RexoGrip

AN ACTIVE HAND REHABILITATION DEVICE

REXOS

The Rexos Team

Anton Khomutskiy (Chief Financial Officer)
- Conceptual Hardware Design

Joshua Law (Chief Operations Officer)
- Documentation and Electronics

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- Conceptual Hardware Design

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- Documentation, Software, and Electronics

Doug Tao (Chief Technology Officer)
- Prototype Hardware Design

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Outline

REXOS

Motivation

- Teammate’s parent experienced a stroke
- Post-stroke symptoms include weakness in hand
- Design a device to help with grip strength

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Motivation
Market
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Market Target

- Worldwide rehabilitation robot market size at $43.3 million is expected grow dramatically to reach $1.8 billion by 2020. Market growth is a result of the effectiveness of robotic treatment of muscle difficulty. [1]
- Rehabilitation treatment for all patients with injuries or physical function damage
- Assist with this task in multiple ways by using hands
- Move more freely in each finger directions problem for stroke and nerve damage patient

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Competition and Existing Solutions

SAEBOGLOVE [2]

Passive device

Hand therapy

Applies tension to the hand as client closes hand

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Competition and Existing Solutions cont’d

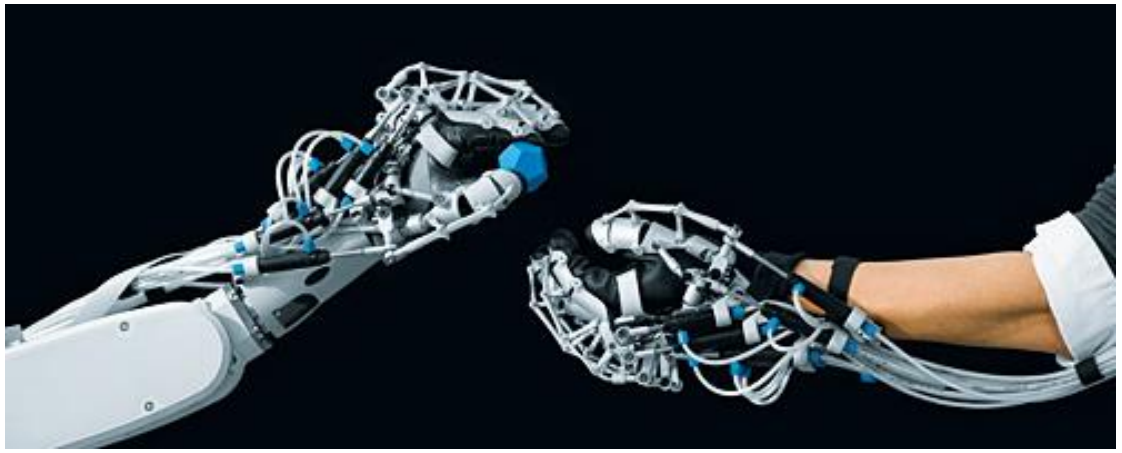
FESTO EXOHAND [3]

Hand force amplification

Pneumatic actuators

Non-Commercial product

Complex design



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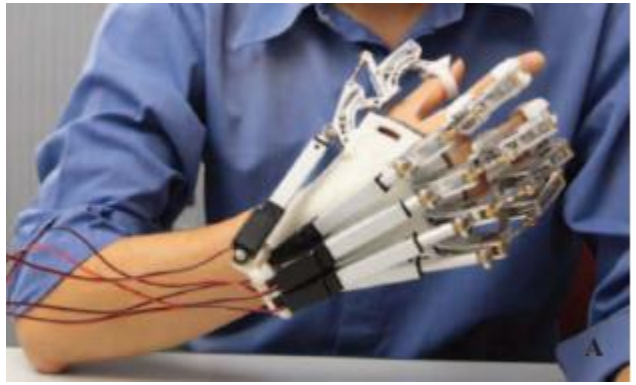
Competition and Existing Solutions cont’d

