Model Based Systems Quadruped

Design Review 6

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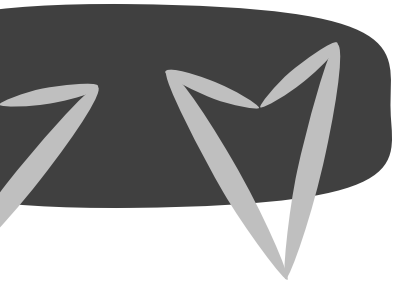

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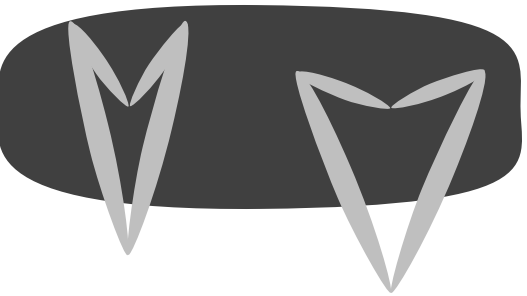

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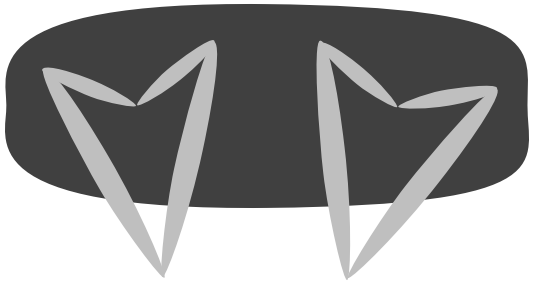

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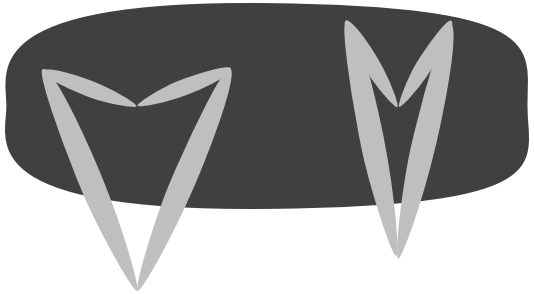

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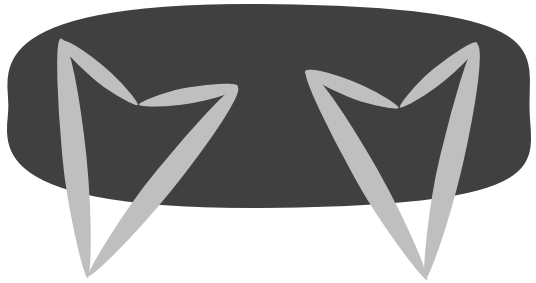

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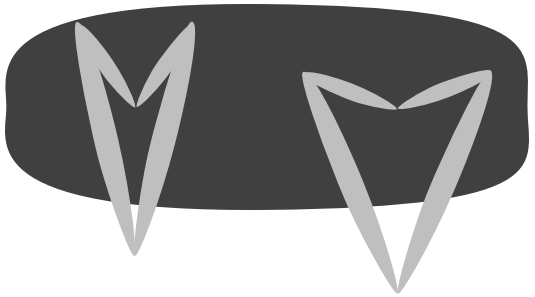

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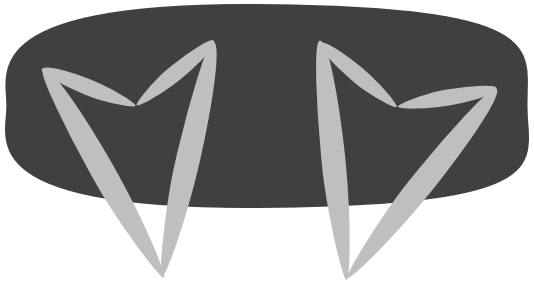

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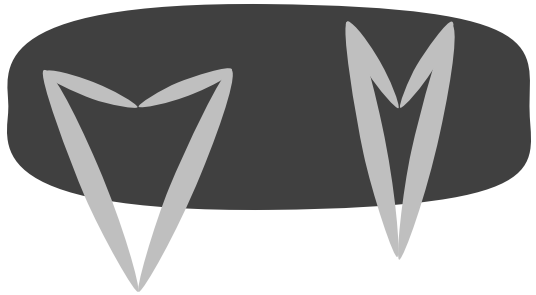

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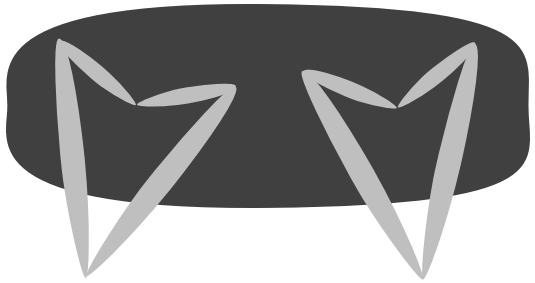

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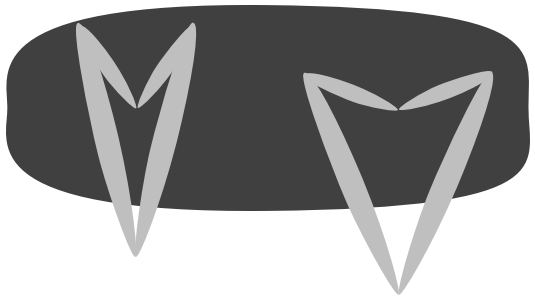

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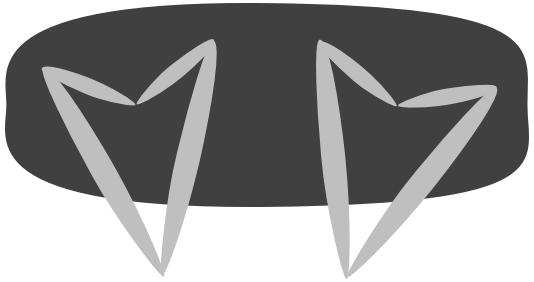

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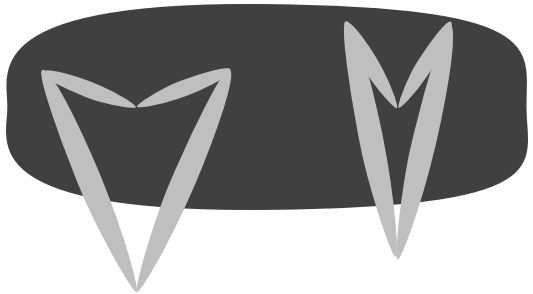

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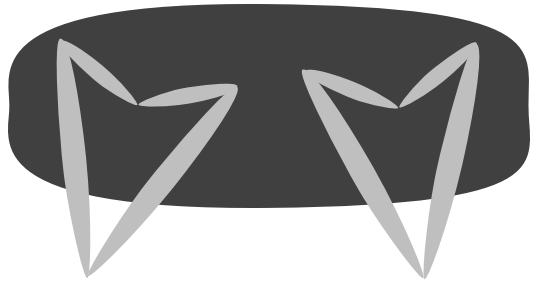

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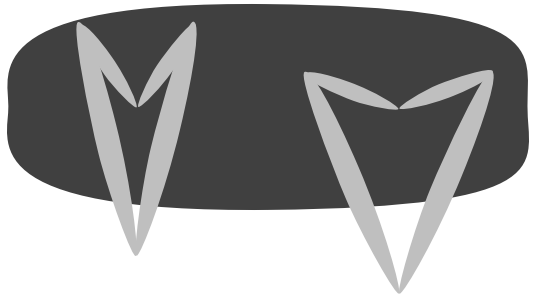

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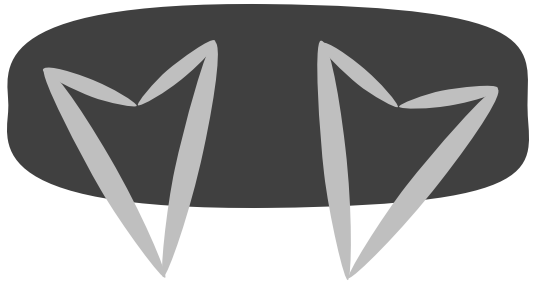

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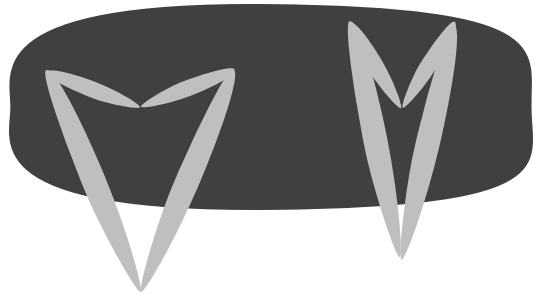

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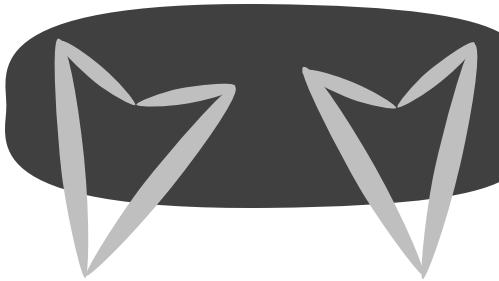

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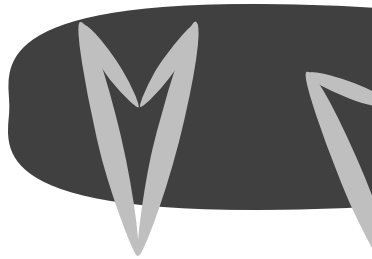

Model Based Systems Quadruped

Design Review 6

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Model Based Systems Quadruped

Design Review 6

Team Introductions

Milton Bouchard
Modeling Engineer

Michael Dina
Systems Engineer

Onoriode Onokpise
User Interface Engineer

Jackson Raines
Testing Engineer

Zachary Shapiro
Testing Engineer

Sponsors and Advisor

CISCOR

Center for Intelligent Systems, Control, and Robotics

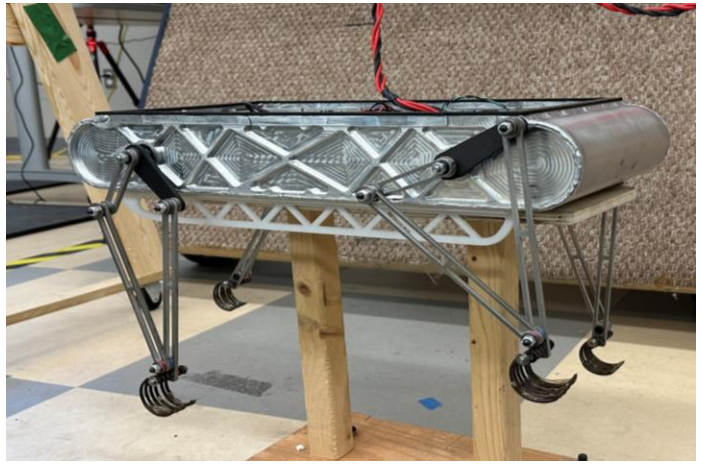
Dr. Jonathon Clark
Sponsor

Dr. Patrick Hollis
Advisor

Dr. Shayne McConomy
Sponsor

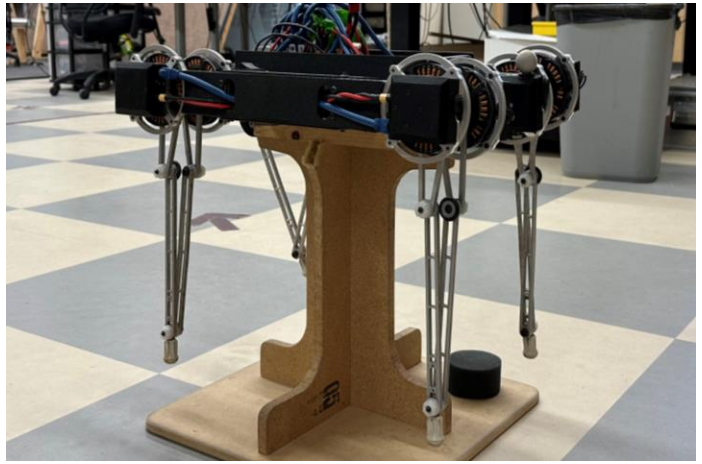
Objective

The objective of this project is to develop a software tool that expedites the design and construction of quadrupedal robots. The tool will use the knowledge gained from robots previously built at CISCOR.



ET-Quad

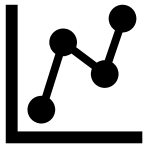
RHex



Minitaur

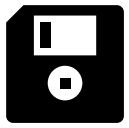
Key Goals

Develop a tool to assist new quadrupedal robot development



Return critical parameter values

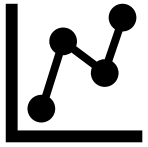
Reduce development time



Act as a database of knowledge for robot development

Key Goals

Develop a tool to assist new quadrupedal robot development



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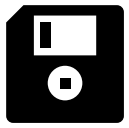

Act as a database of knowledge for robot development

Key Goals

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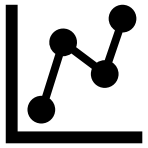

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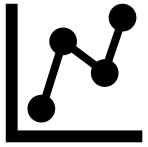

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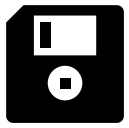

Act as a database of knowledge for robot development

Key Goals

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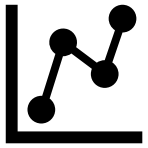
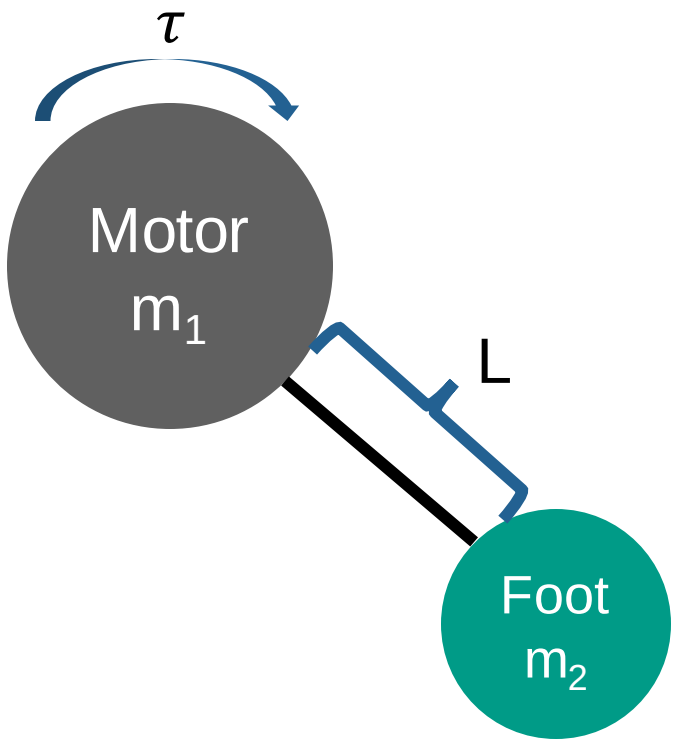


Return critical parameter values

Reduce development time

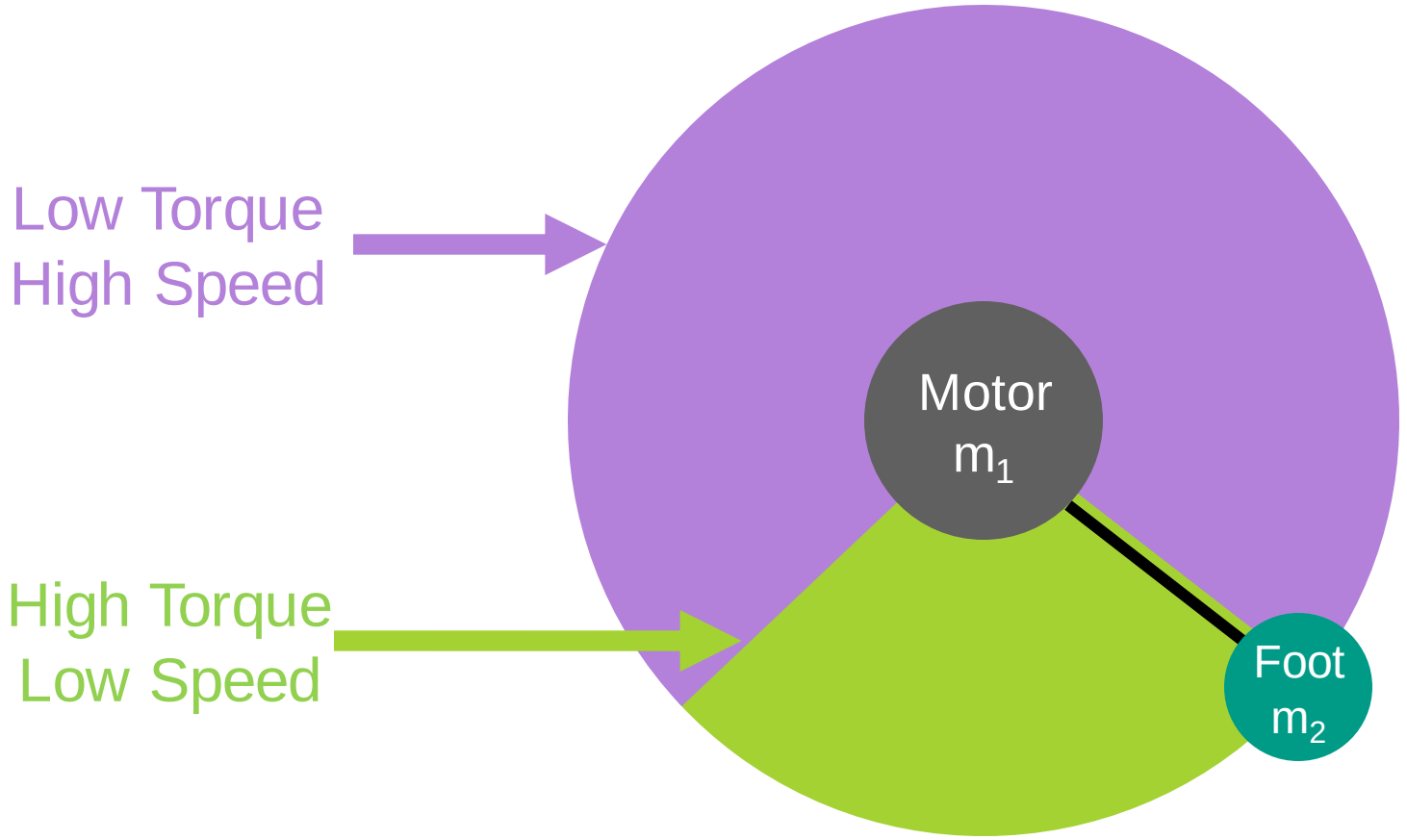
Act as a database of knowledge for robot development

