength and Dexterity

*Use of Technology in Occupational Therapy Rehabilitation. Julia Naumes (2013)

Treatment reduced to 6 weeks

*Intelligent Physiotherapy Through Procedural Content Generation
Shabnam Sadeghi Esfahlani and Tommy Thompson

Augmented Reality Multimodal feedback System


Raw Input
(Sensors)
Features
(Pre-engineered and
Selected)
Model
Output
(Next Step -
Progressive
Rehabilitation)

Models

Preliminary

Multinomial Linear Regression
Gradient Descent

**small amount of data, short training time, fast response*

Advance

Artificial Neural Networks and Deep Learning
Reinforcement Learning

*better predictive outputs for tailored learning, requires more data and training time

Var	Description	Device	Sensors / Components
Height	User characteristics		
Weight	User characteristics		
Ax	Linear acceleration of leg in the x-direction at point i	Prosthetic Limb Sensors	Accelerometer
Ay	Linear acceleration of leg in the y-direction at point i		
Az	Linear acceleration of leg in the z-direction at point i		
Gx	Orientation of leg in the x-direction at point i		Gyrometer
Gy	Orientation of leg in the y-direction at point i		
Gz	Orientation of leg in the z-direction at point i		
Actual_x	Mean placement of foot in x-direction	IR Camera	Camera
Actual _y	Mean placement of foot in y-direction		
Actual_deg	Mean angle of foot		
t_step	Time taken for one step to be made	Mobile	Time
t_session	Time spent on one session		
Pain_level	Input of pain by user		Mic
Next_x	Mean placement of next step in x-direction	AR Device	Display
Next_y	Mean placement of next step in y-direction		
Next_z	Mean placement of next step in z-direction		

Metric of Success:

Engineering

Time take for each step

Accuracy of step

Pain level

Session-to-session progression

Business

Cost (Prosthetic limbs, rails and AR software)

Quality and Satisfaction (Popularity, review and complaints)

Augment or remove the role of physiotherapist, in an immersive AR environment, using a smartphone that functions the same as the physiotherapist. Reduce the time it takes to help Anne adapt to her prosthetic limb.