EMG-DRIVEN EXOSKELETON HAND [4]

The Hong Kong Polytechnic University, Hong Kong, China

Electromyography (EMG)

Linear actuators



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Competition and Existing Solutions cont'd

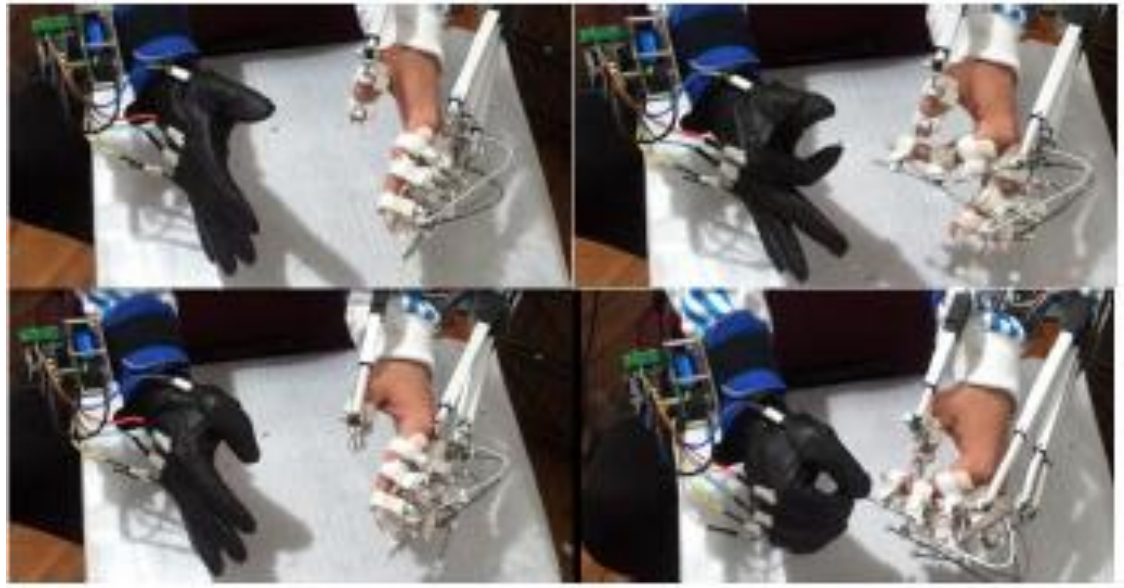
BILATERAL THERAPEUTIC HAND DEVICE [5]