Starting Motor Model - Simple

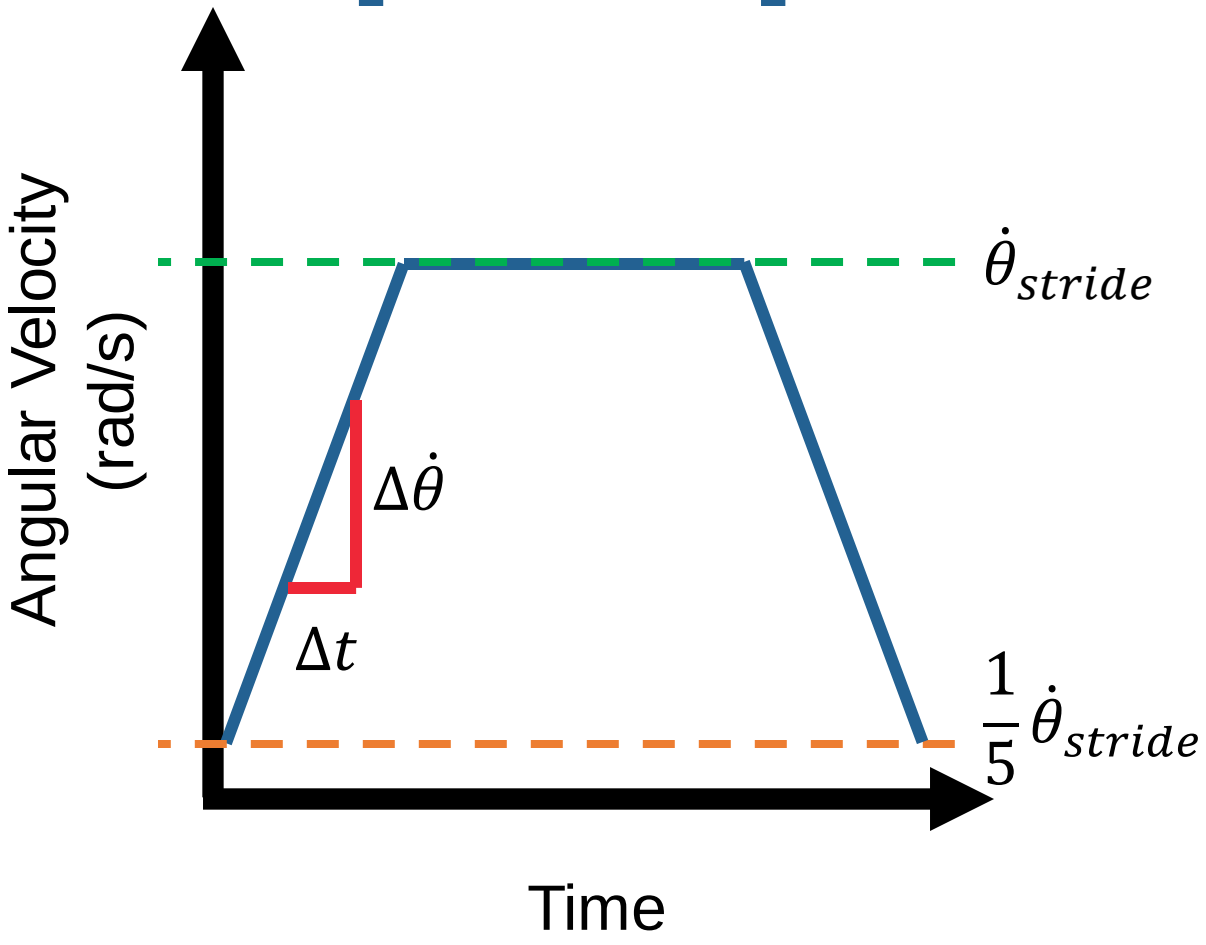


RHex

Two Phases - Flight

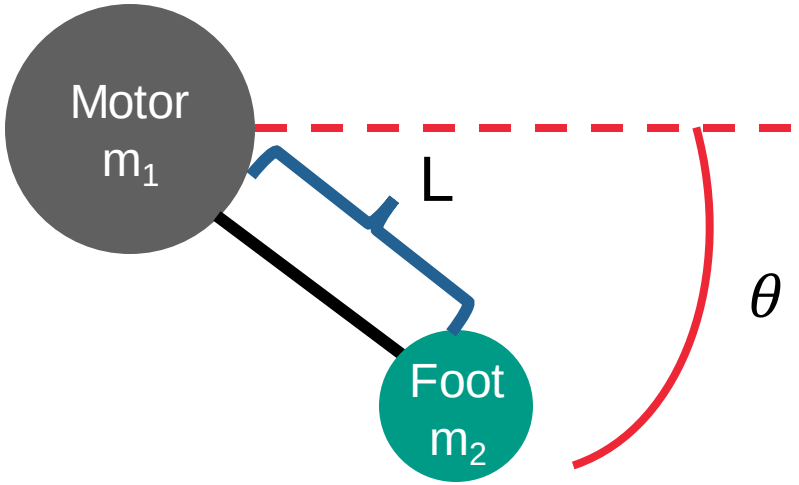


Torque Required

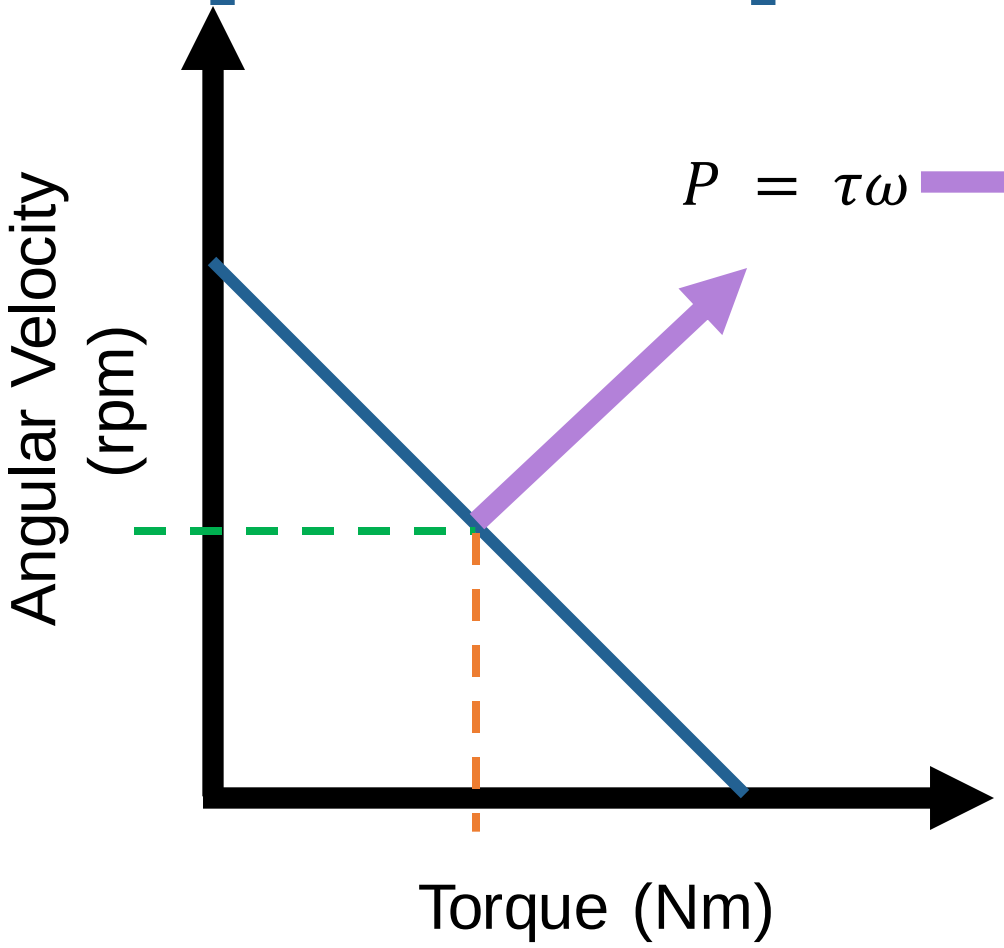


$$\tau_{stance} = m_1 L g \cos\theta$$

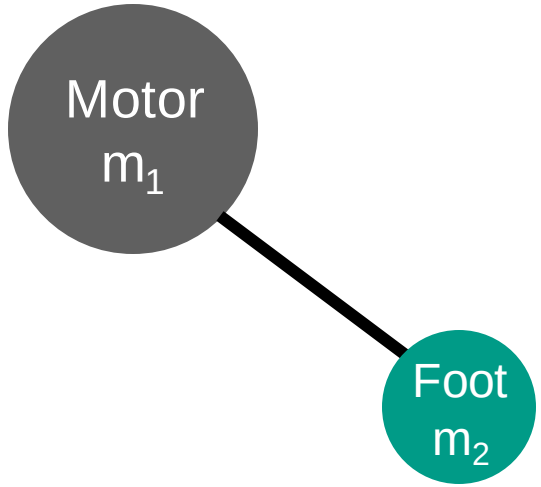
$$\tau_{stanceflight} = m_2\left(\frac{8\pi f_{stride}}{5\Delta t}\left(\frac{8\pi f_{stride}}{5\Delta t}L^2\right) + g\cos\theta\right)$$



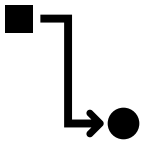
Speed-Torque Curve



$$P = \tau\omega \rightarrow P \propto m \rightarrow m_{motor} \cong 0.2m_{total}$$

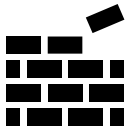


Primary Scope



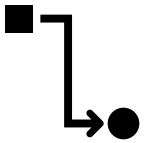
Complete process from the input to the output

Focus on ET-Quad database



Set framework for improvement and future complexity

Primary Scope



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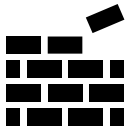

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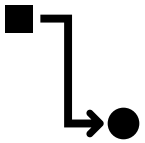

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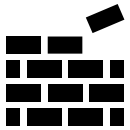

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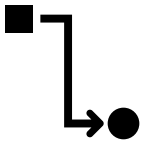

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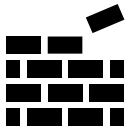
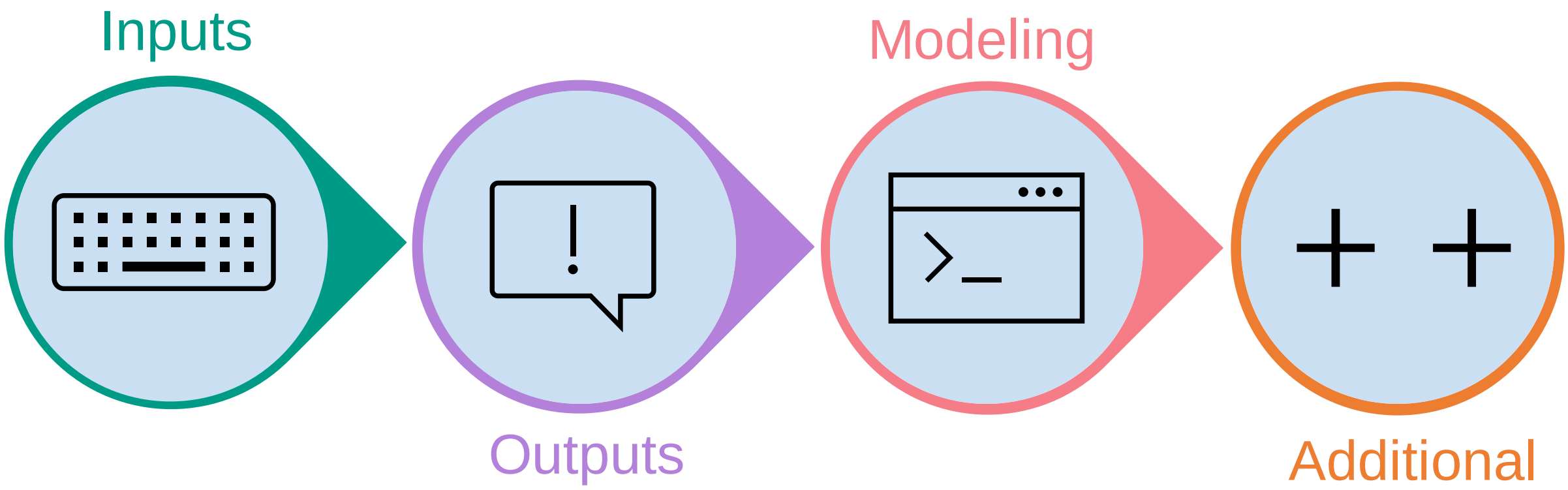


