NAU
NORTHERN ARIZONA UNIVERSITY
College of Engineering, Informatics, and Applied Sciences

Open-Source 3D Printed Foot Prosthesis

Dr. Sarah Oman
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Abdulwahab Zaidan (Team Manager)
Ali Abdullah (Secretary / Document Manager)
Salman Malallah (Website Developer)
Omar Alajmi (Budget Liaison)

Overview

- Introduction.
- Project description.
- Customer/Engineering Requirements.
- Design Changes.
- Final Design
- Manufacturing Process.
- Testing.
- Total cost.

Introduction

1. People who have below-knee amputee are suffering from the prices inflation of prosthetic leg.
2. Jenn Whealy, volunteered to help our team in this project.

   a. She has below-knee amputee.

   b. Spent $15k on her prosthetic leg.

- Stakeholders:

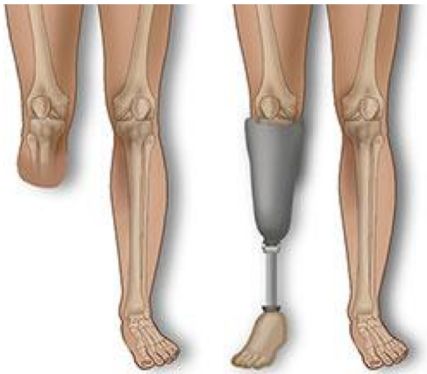
  a. E-nable company.

  b. People who has below- knee amputees

- Sponsors:

  a. Northern Arizona University. [2]

  b. [3]



[1]

Project Description

- Affordable and available passive 3D printed mechanical prosthesis for below-knee amputee.
- Hold up adult person .
- Must not be heavy.
- Materials are readily available to the general public.

Customer Requirements

- Below-Knee
- Portable
- Lightweight
- Robust
- Comfortable when wearing
- Height adjustable
- Inexpensive
- 3D printed parts
- Limited filament material
- Safety

Engineering Requirements

- Open-source
- Weight of the device < 8lbs
- Must hold up to 215 lbs
- Filament material: ABS, PLA, PET, HIPS
- Cost lower than $1500
- Fits different height of people 5’-0” to 6’-5”
- Reliability 99%

Ali Abdullah

Design Changes - Design 1

- Heavy
- Not Accurate
- Customized
- Can’t hold up to 215 lbs.

Figure 1: Assembly in CAD

Design Changes - Design 2

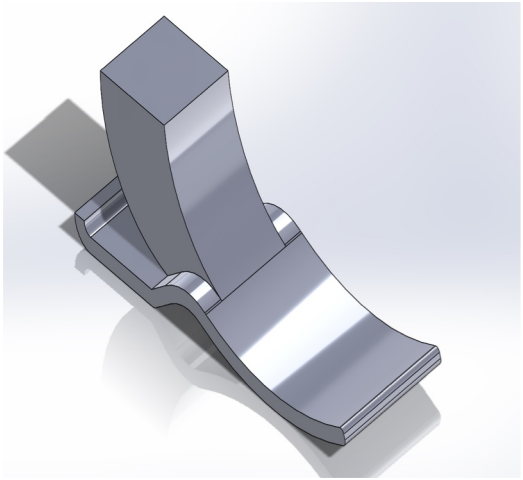


Figure 2: Foot in Design 2

Figure 3: PVC Pipe

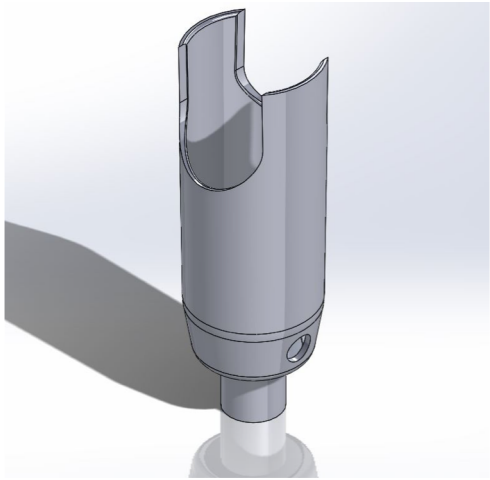


Figure 4: Supporting Channel in Design 2

Design Changes - Design 3

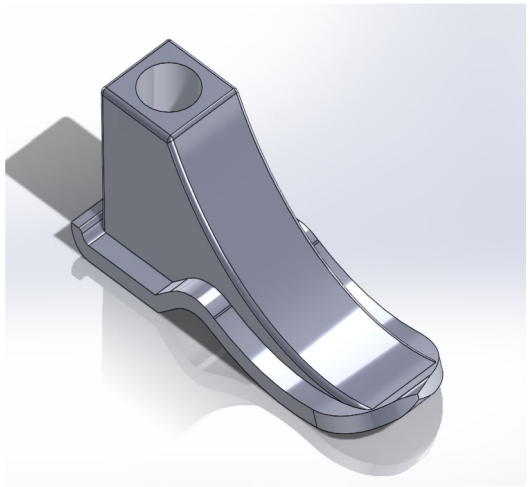


Figure 5: Foot in Design 3

Figure 6: PVC Pipe

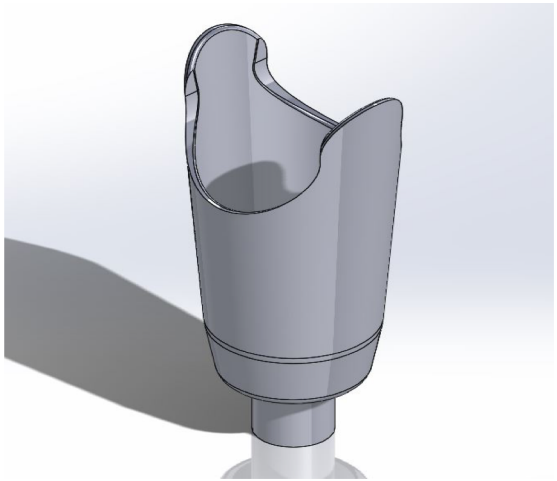


Figure 7: Supporting Channel in Design 3

Final Design

Figure 8: Linr

Figure 9; Final Foot

Figure 10: Final Supporting Channel

Figure 11: PVC Pipe

Figure 12: Final Assembly

Testing

- Hand Press
- Using P=F/A
- 300 lbs
- Test one straight
- Test two on an angle

Figure 13: Hand Press Machine

Manufacturing Process

- Print the 3D parts.
- Get 2 PVC pipes
- Cut 6 in PVC pipes
- Use the hand drill to make holes.

Figure 14: PVC Pipes

Figure 16: Supporting Channel

Figure 15: PVC Pipes

Figure 17: Foot

Total Cost

Table 1: Total Cost

Parts	Cost
2 PVC Pipes	11.16$
Supporting Channel	60$
Foot	30$
Liner	300$
Total Cost	401.16$

Omar Alajmi

References

[1] “Transtibial (Below-Knee) Amputation,” *American Physical Therapy Association*, 17-Sep-2018. [Online]. Available: https://www.moveforwardpt.com/SymptomsConditionsDetail.aspx?cid=c6bc380c-09fc-4dd5-987b-4bbba87e45bc. [Accessed: 26-Apr-2019].

[2] “NAU Logo.png,” *The Lumberjack*, 29-Aug-2018. [Online]. Available: http://www.jackcentral.org/news/nau-logo-png/image_5174a3ee-d5c2-5785-bd0a-d2513c00b4e0.html. [Accessed: 26-Apr-2019].

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Any Questions