University of Technology, Sydney, Australia

Requires control glove

Flex sensors in control glove

Bulky linear actuators



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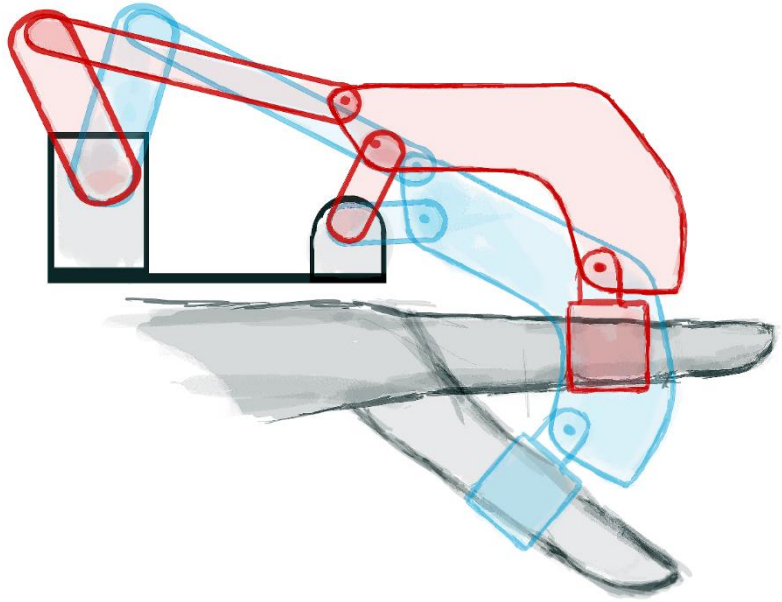
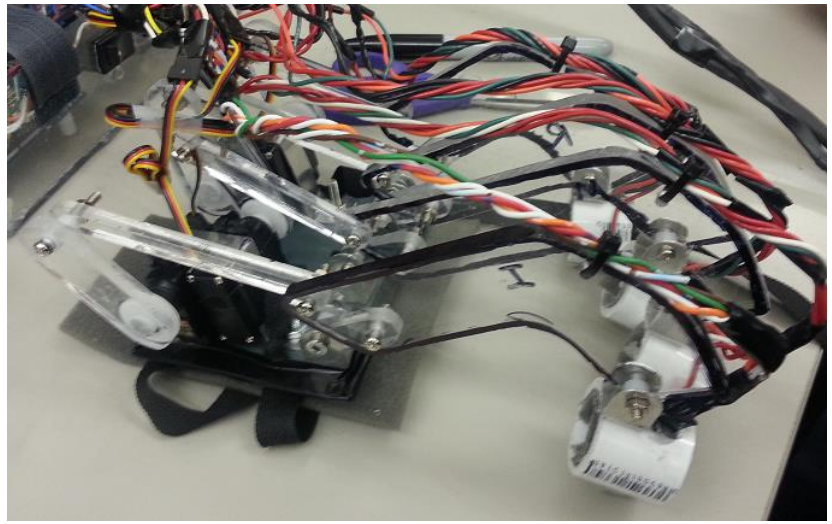
Conceptual Design





- Average grip force per finger is around 4N [6]
- Servo motor provides sufficient force to grip
- One motor per finger, the force is applied to the middle joint

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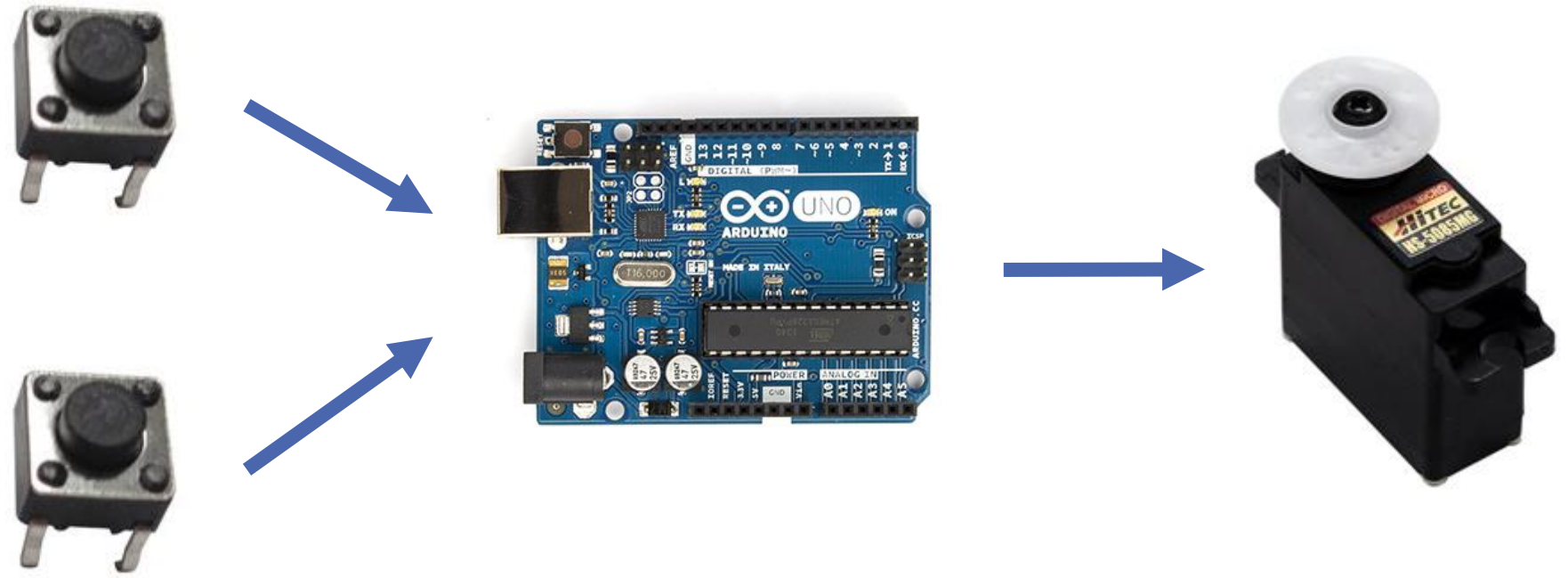
Electronics: Overview