Set framework for improvement and future complexity

Targets and Metrics

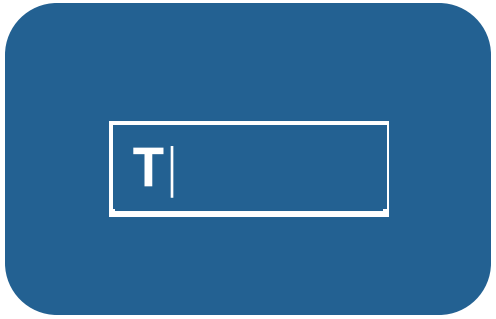


Concept Generation

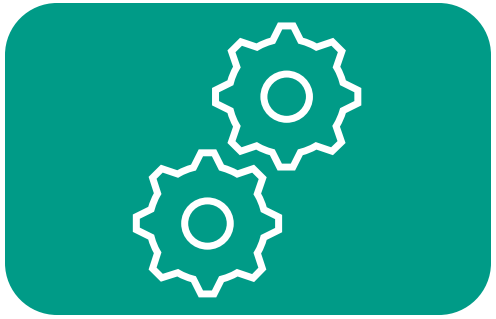
Brainstorming

Forced Analogy

Medium Fidelity



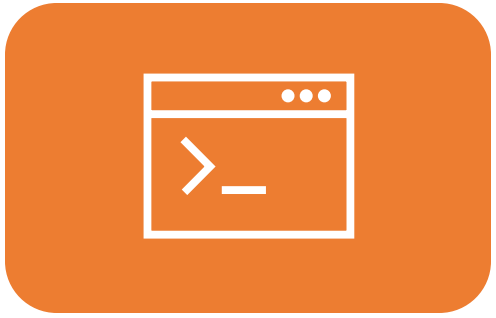
MATLAB Textbox



Simscape Model

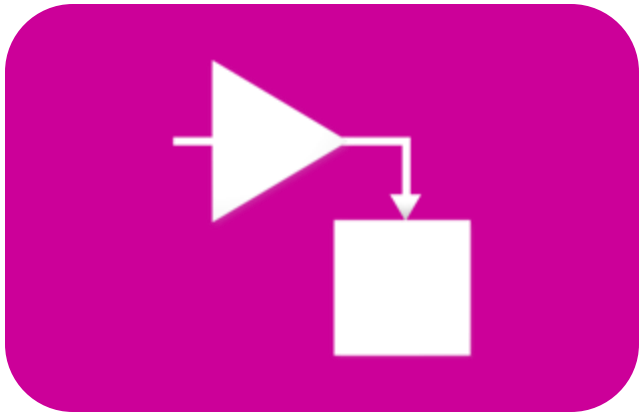
MATLAB GUI with information Dashboard

Racing Car Game Selection



MATLAB command line

High Fidelity



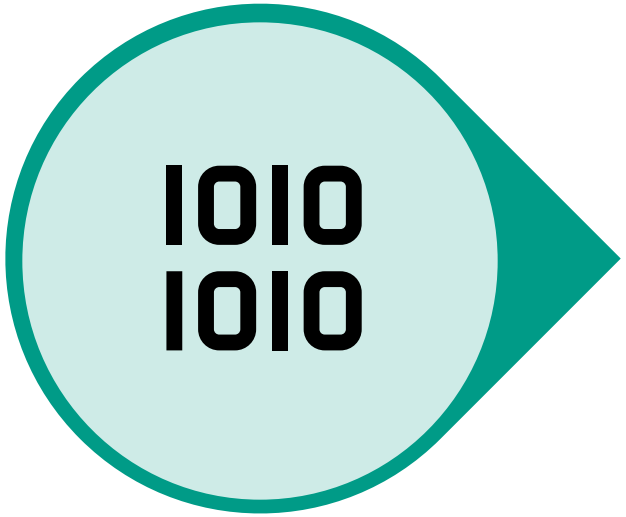
MATLAB to
Simulink

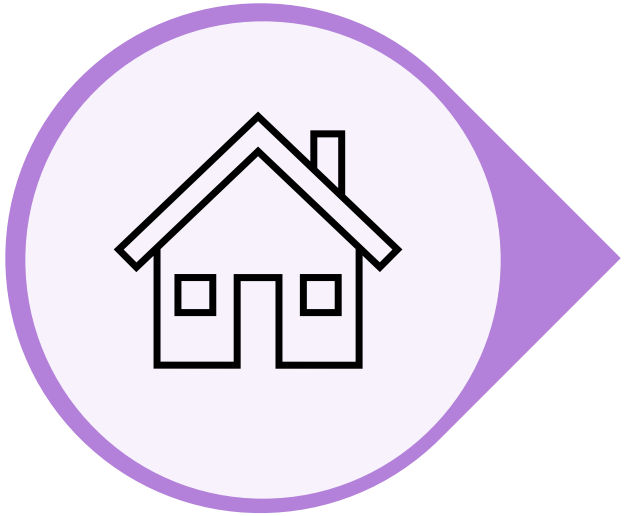
MATLAB GUI
with Dropdowns

System
Composer GUI

Concept Selection

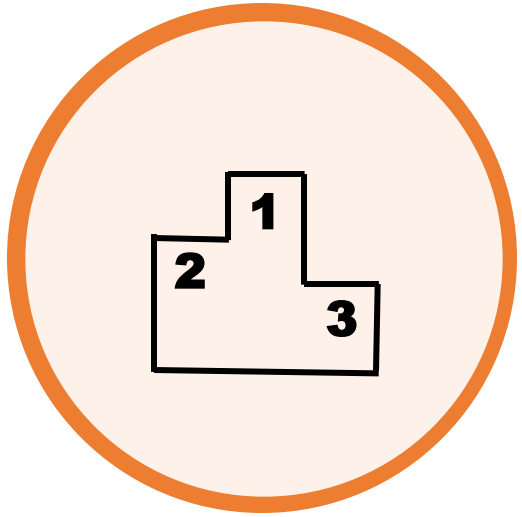
Pairwise Comparison





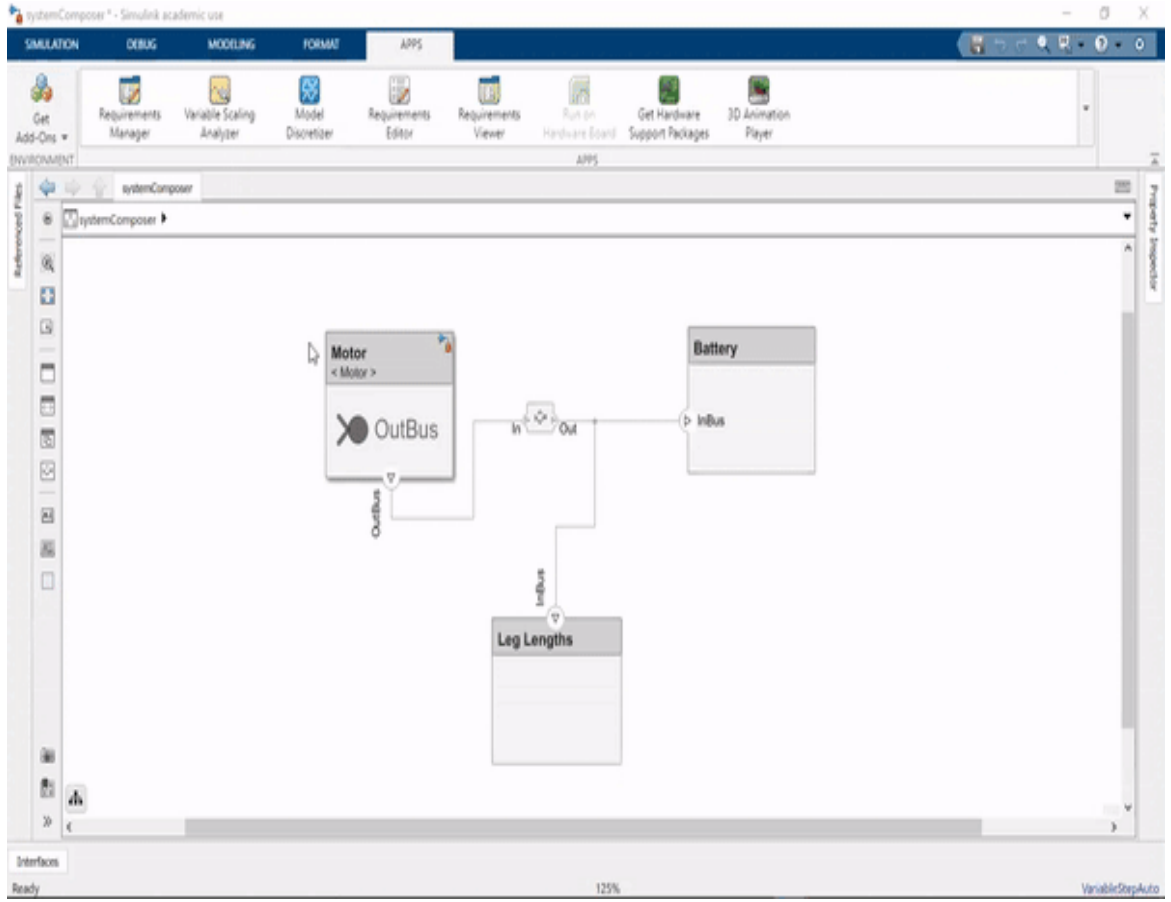
House of Quality

Pugh Chart



Analytical Hierarchy

Final Selection

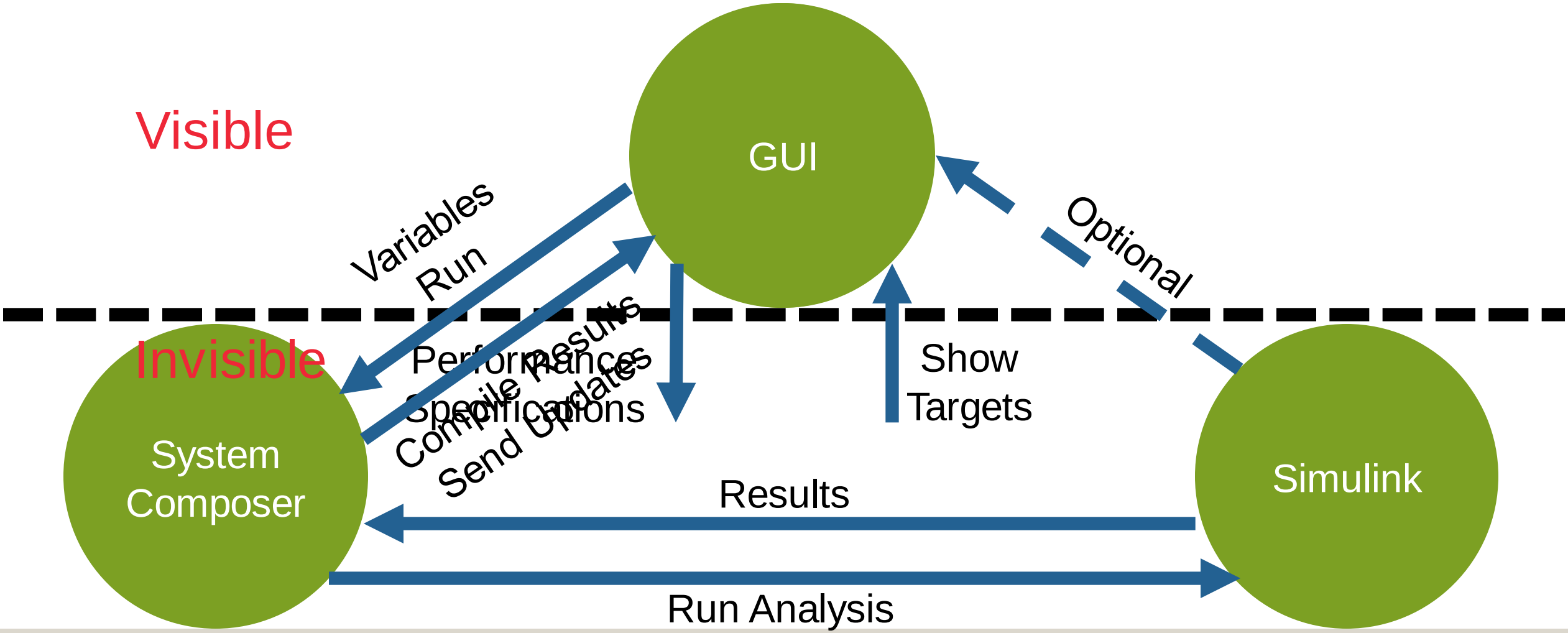


System Composer GUI

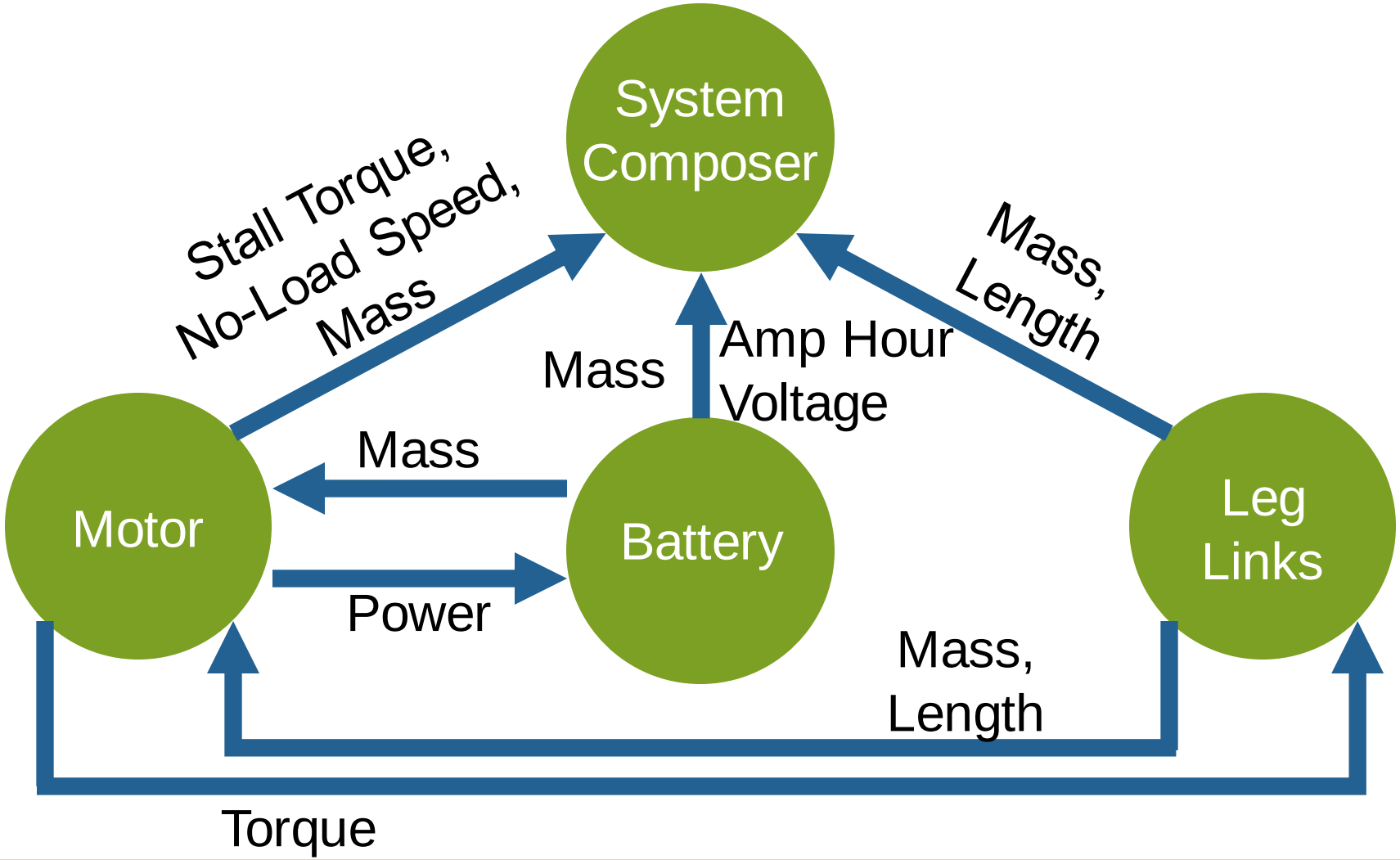
Accepts constraints from user in the form of performance characteristics

Attach Simulink models to specific functions

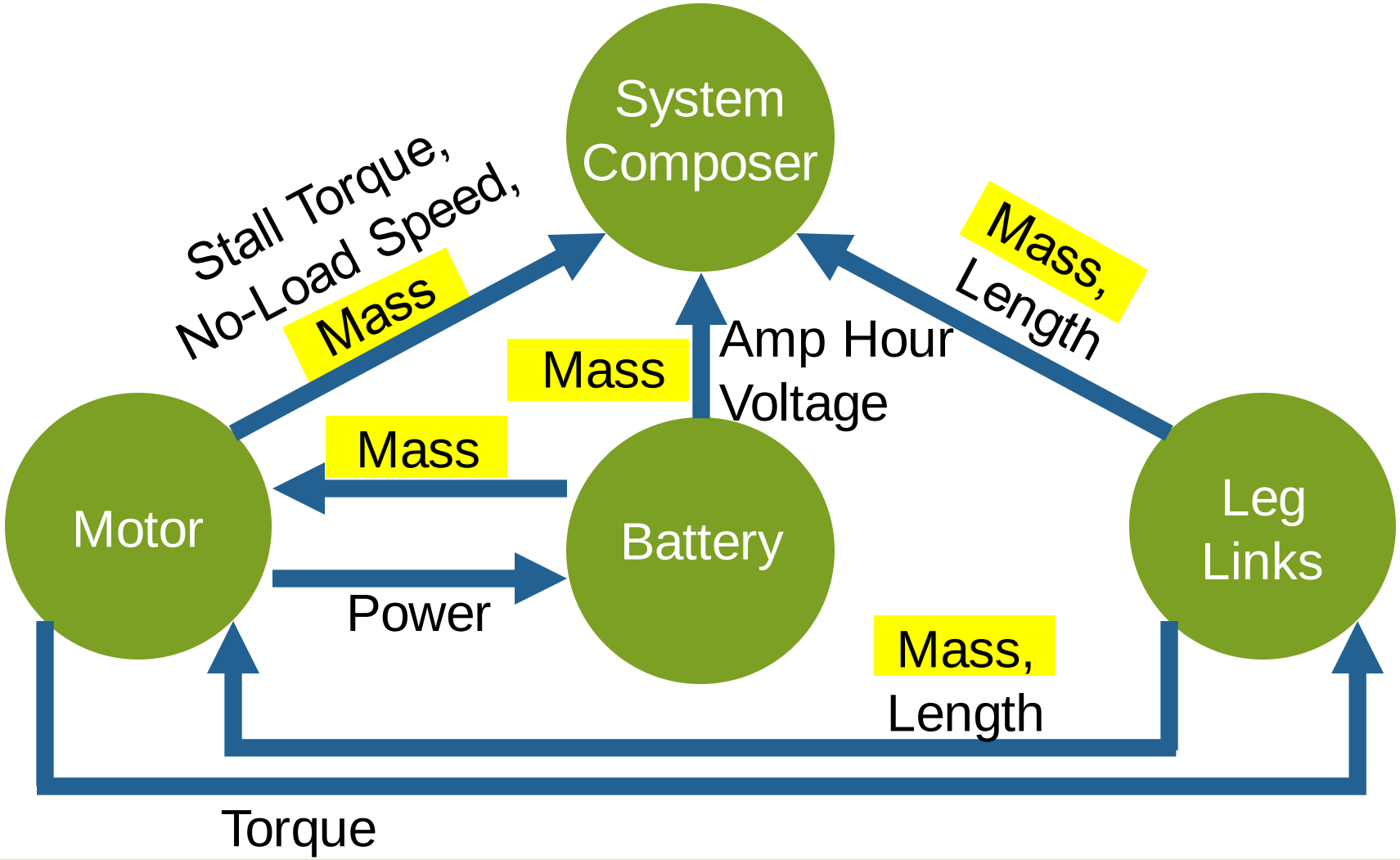
Software Architecture



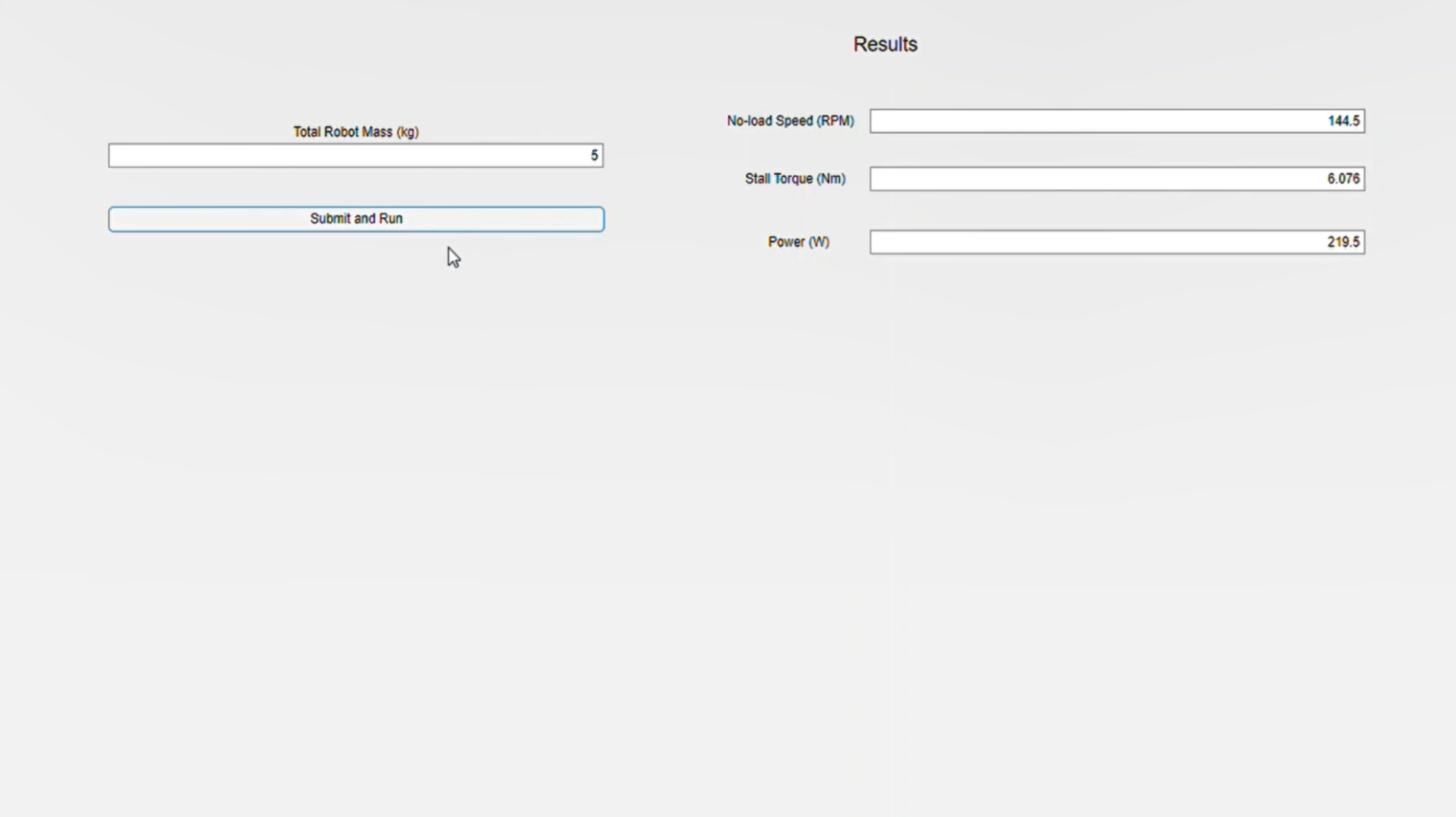
System Composer Architecture



System Composer Architecture



First Functional GUI



Results

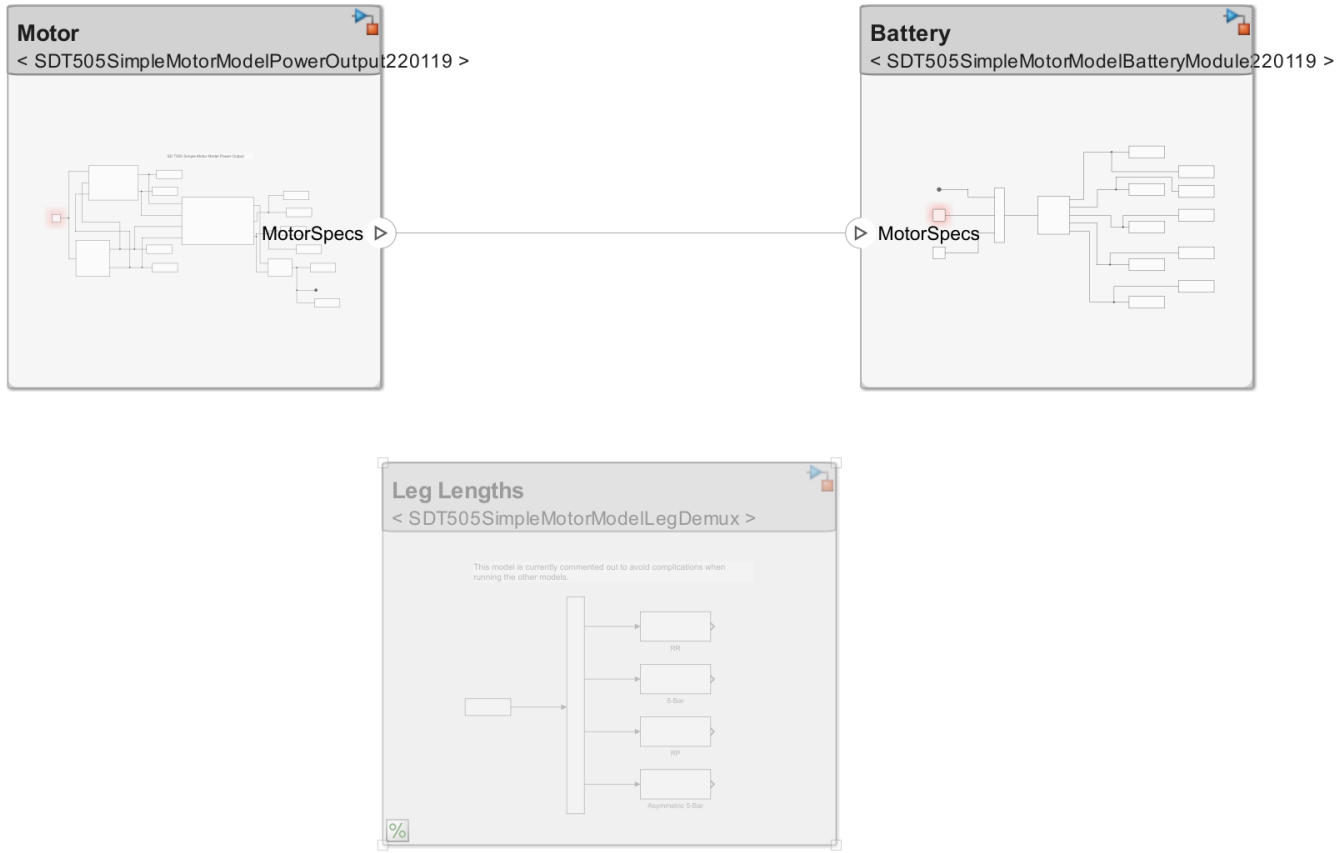
Total Robot Mass (kg)

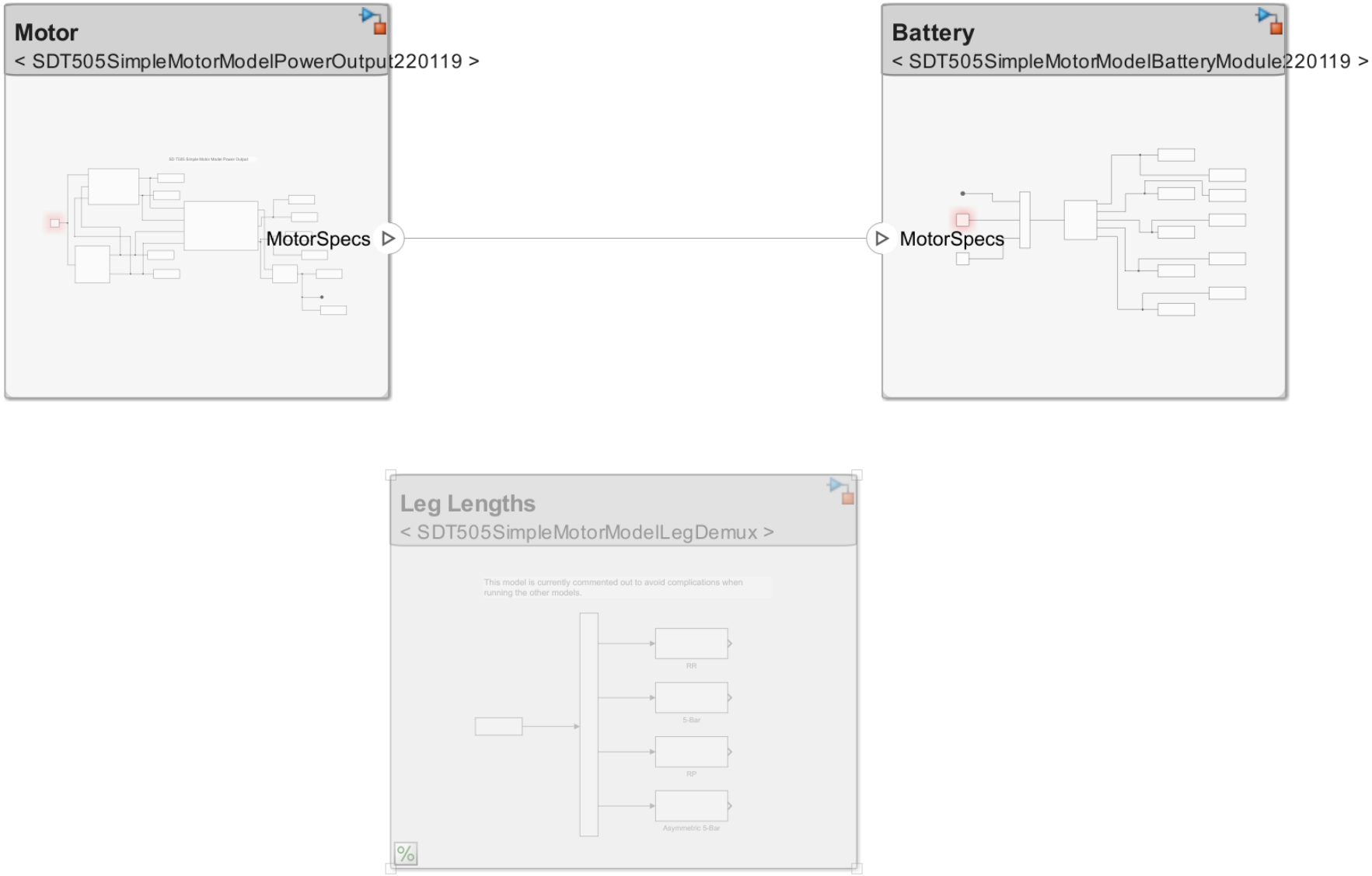
5

Submit and Run

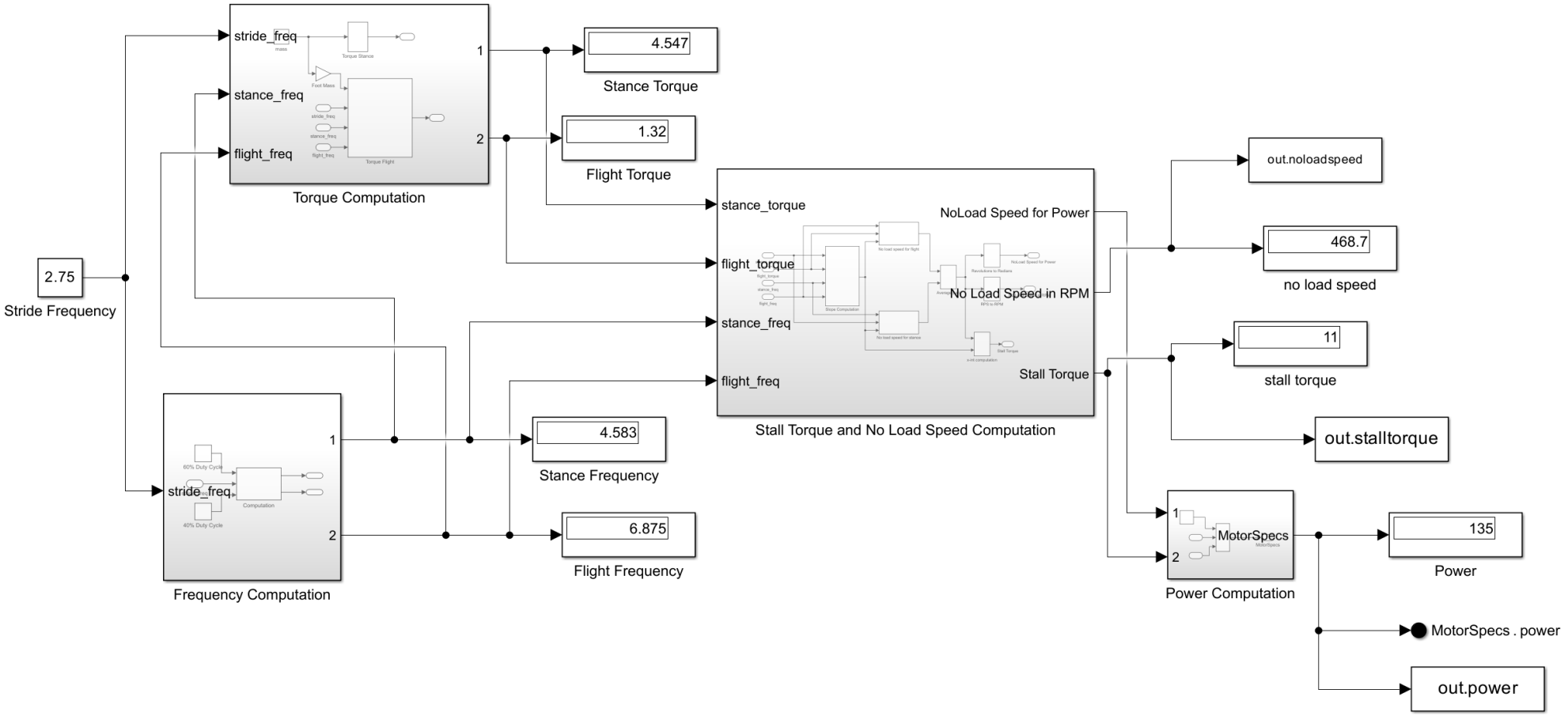
No-load Speed (RPM)	144.5
Stall Torque (Nm)	6.076
Power (W)	219.5

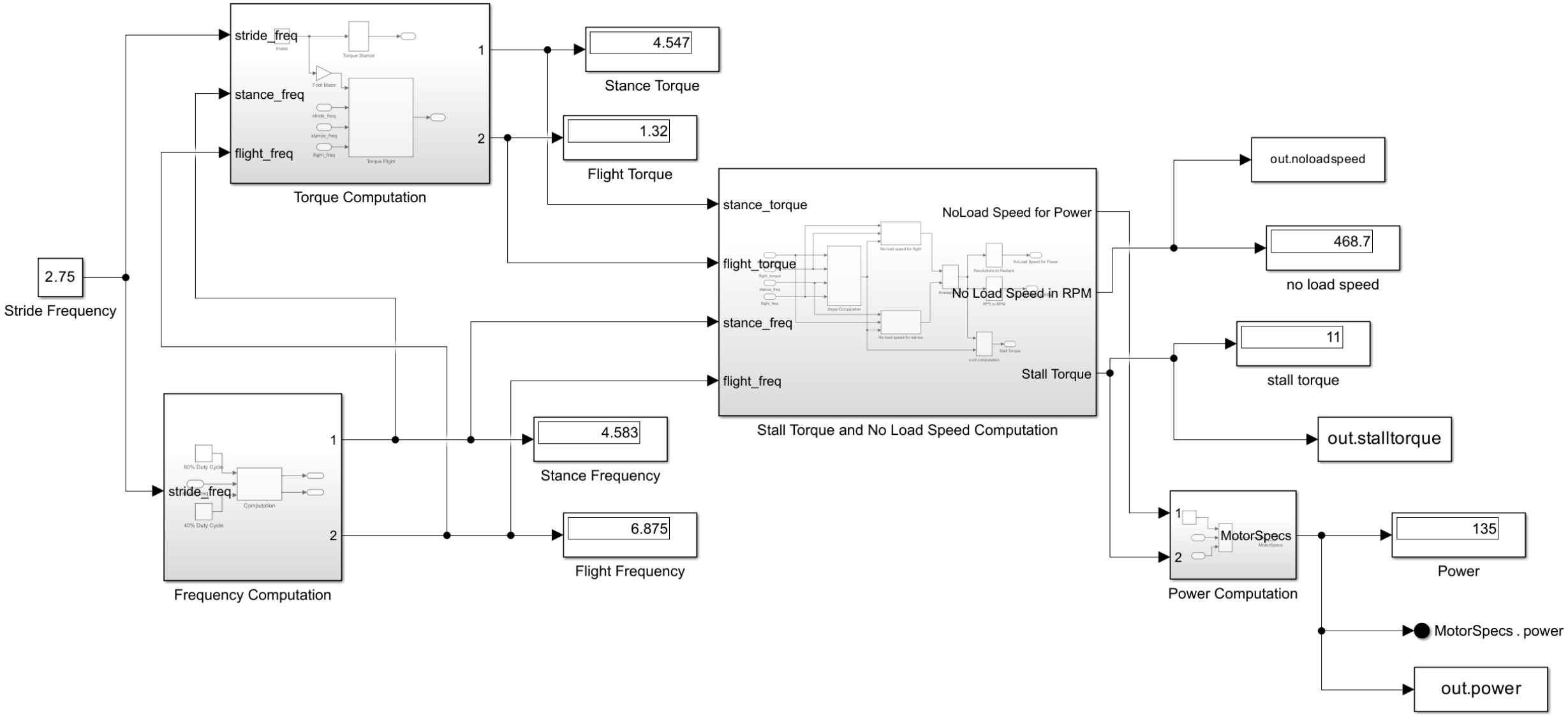
System Composer Interface

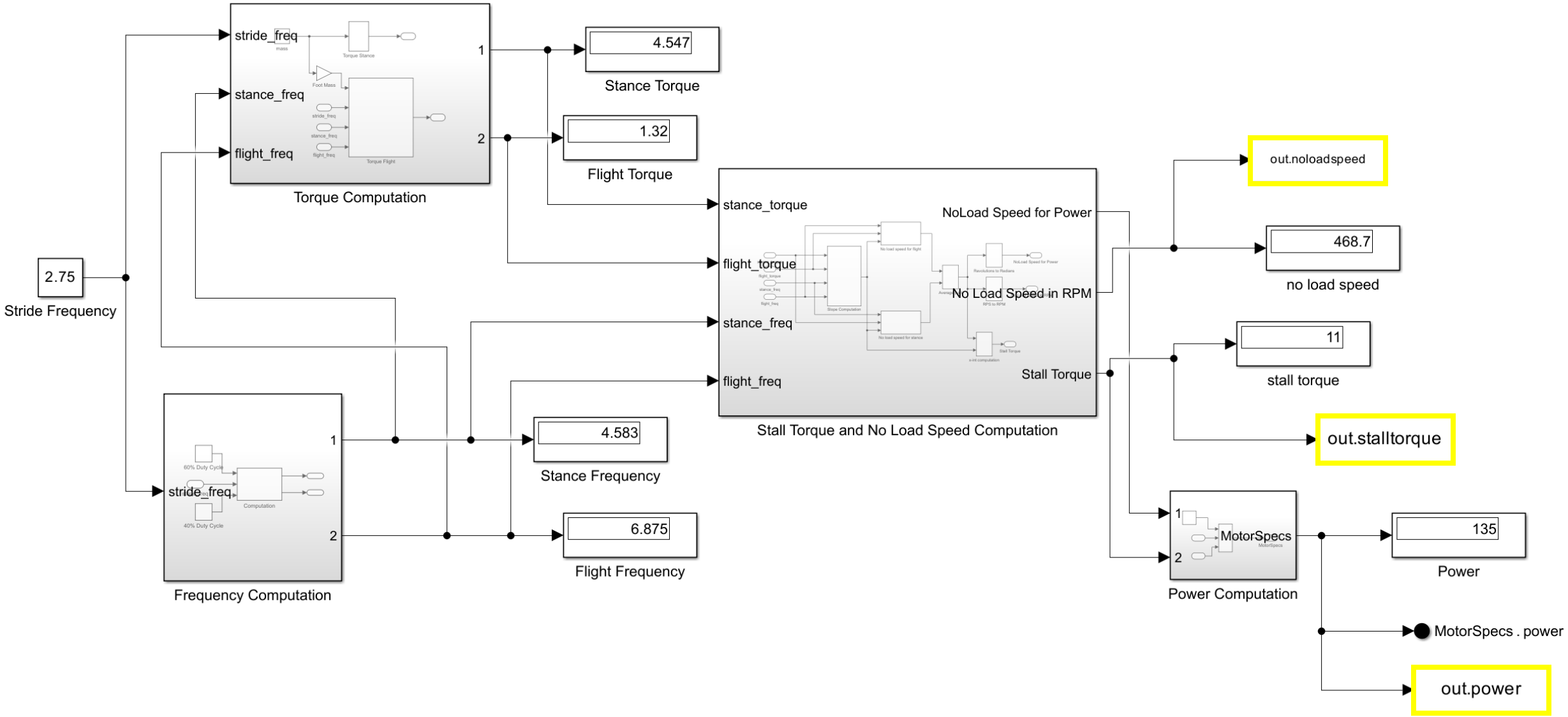


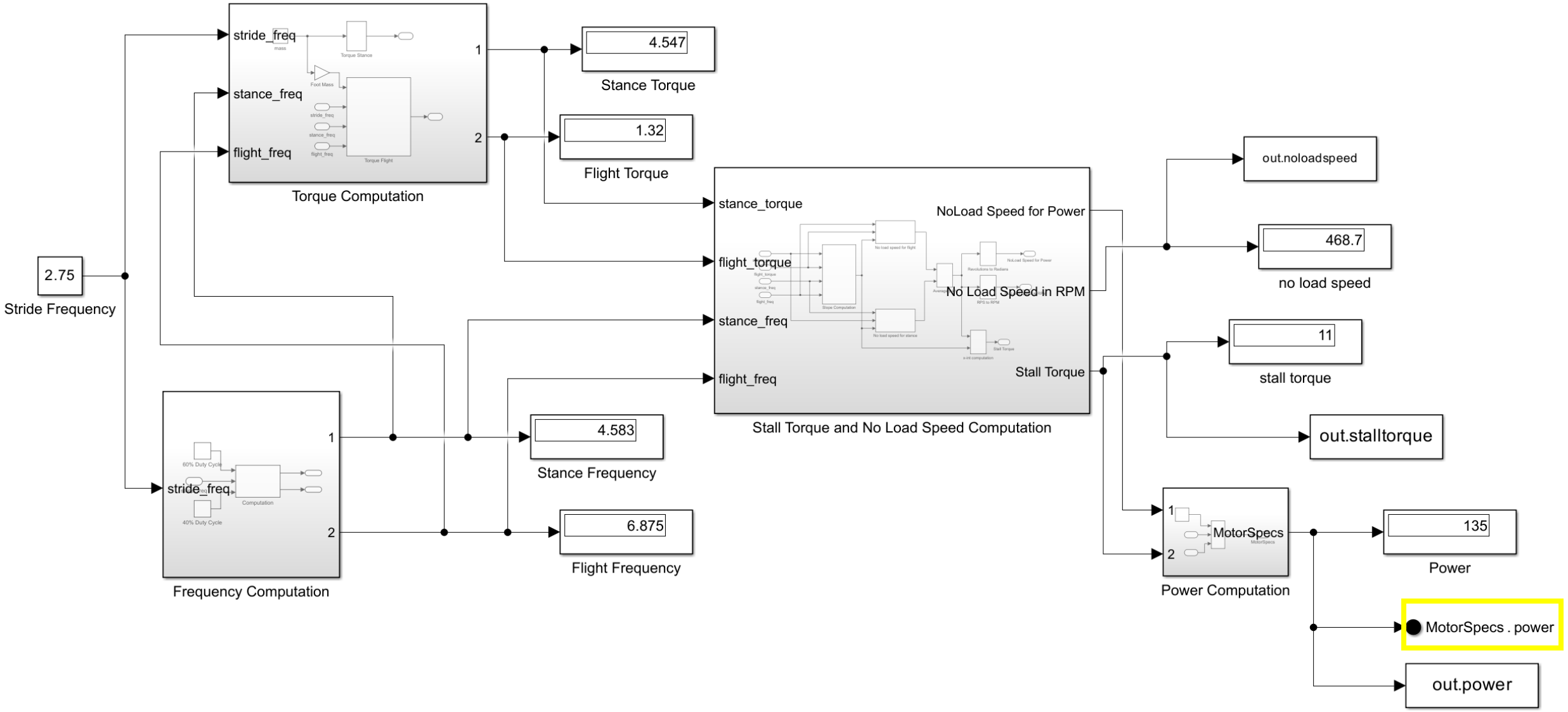

Motor
< SDT505SimpleMotorModelPowerOutput220119 >
MotorSpecs
Battery
< SDT505SimpleMotorModelBatteryModule220119 >
MotorSpecs
Leg Lengths
< SDT505SimpleMotorModelLegDemux >
This model is currently commented out to avoid complications when running the other models.
RR
5-Bar
RP
Asymmetric 5-Bar