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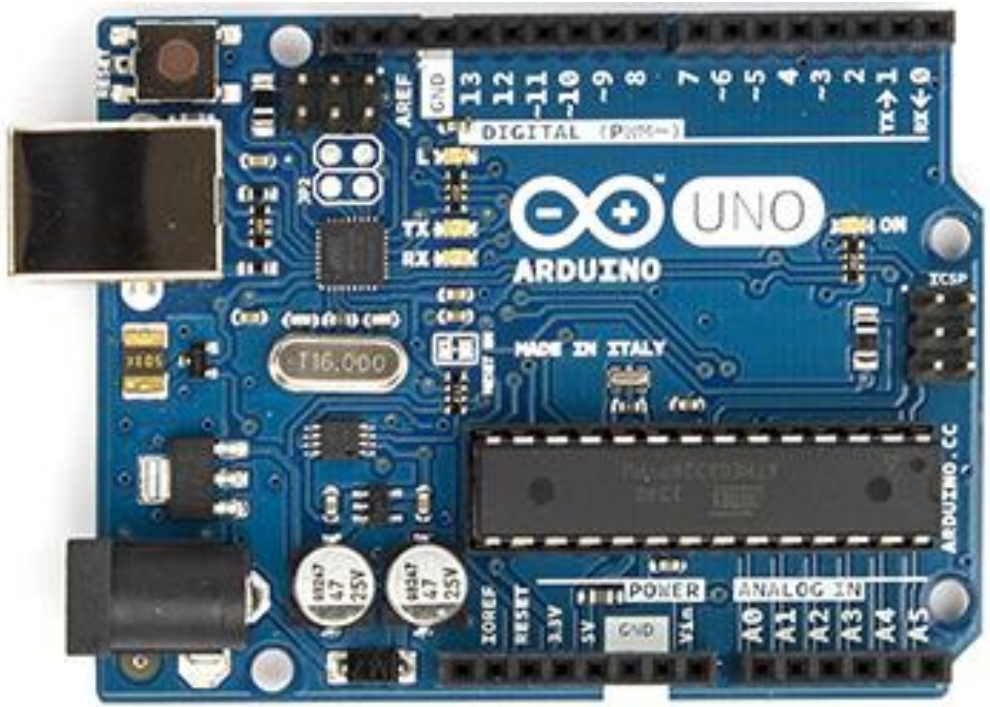
Electronics: Microcontroller

Arduino Uno R3

12 Digital Pins

Pin	Purpose
2,4	Middle Sensor
5,6	Ring Sensor
7,8	Pinky Sensor
12,13	Index Sensor