Simulink Motor Model

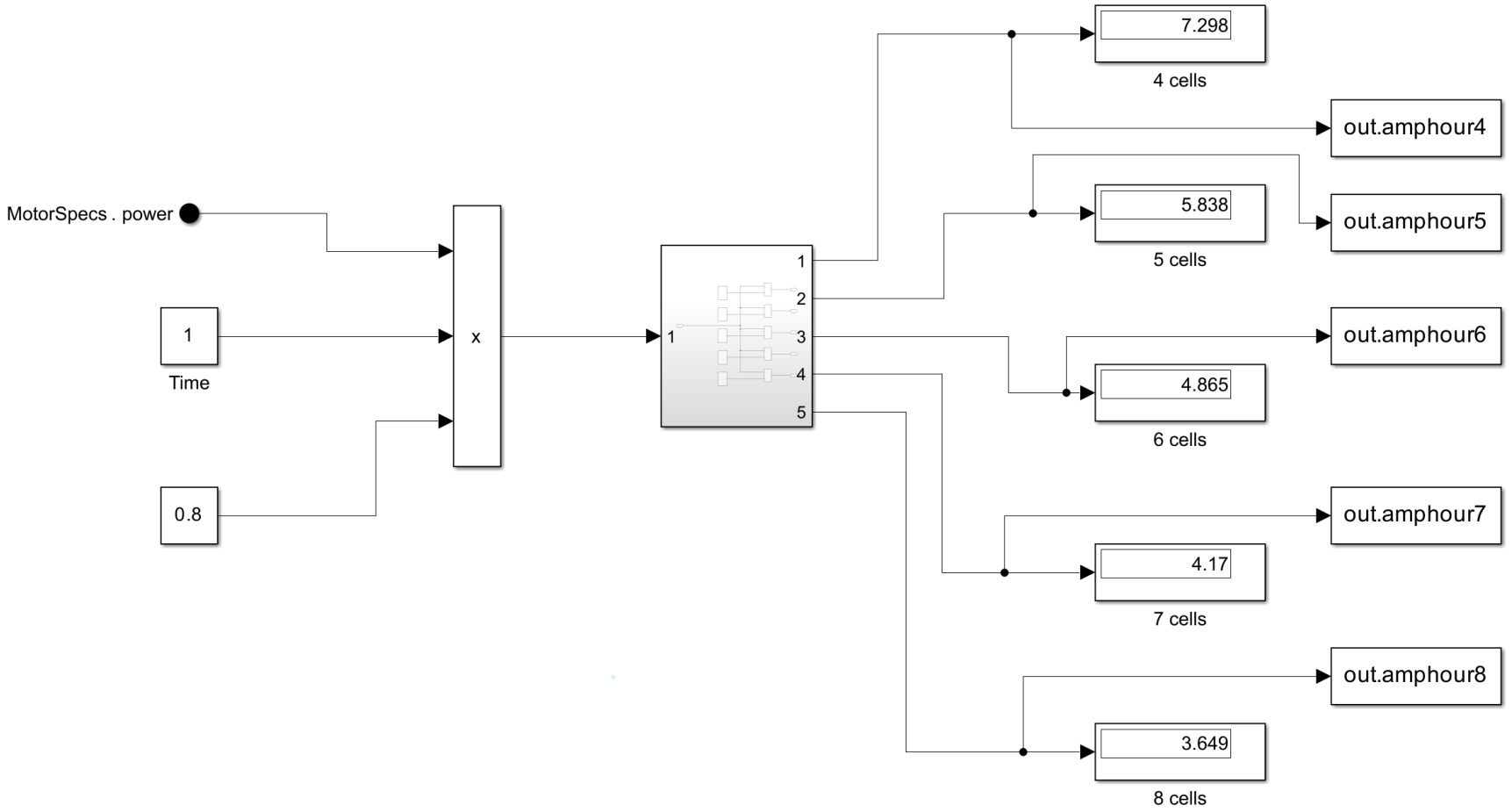


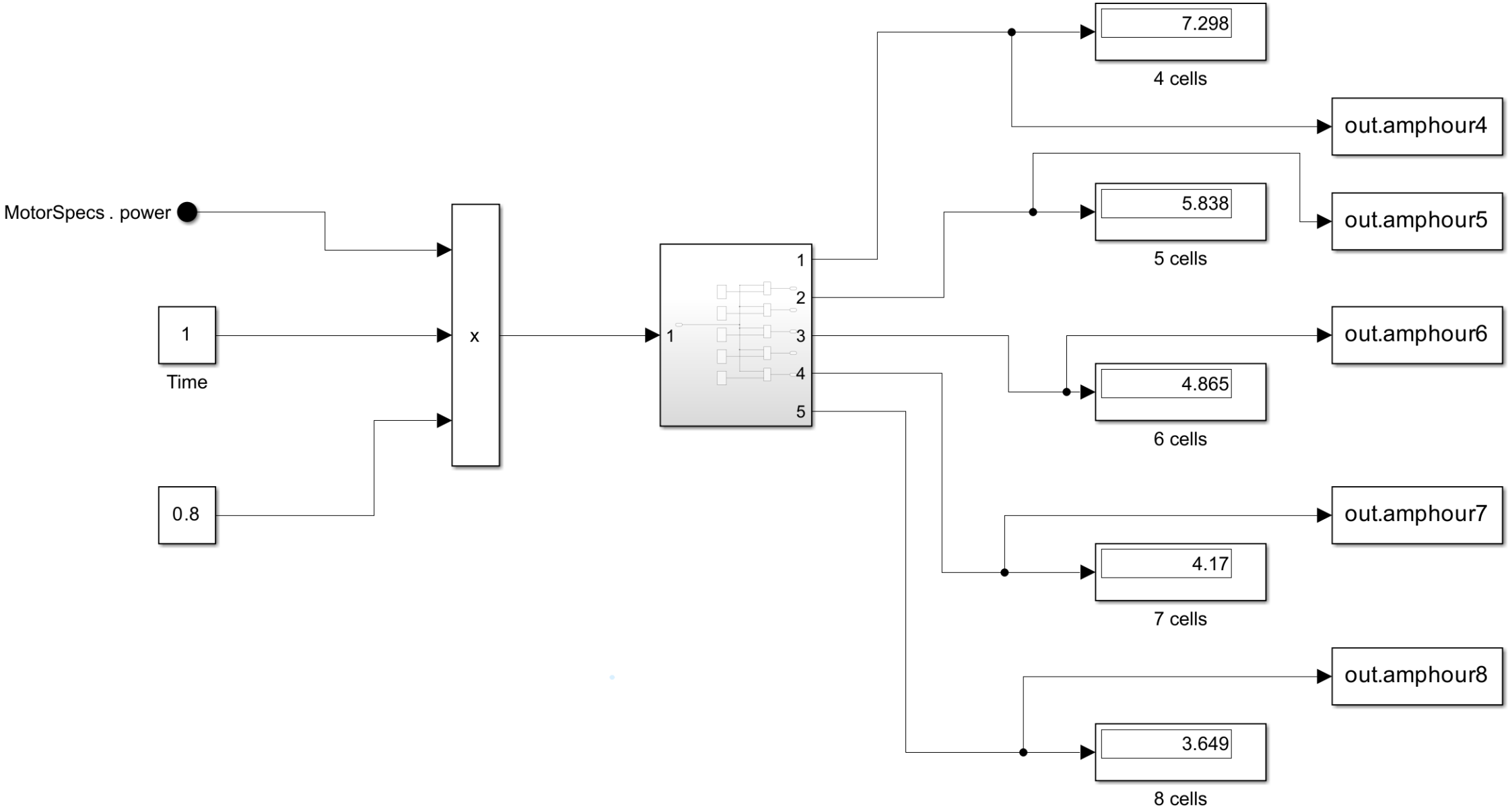

stride_freq
stance_freq
flight_freq
1
2
Torque Computation
4.547
Stance Torque
1.32
Flight Torque
2.75
Stride Frequency
stance_torque
flight_torque
stance_freq
flight_freq
NoLoad Speed for Power
No Load Speed in RPM
Stall Torque
Stall Torque and No Load Speed Computation
out.noloadspeed
468.7
no load speed
11
stall torque
out.stalltorque
4.583
Stance Frequency
6.875
Flight Frequency
stride_freq
Frequency Computation
MotorSpecs
Power Computation
135
Power
MotorSpecs . power
out.power

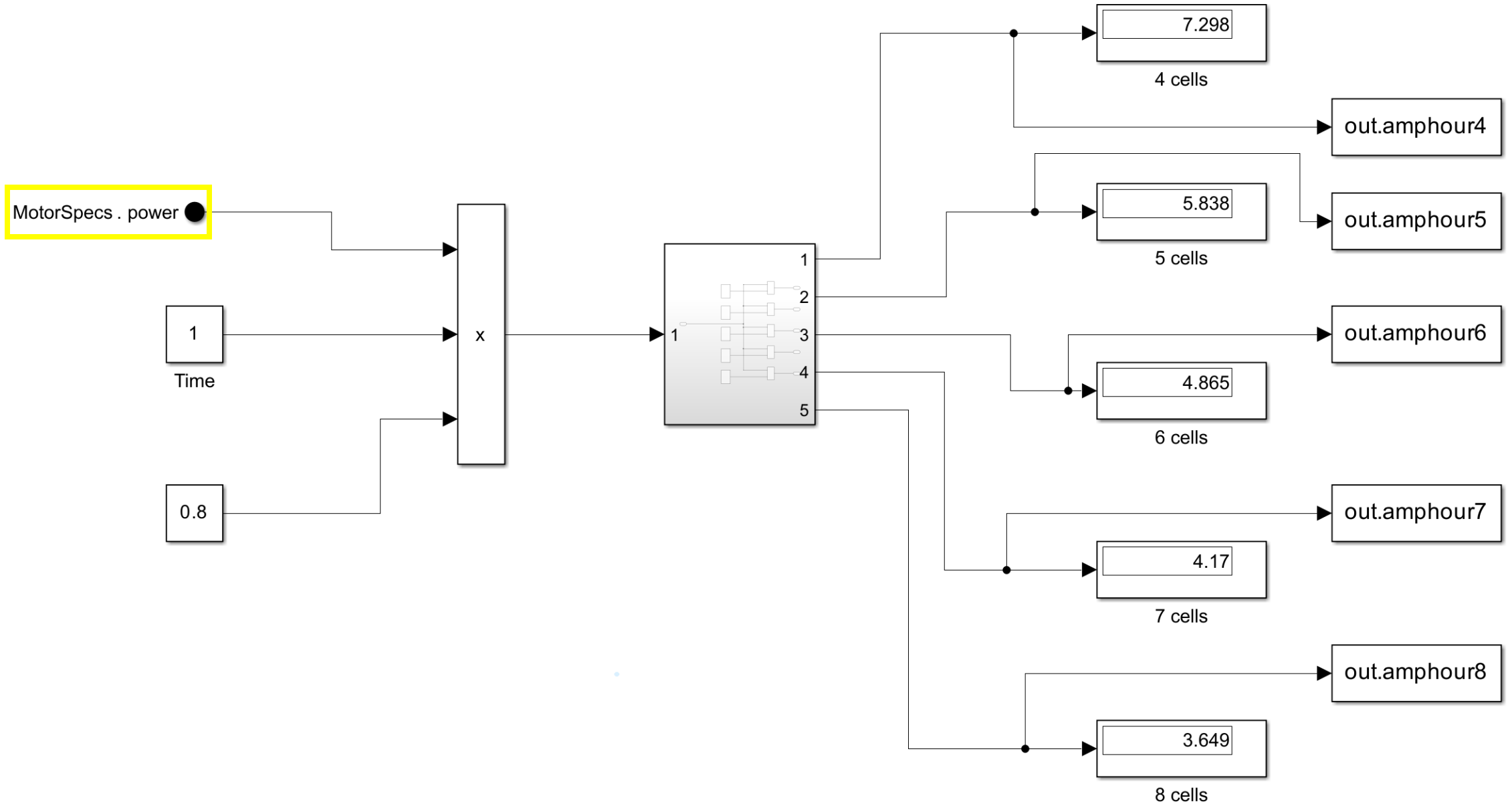

stride_freq
stance_freq
flight_freq
1
2
Torque Computation
4.547
Stance Torque
1.32
Flight Torque
2.75
Stride Frequency
stance_torque
flight_torque
stance_freq
flight_freq
NoLoad Speed for Power
No Load Speed in RPM
Stall Torque
Stall Torque and No Load Speed Computation
out.noloadspeed
468.7
no load speed
11
stall torque
out.stalltorque
4.583
Stance Frequency
6.875
Flight Frequency
Frequency Computation
MotorSpecs
Power Computation
135
Power
MotorSpecs . power
out.power


stride_freq
stance_freq
flight_freq
1
2
Torque Computation
4.547
Stance Torque
1.32
Flight Torque
2.75
Stride Frequency
stance_torque
flight_torque
stance_freq
flight_freq
NoLoad Speed for Power
No Load Speed in RPM
Stall Torque
Stall Torque and No Load Speed Computation
out.noloadspeed
468.7
no load speed
11
stall torque
out.stalltorque
4.583
Stance Frequency
6.875
Flight Frequency
Frequency Computation
MotorSpecs
Power Computation
135
Power
MotorSpecs . power
out.power

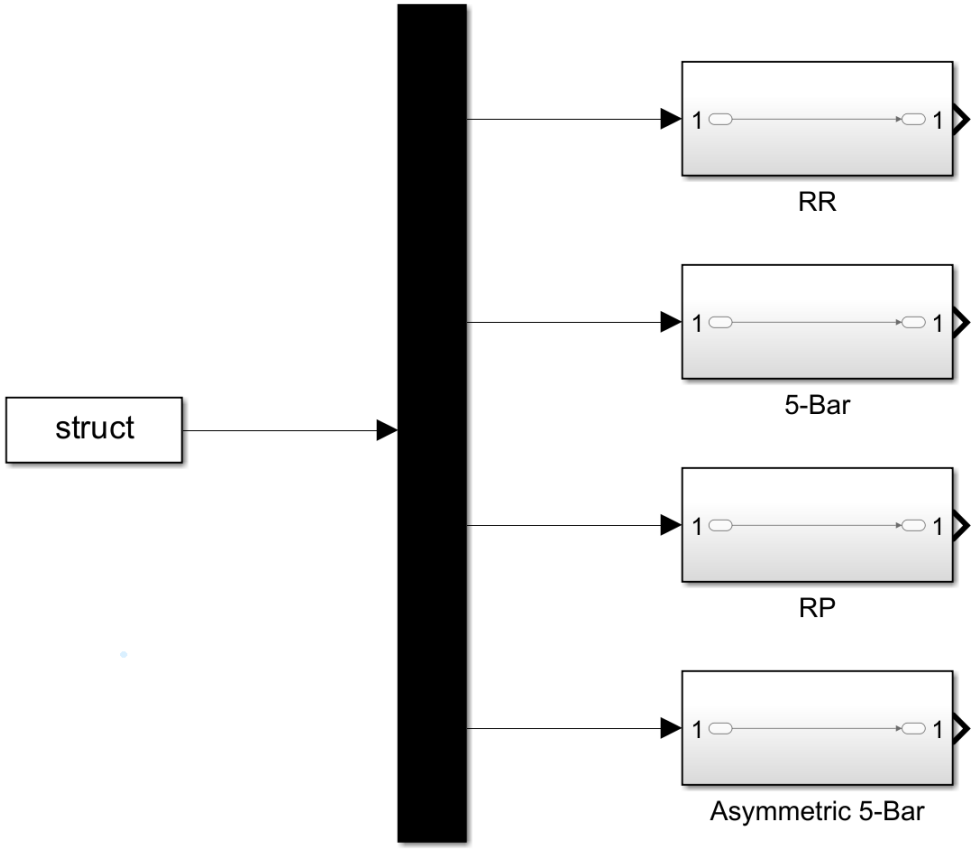
Simulink Battery Model

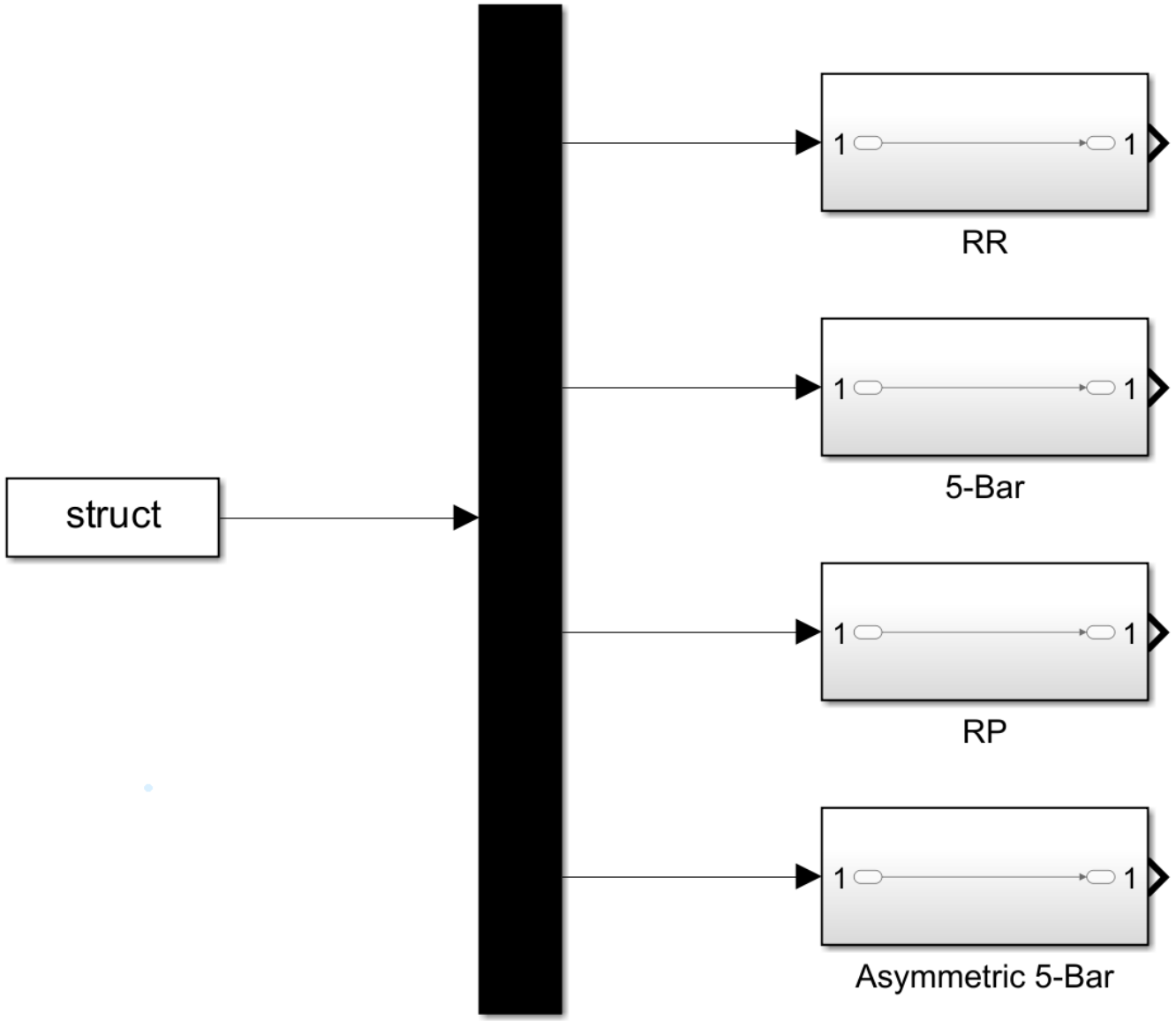



MotorSpecs . power
1
Time
0.8
x
1
2
3
4
5
7.298
4 cells
5.838
5 cells
4.865
6 cells
4.17
7 cells
3.649
8 cells
out.amphour4
out.amphour5
out.amphour6
out.amphour7
out.amphour8


MotorSpecs . power
1
Time
0.8
x
1
2
3
4
5
1
7.298
4 cells
out.amphour4
5.838
5 cells
out.amphour5
out.amphour6
4.865
6 cells
out.amphour7
4.17
7 cells
out.amphour8
3.649
8 cells