Pin	Purpose
3	Index Motor
10	Middle Motor
11	Ring Motor
12	Pinky Motor



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Electronics: Power Supply

Arduino

On/Off Switch

9V battery

Motors and Sensors

On/Off Switch

6V from four AA batteries

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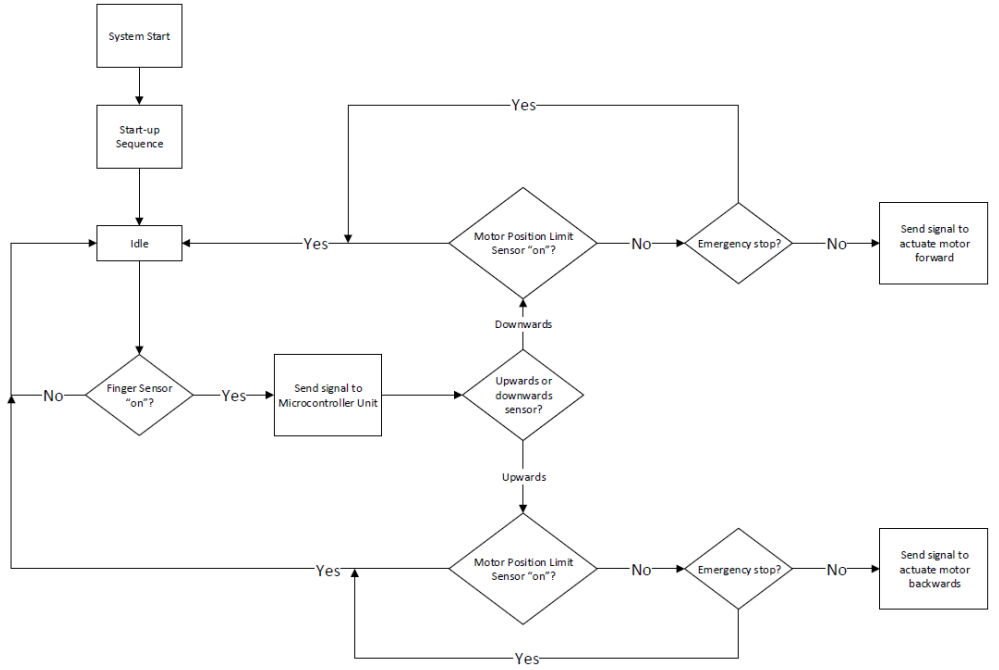
Software

Start-up Sequence
- Default Motor Positions

Finger Sensors
- Push Switches
- Individually Controlled

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Financials

Category	Budgeted Cost	Actual Cost	Change
Microcontroller			
Motor			
Material			
Power			
Switches			
3D Printing			
Total			

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Financials

Category	Budgeted Cost	Actual Cost	Change
Microcontroller	$ 85.00		
Motor	$ 425.00		
Material	$ 100.00		
Power	$ 140.00		
Sensors	$ 10.00		
3D Printing	$ 300.00		
Total	$ 1,060.00		

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Financials cont’d

Category	Budgeted Cost	Actual Cost	Change
Microcontroller	$ 85.00	$ 79.98	
Motor	$ 425.00	$ 446.22	
Material	$ 100.00	$ 144.01	
Power	$ 140.00	$ 47.26	
Sensors	$ 10.00	$ 4.14	
3D Printing	$ 300.00	$ 50.00	
Total	$ 1,060.00	$ 771.62	

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Financials cont'd

Category	Budgeted Cost	Actual Cost	Change
Microcontroller	$ 85.00	$ 79.98	$ 5.02
Motor	$ 425.00	$ 446.22	-$ 21.22
Material	$ 100.00	$ 144.01	-$ 44.01
Power	$ 140.00	$ 47.26	$ 92.74
Sensors	$ 10.00	$ 4.14	$ 5.86
3D Printing	$ 300.00	$ 50.00	$ 250.00
Total	$ 1,060.00	$ 771.62	$ 288.38

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Financials cont’d

Category	Approximate Cost
Microcontroller	$ 45.00
Motor	$ 200.00
Material	$ 105.00
Power	$ 15.00
Sensors	$ 5.00
3D Printing	$ 50.00
Total	$ 420.00