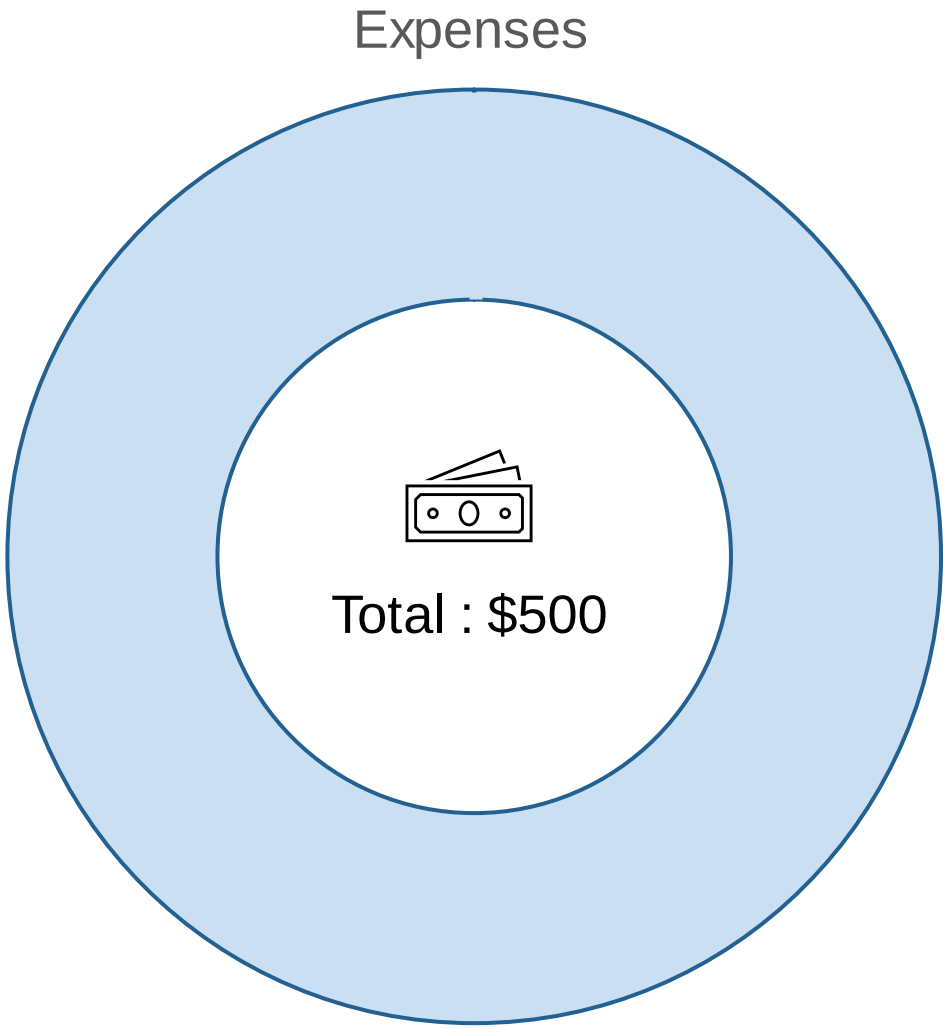
Simulink Leg Length Model




struct
1
1
RR
1
1
5-Bar
1
1
RP
1
1
Asymmetric 5-Bar

Budget Report

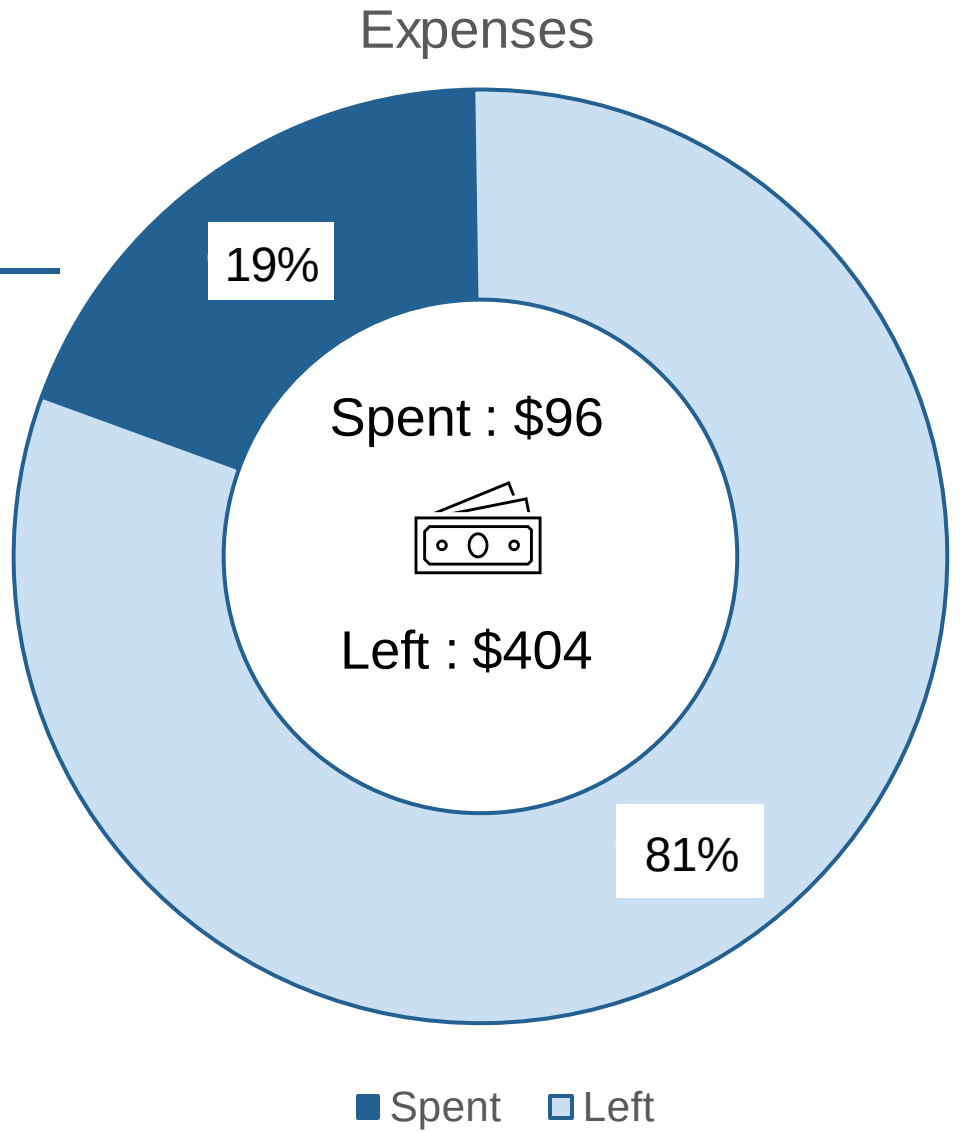
Project funding comes from $500 provided by CISCOR



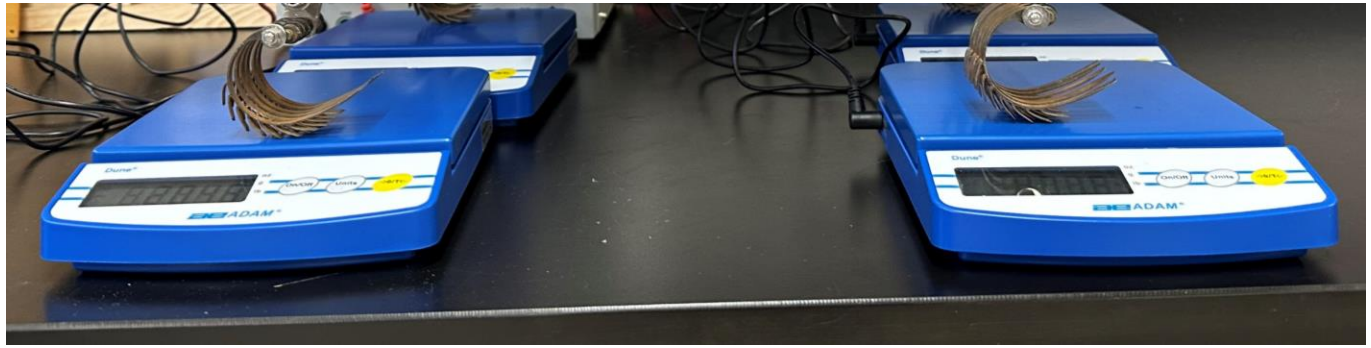
Budget Report

Compact Bench Scale

$96 (19%) spent purchasing a scale to weigh robot parts

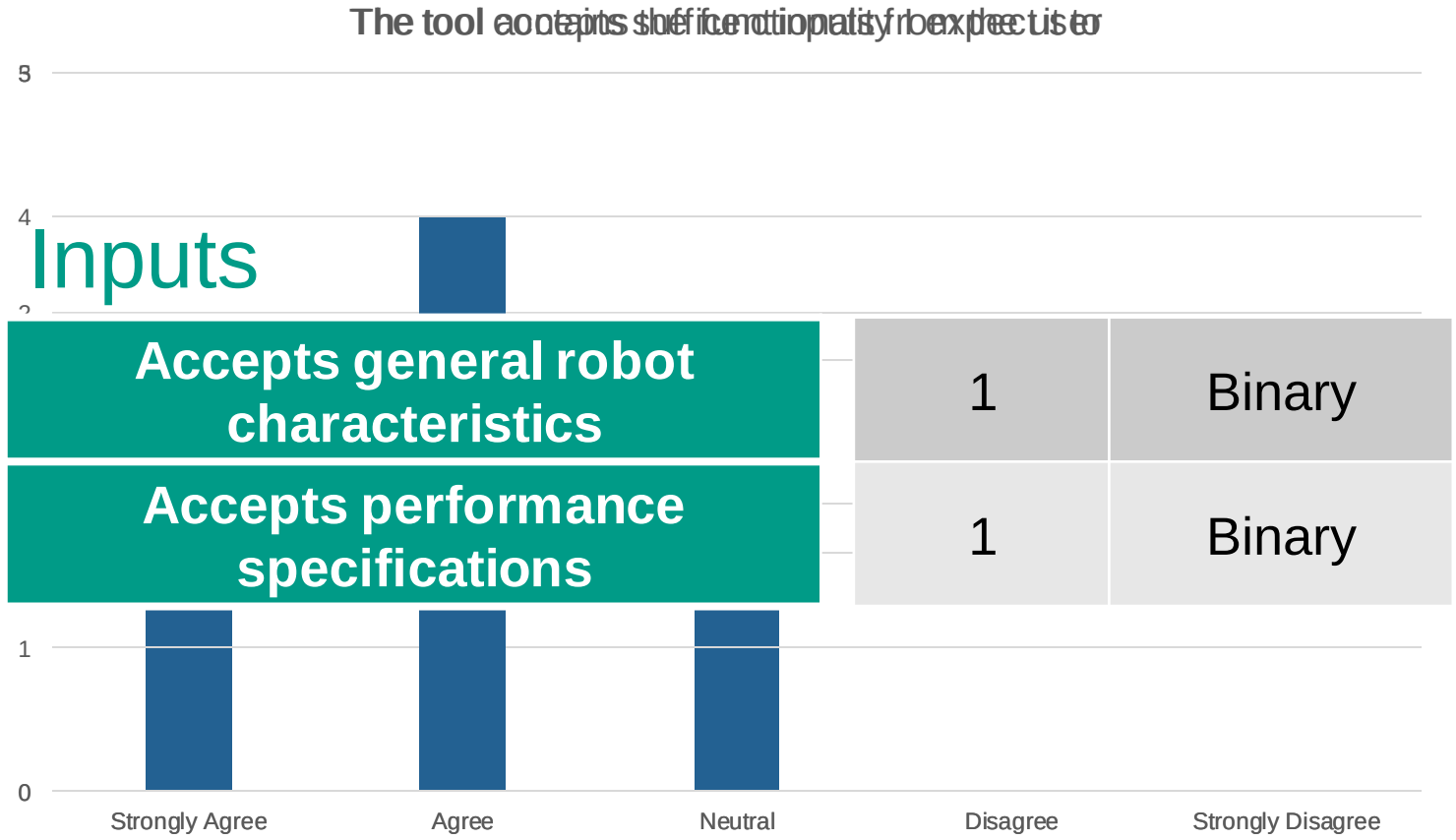


Database Creation



- Total robot mass
  - ✓ Used for verification
- Leg mass, battery mass, and sensor package mass
  - ✓ Help with mass budget
- Battery Mass
  - ✓ Used for linear approximations
- Motor mass
  - ✓ Used for verification

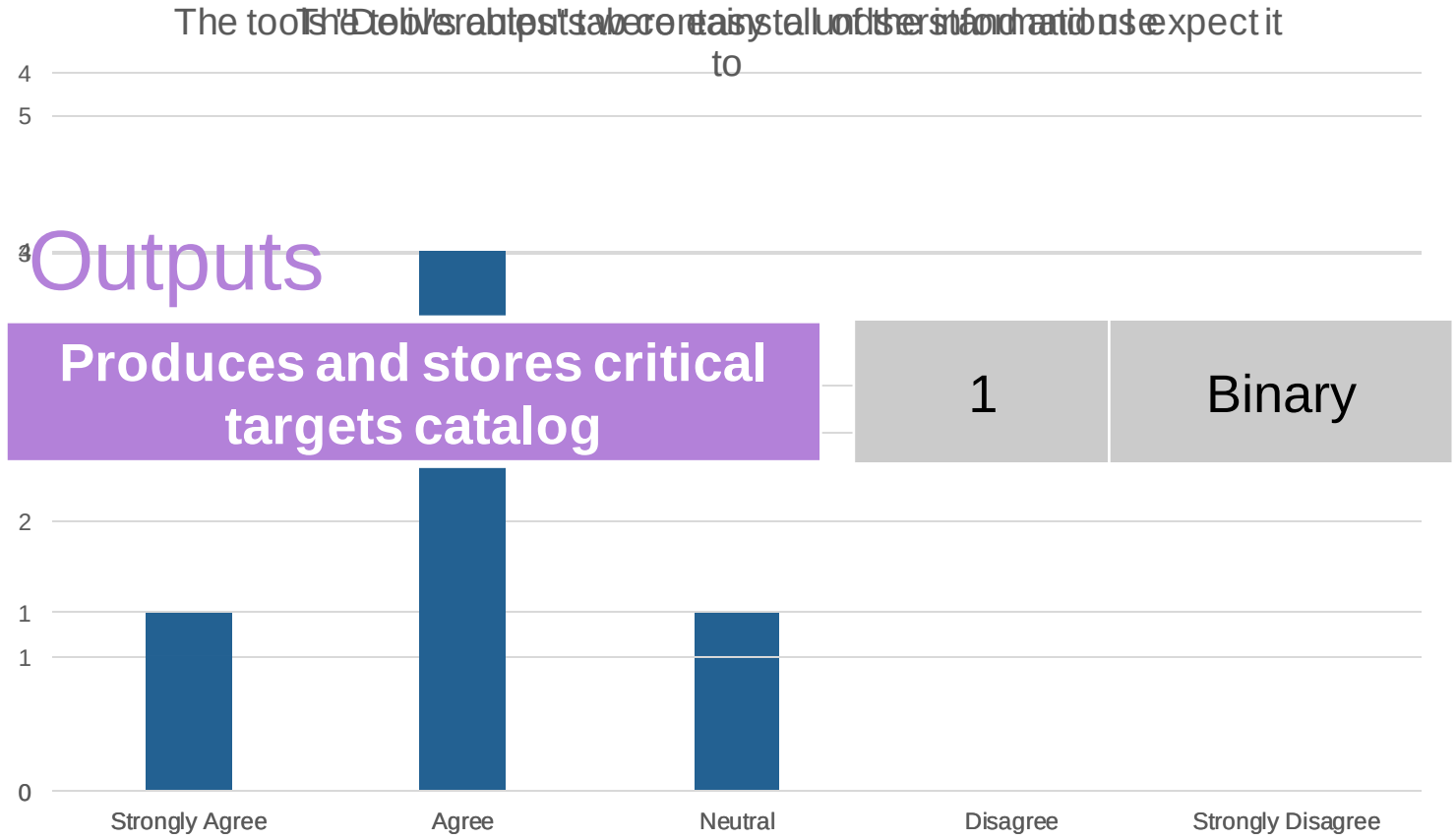
Model Validation



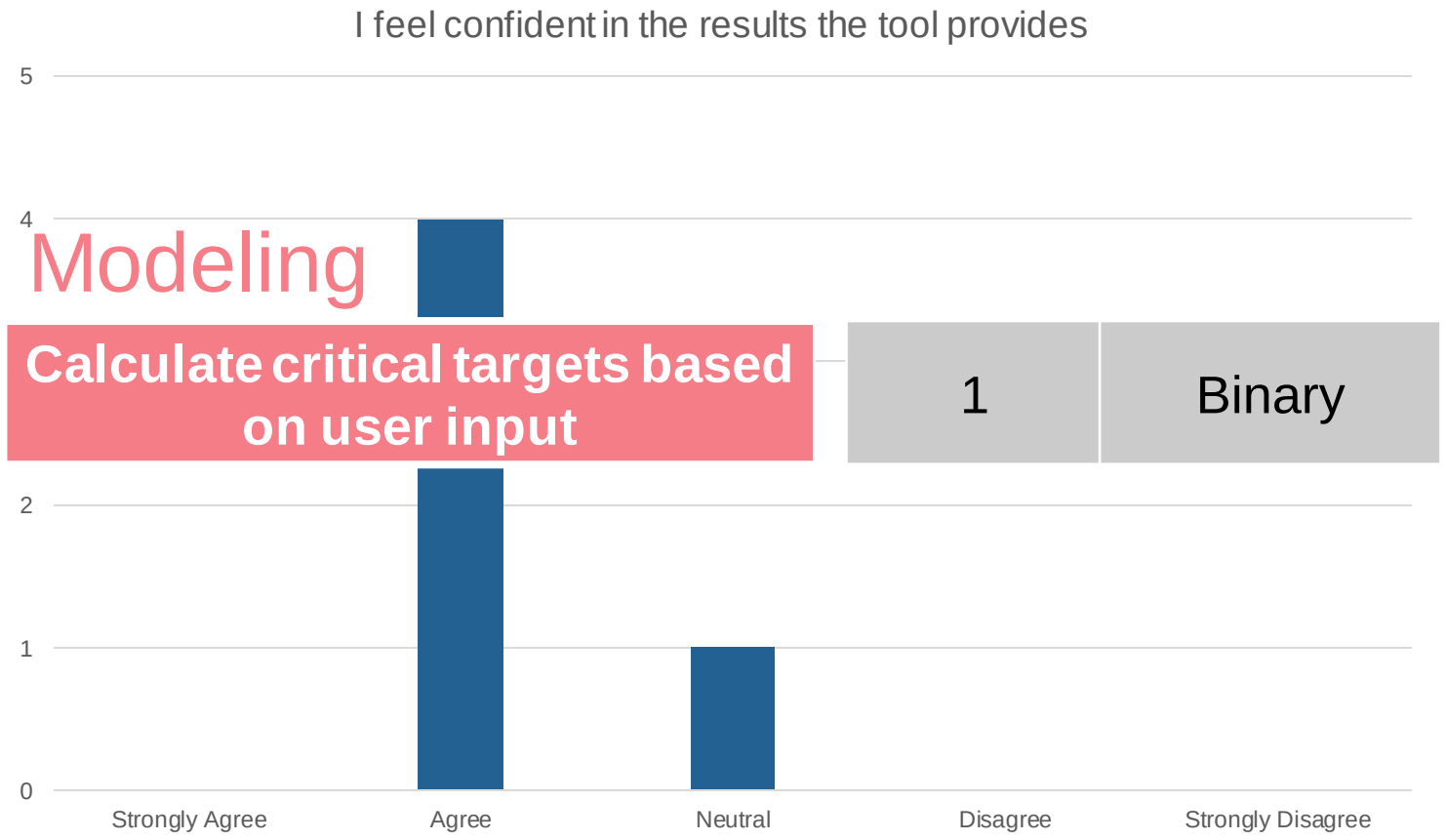
Inputs

Accepts general robot characteristics	1	Binary
Accepts performance specifications	1	Binary