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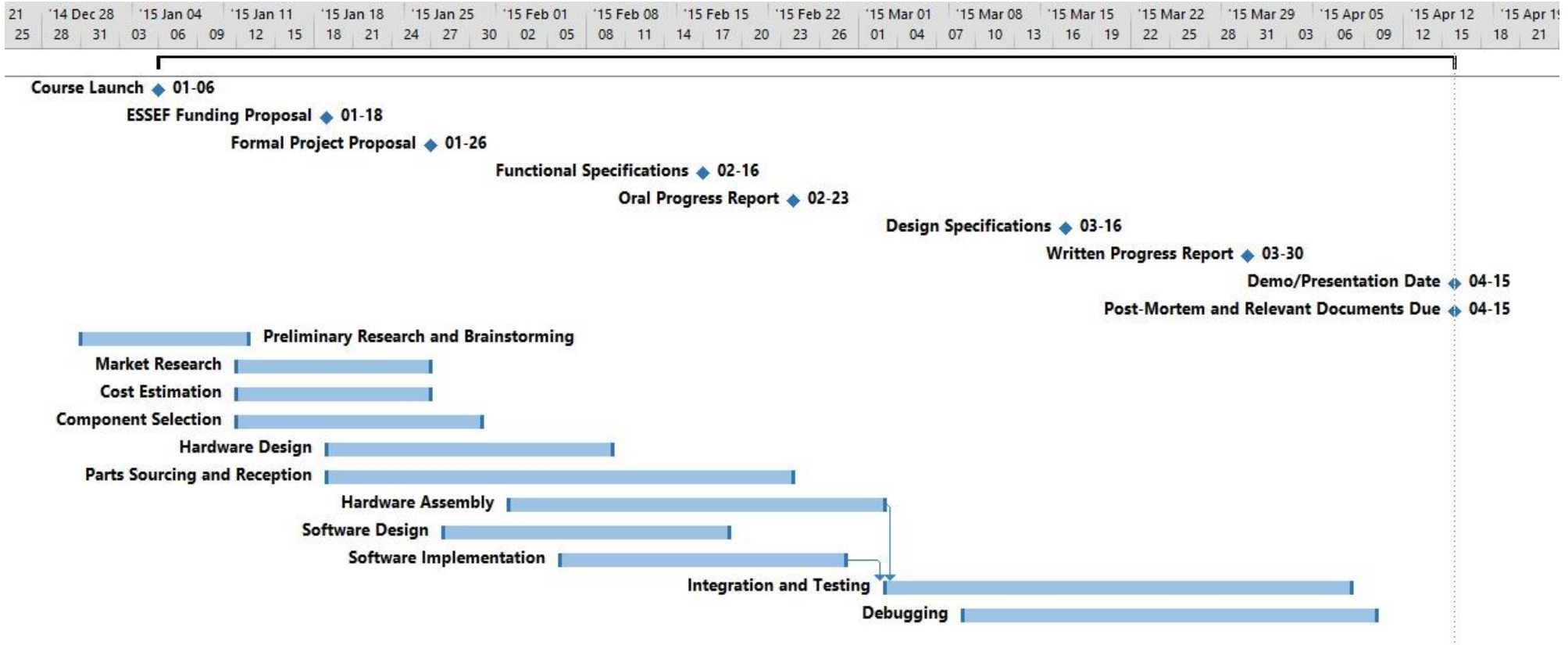