Model Validation

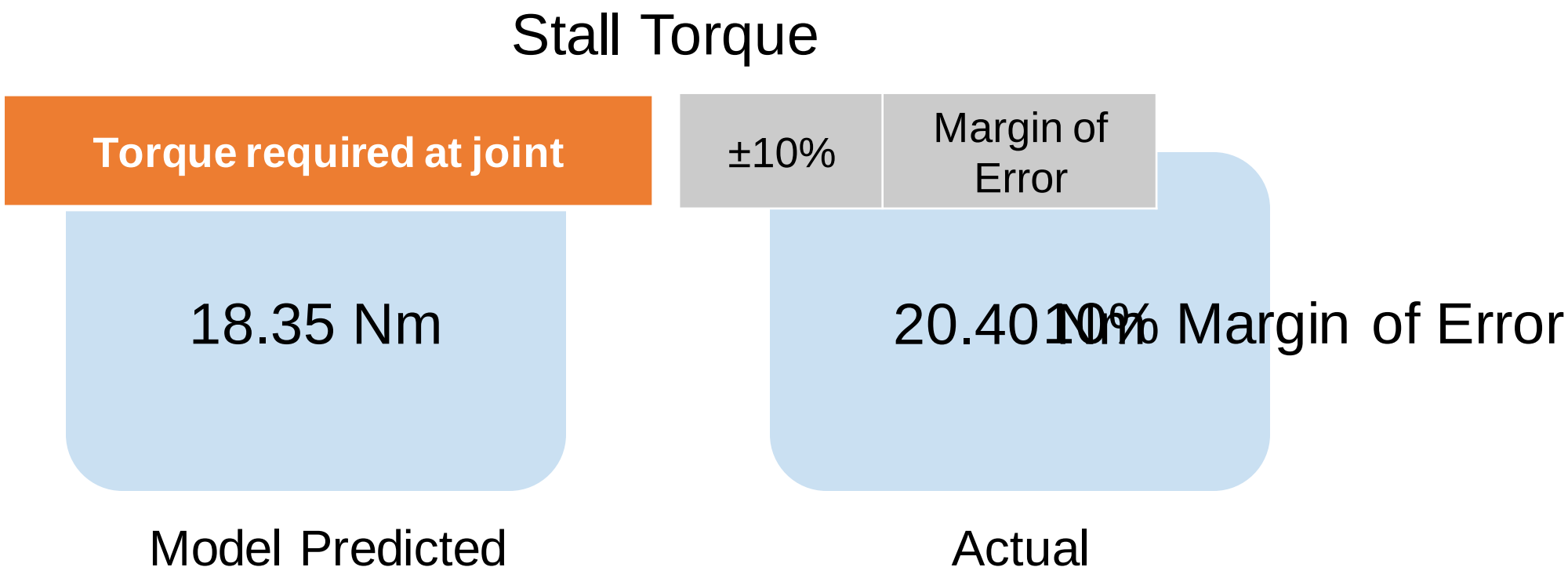


Model Validation

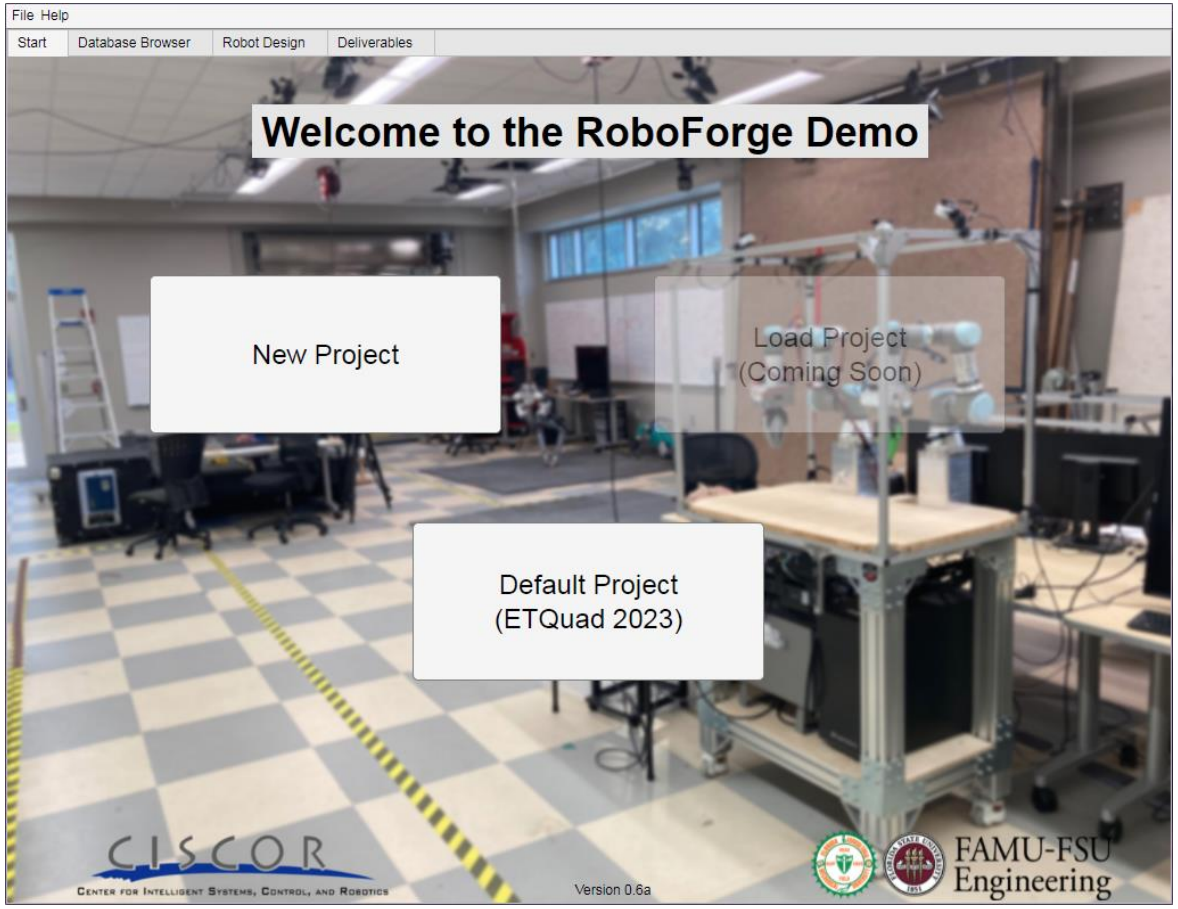


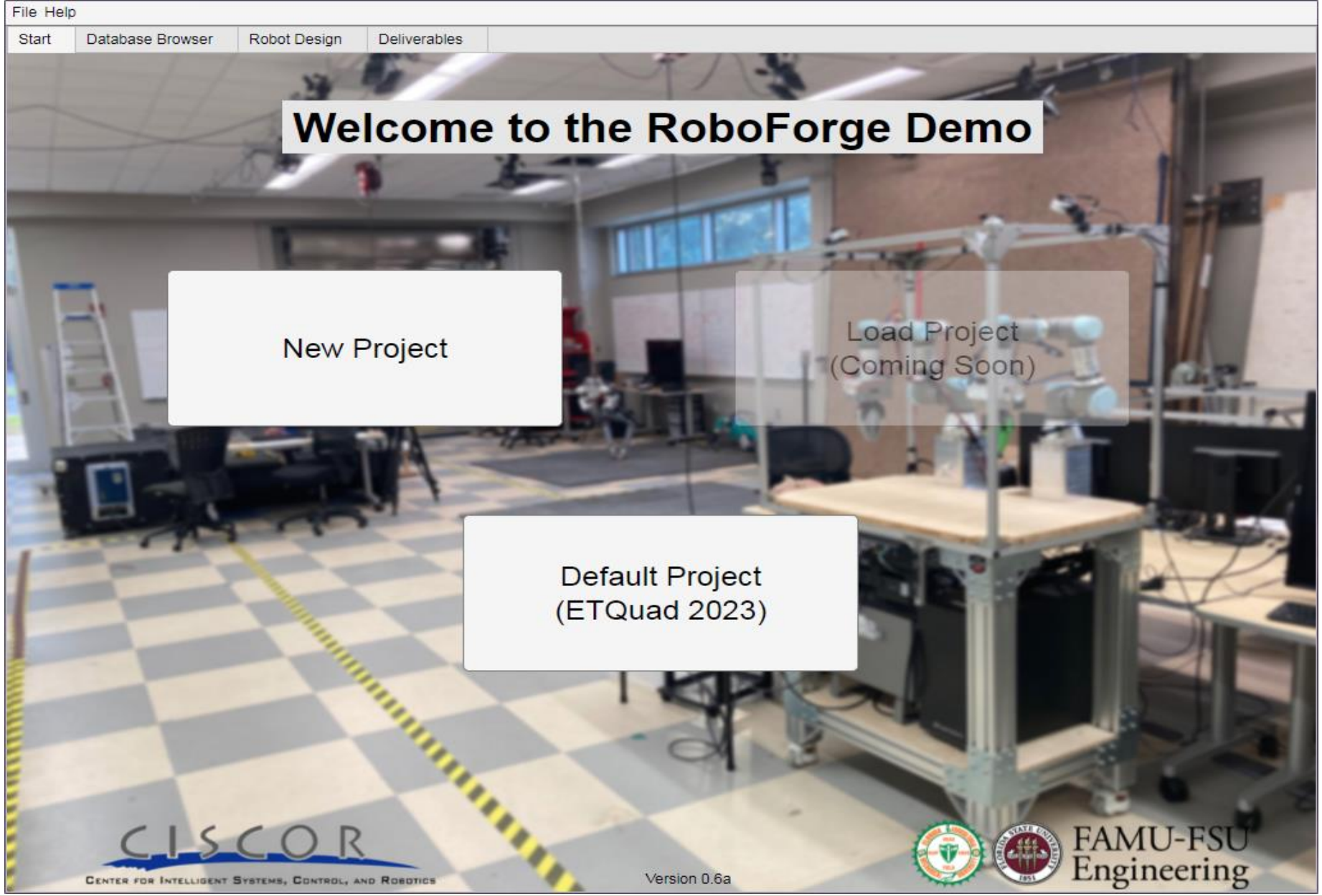
Model Validation

For a robot with a total body mass of 7.5kg:



RoboForge


File Help
Start
Database Browser
Robot Design
Deliverables
Welcome to the RoboForge Demo
New Project
Load Project
(Coming Soon)
Default Project
(ETQuad 2023)
CISCOR
Center for Intelligent Systems, Control, and Robotics
Version 0.6a
FAMU-FSU
Engineering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Robot Design
Deliverables
Welcome to the RoboForge Demo
New Project
Load Project
(Coming Soon)
Default Project
(ETQuad 2023)
CISCOR
Center for Intelligent Systems, Control, and Robotics
Version 0.6a
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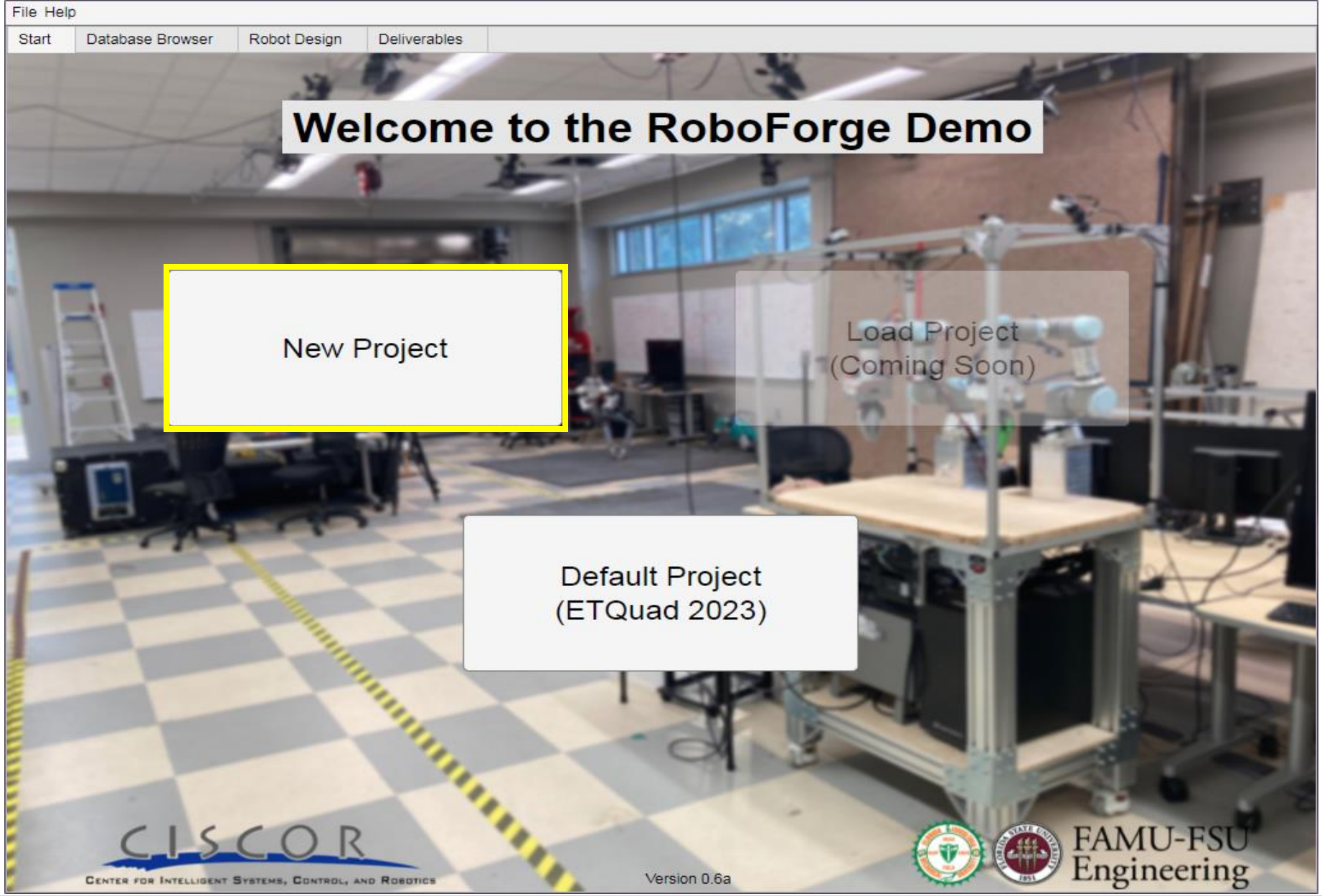
Engineering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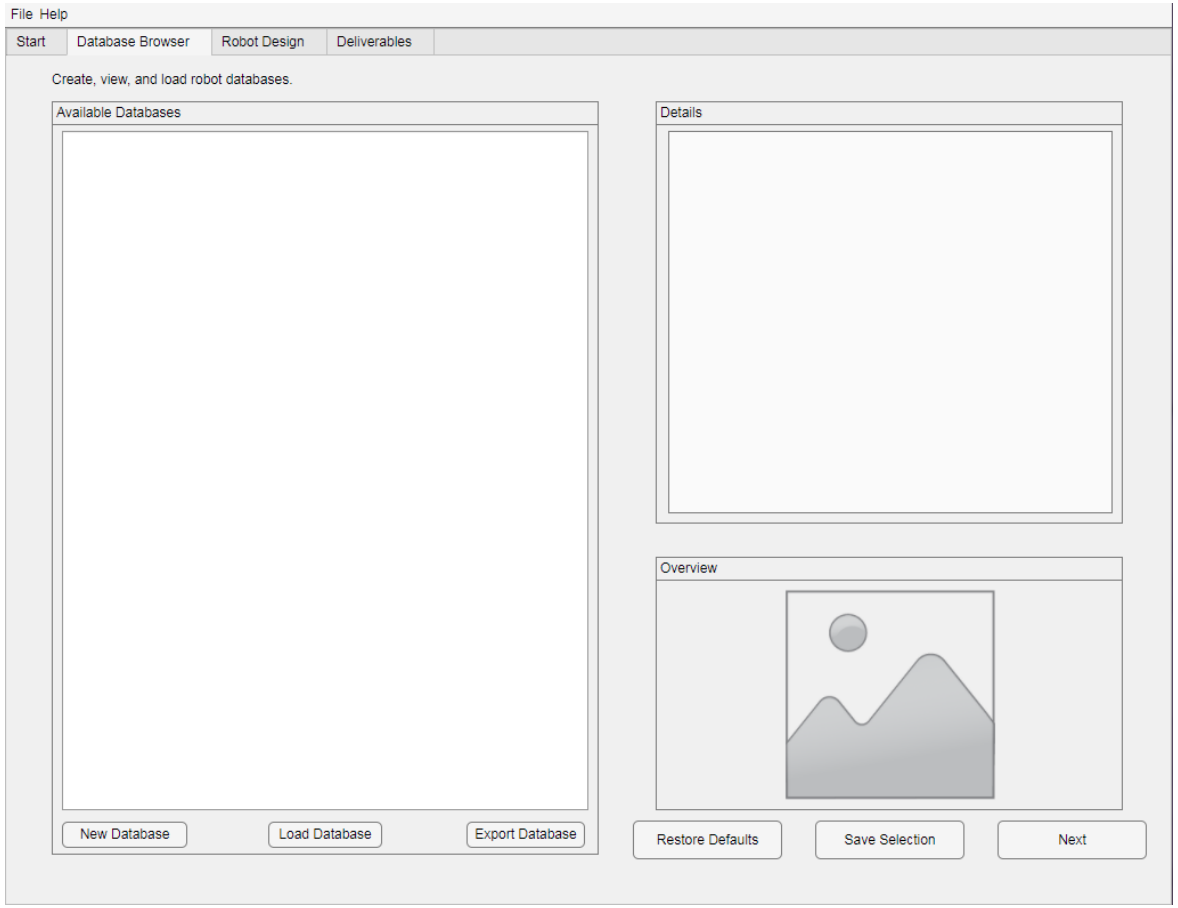
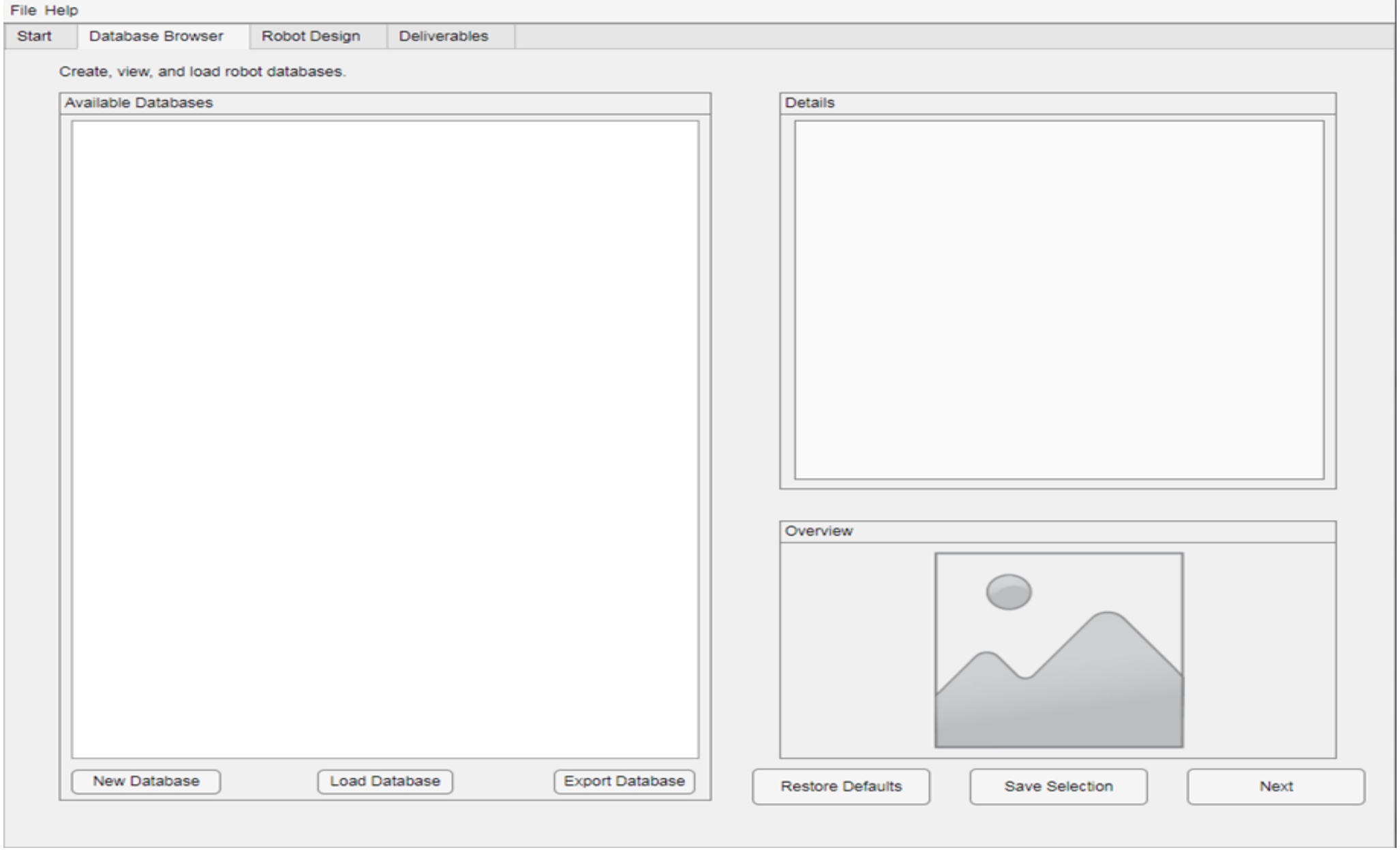
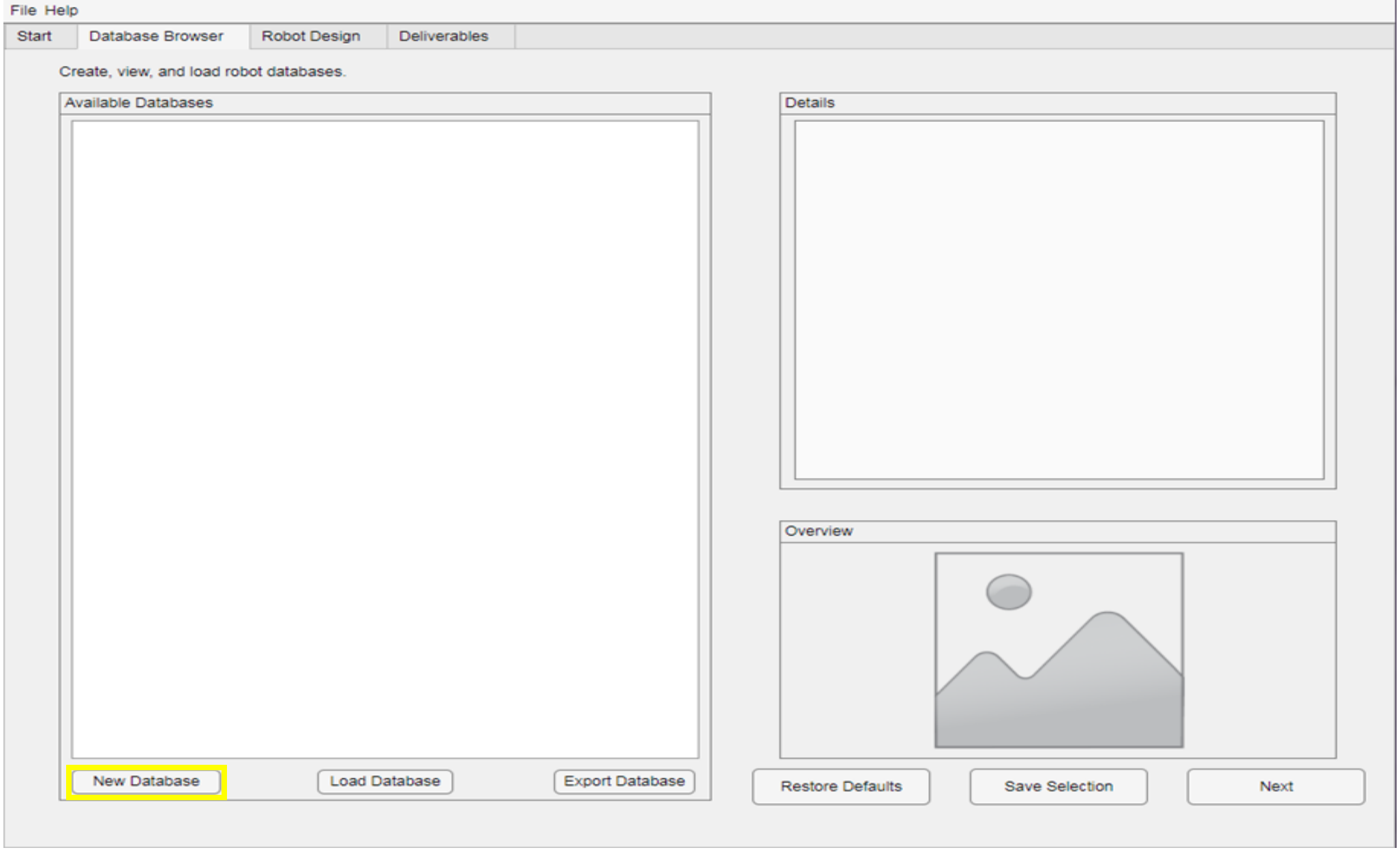
Deliverables
Welcome to the RoboForge Demo
New Project
Load Project
(Coming Soon)
Default Project
(ETQuad 2023)
CISCOR
Center for Intelligent Systems, Control, and Robotics
Version 0.6a
FAMU-FSU
Engineering