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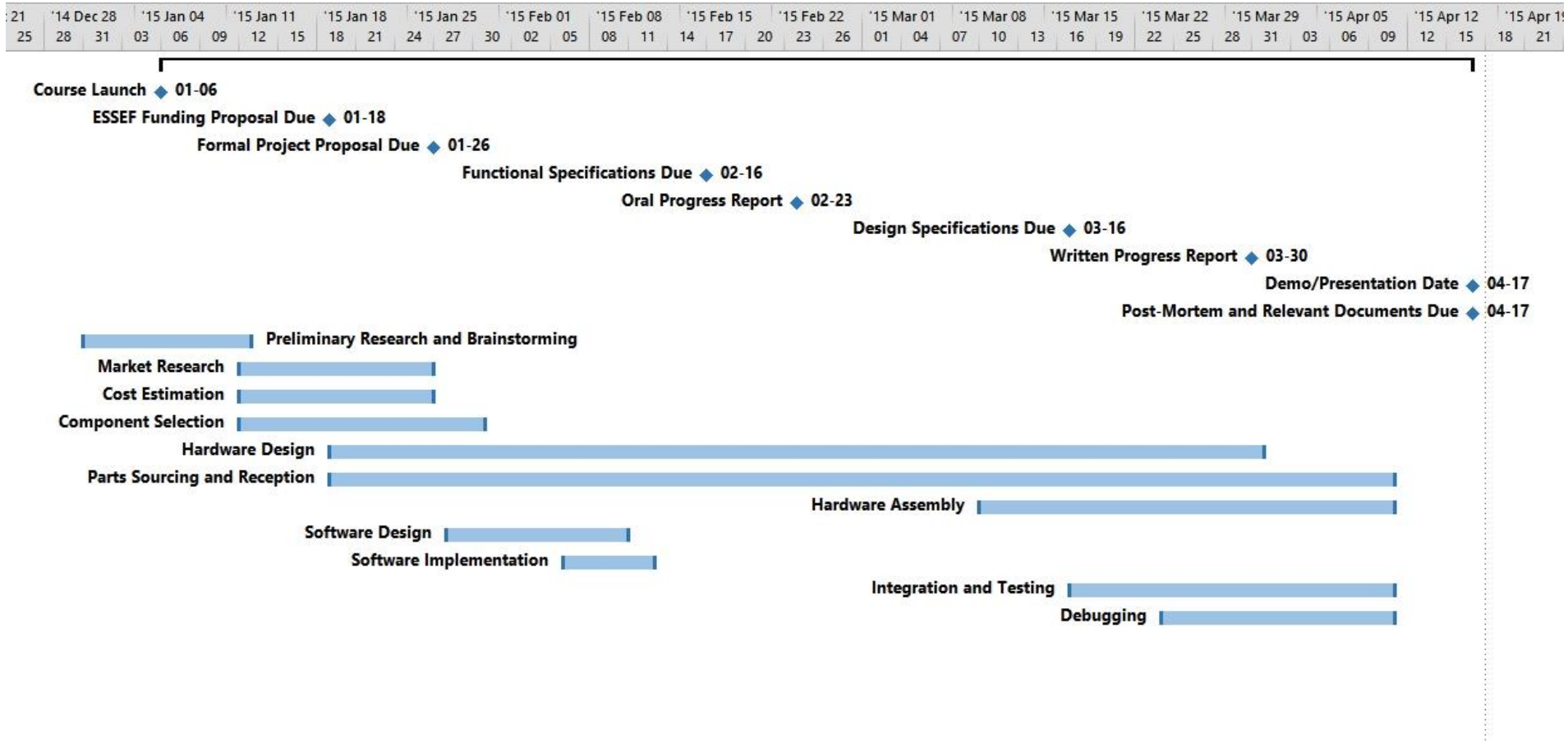
Schedule cont’d



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Prototype design

- 3D printing

Production Materials

- Cobalt Alloys: Stellite,Vitallium
- Ceramics: Boron Carbide
- Polymers: Polycarbonate, Polypropylene, Polysulfone

Reduced size of the enclosure

Lower profile

Pressure sensor

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Acknowledgements

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- Lab 1 Staff
- Todd Ablett (Gladstone Secondary School Technology Dept. Head)

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Questions?

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