Database Browser




File Help
Start
Database Browser
Robot Design
Deliverables
Create, view, and load robot databases.
Available Databases
Details
Overview
New Database
Load Database
Export Database
Restore Defaults
Save Selection
Next


File Help
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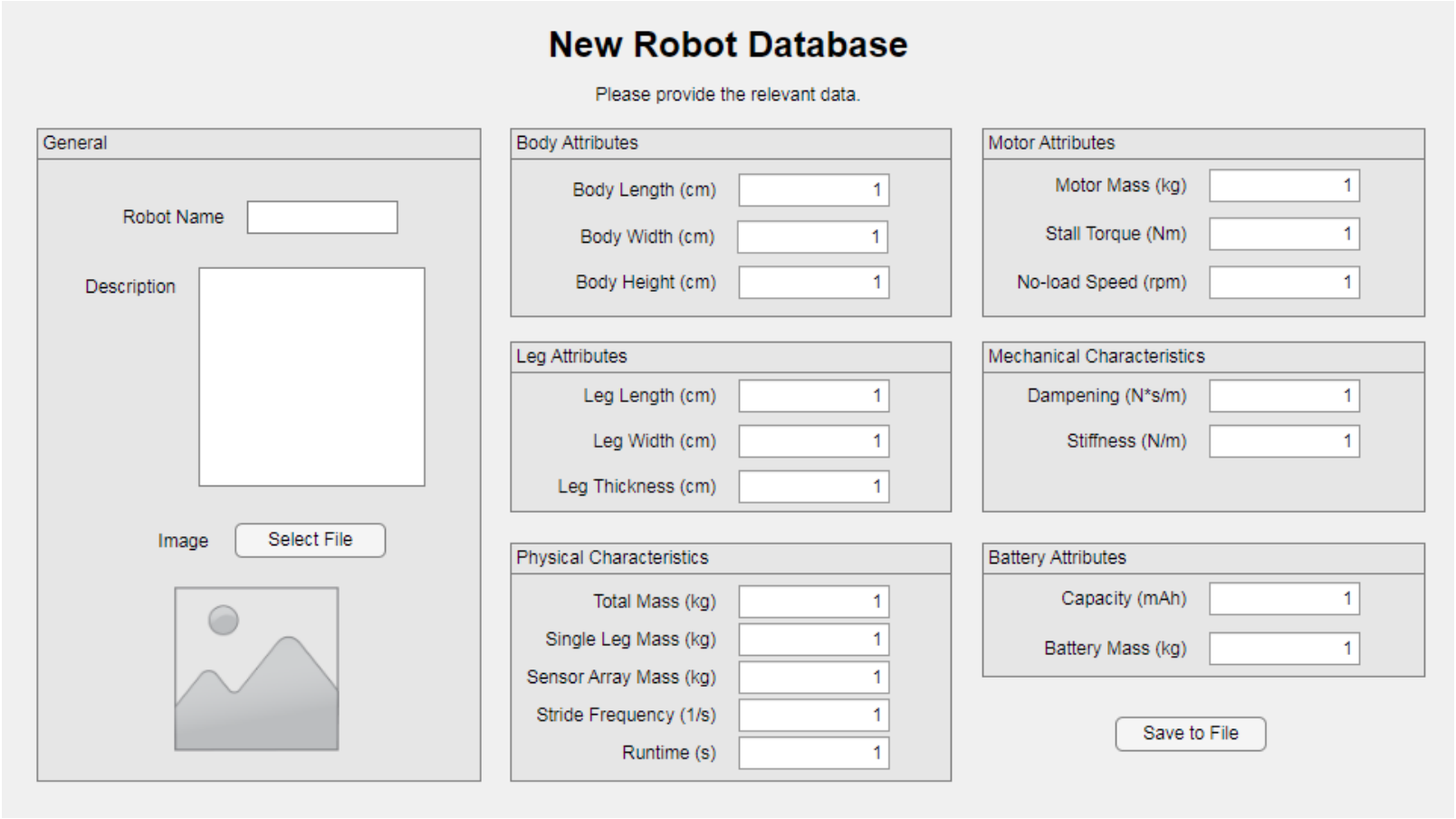
Database Browser
Robot Design
Deliverables
Create, view, and load robot databases.
Available Databases
Details
Overview
New Database
Load Database
Export Database
Restore Defaults
Save Selection
Next

Database Creator



New Robot Database

Please provide the relevant data.

General

Robot Name

Description

Image — Select File

Body Attributes

Body Length (cm)	1
Body Width (cm)	1
Body Height (cm)	1

Leg Attributes

Leg Length (cm)	1
Leg Width (cm)	1
Leg Thickness (cm)	1

Physical Characteristics

Total Mass (kg)	1
Single Leg Mass (kg)	1
Sensor Array Mass (kg)	1
Stride Frequency (1/s)	1
Runtime (s)	1

Motor Attributes

Motor Mass (kg)	1
Stall Torque (Nm)	1
No-load Speed (rpm)	1

Mechanical Characteristics

Dampening (N*s/m)	1
Stiffness (N/m)	1

Battery Attributes

Capacity (mAh)	1
Battery Mass (kg)	1

Save to File

New Robot Database

Please provide the relevant data.

General

Robot Name

Description

Image — Select File

Body Attributes

Body Length (cm)	1
Body Width (cm)	1
Body Height (cm)	1

Leg Attributes

Leg Length (cm)	1
Leg Width (cm)	1
Leg Thickness (cm)	1

Physical Characteristics

Total Mass (kg)	1
Single Leg Mass (kg)	1
Sensor Array Mass (kg)	1
Stride Frequency (1/s)	1
Runtime (s)	1

Motor Attributes

Motor Mass (kg)	1
Stall Torque (Nm)	1
No-load Speed (rpm)	1

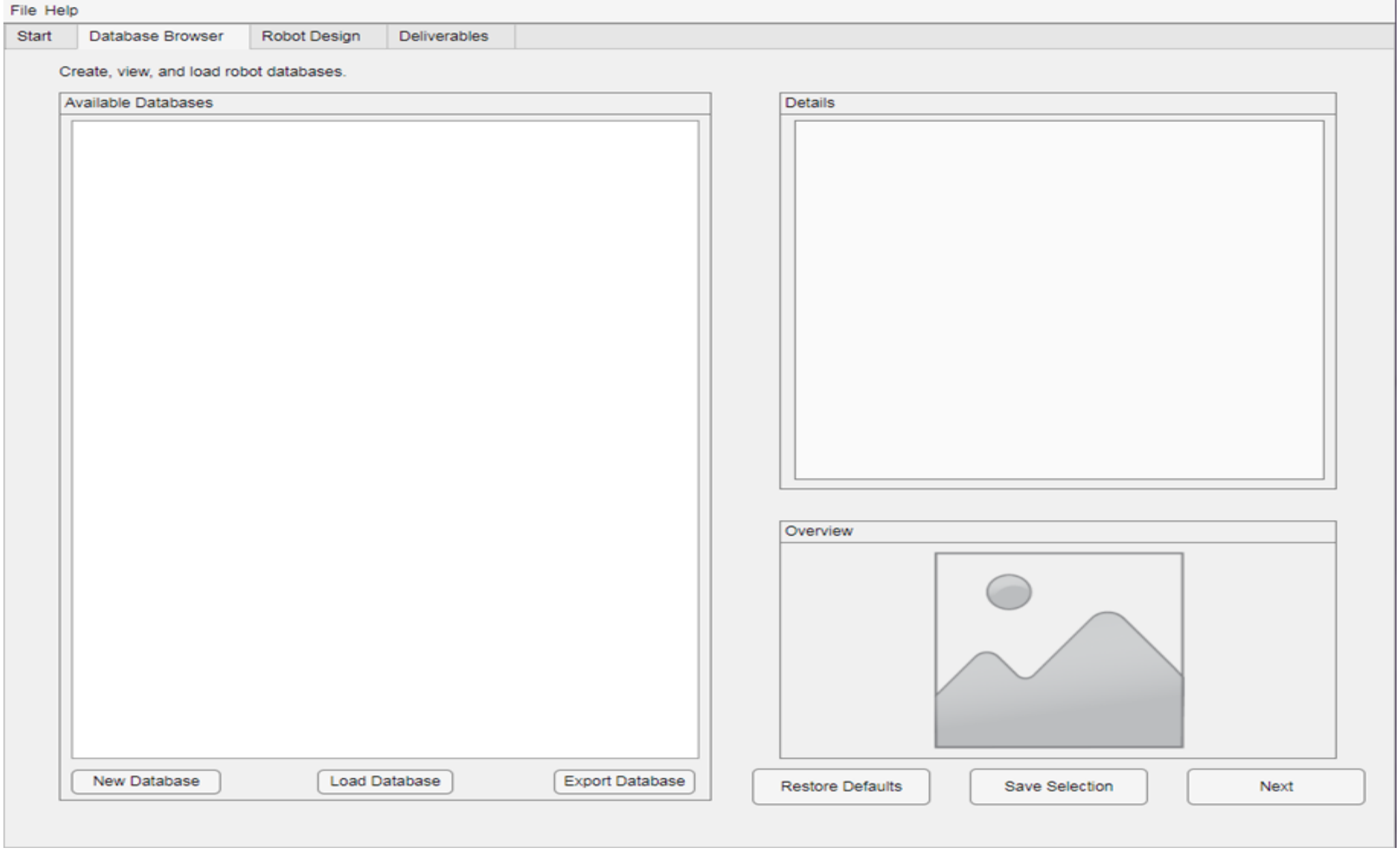
Mechanical Characteristics

Dampening (N*s/m)	1
Stiffness (N/m)	1

Battery Attributes

Capacity (mAh)	1
Battery Mass (kg)	1

Save to File


File Help
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Details
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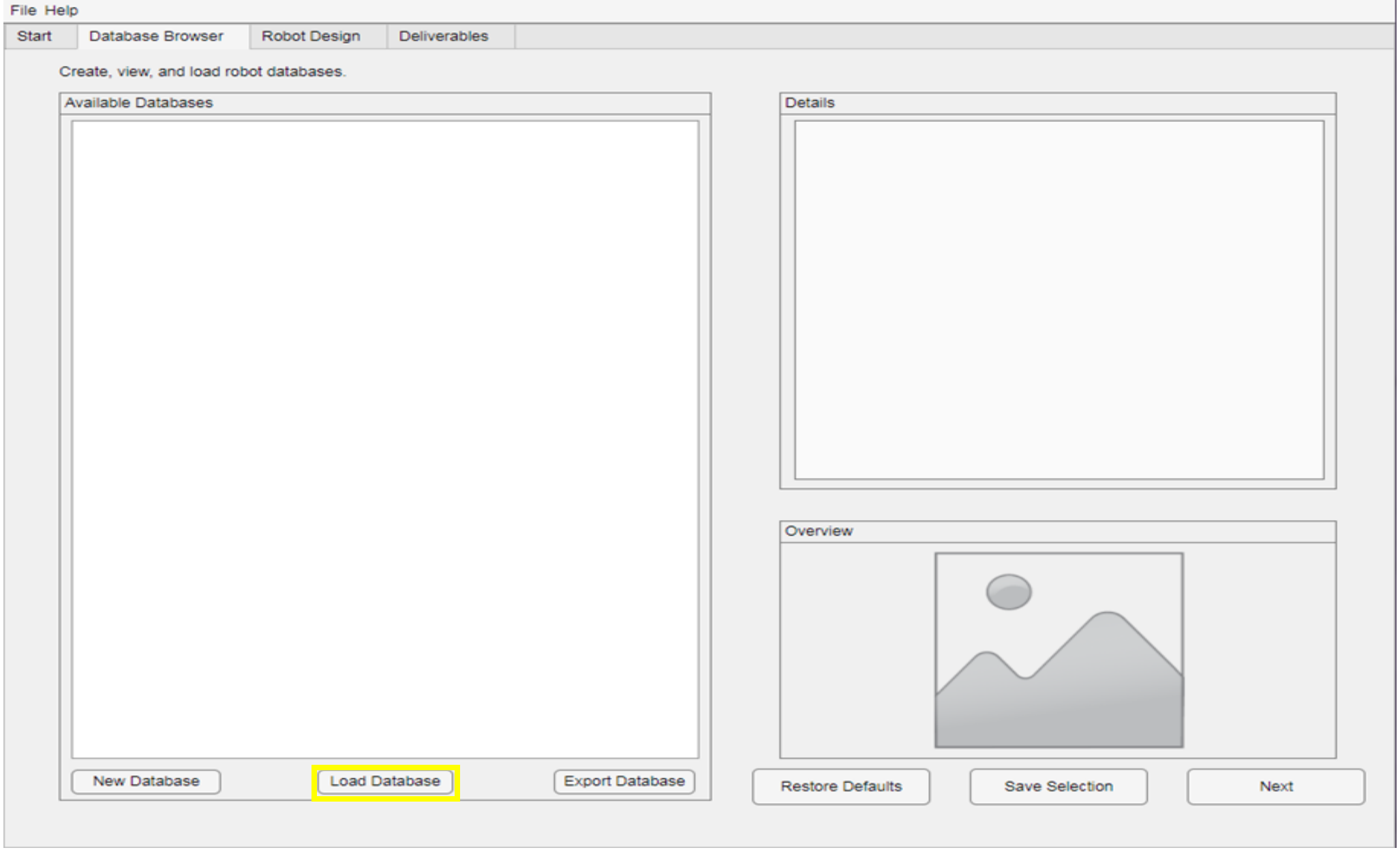
New Database
Load Database
Export Database
Restore Defaults
Save Selection
Next


File Help
Start
Database Browser
Robot Design
Deliverables
Create, view, and load robot databases.
Available Databases
Details
Overview
New Database
Load Database
Export Database
Restore Defaults
Save Selection
Next

File Help

Start | Database Browser | Robot Design | Deliverables

Create, view, and load robot databases.

Available Databases

ETQuad

New Database | Load Database | Export Database

Details

Database: ETQuad

Available Nodes: body, leg, motor, battery

Description: Quadrupedal robot designed by CISCOR, Spring 2022.

Date Modified: 07-Mar-2023 20:28:28

Overview

Restore Defaults | Save Selection | Next

File Help

Start | Database Browser | Robot Design | Deliverables

Create, view, and load robot databases.

Available Databases

ETQuad

New Database | Load Database | Export Database

Details

Database: ETQuad

Available Nodes: body, leg, motor, battery

Description: Quadrupedal robot designed by CISCOR, Spring 2022.

Date Modified: 07-Mar-2023 20:28:28

Overview

Restore Defaults | Save Selection | Next

File Help

Start | Database Browser | Robot Design | Deliverables

Create, view, and load robot databases.

Available Databases

ETQuad

New Database | Load Database | Export Database

Details

Database: ETQuad

Available Nodes: body, leg, motor, battery

Description: Quadrupedal robot designed by CISCOR, Spring 2022.

Date Modified: 07-Mar-2023 20:28:28

Overview

Restore Defaults | Save Selection | Next

File Help

Start | Database Browser | Robot Design | Deliverables

Create, view, and load robot databases.

Available Databases

ETQuad

New Database | Load Database | Export Database

Details

Database: ETQuad

Available Nodes: body, leg, motor, battery

Description: Quadrupedal robot designed by CISCOR, Spring 2022.

Date Modified: 07-Mar-2023 20:28:28

Overview

Restore Defaults | Save Selection | Next

File Help

Start | Database Browser | Robot Design | Deliverables

Create, view, and load robot databases.

Available Databases

ETQuad

New Database | Load Database | Export Database

Details

Database: ETQuad

Available Nodes: body, leg, motor, battery

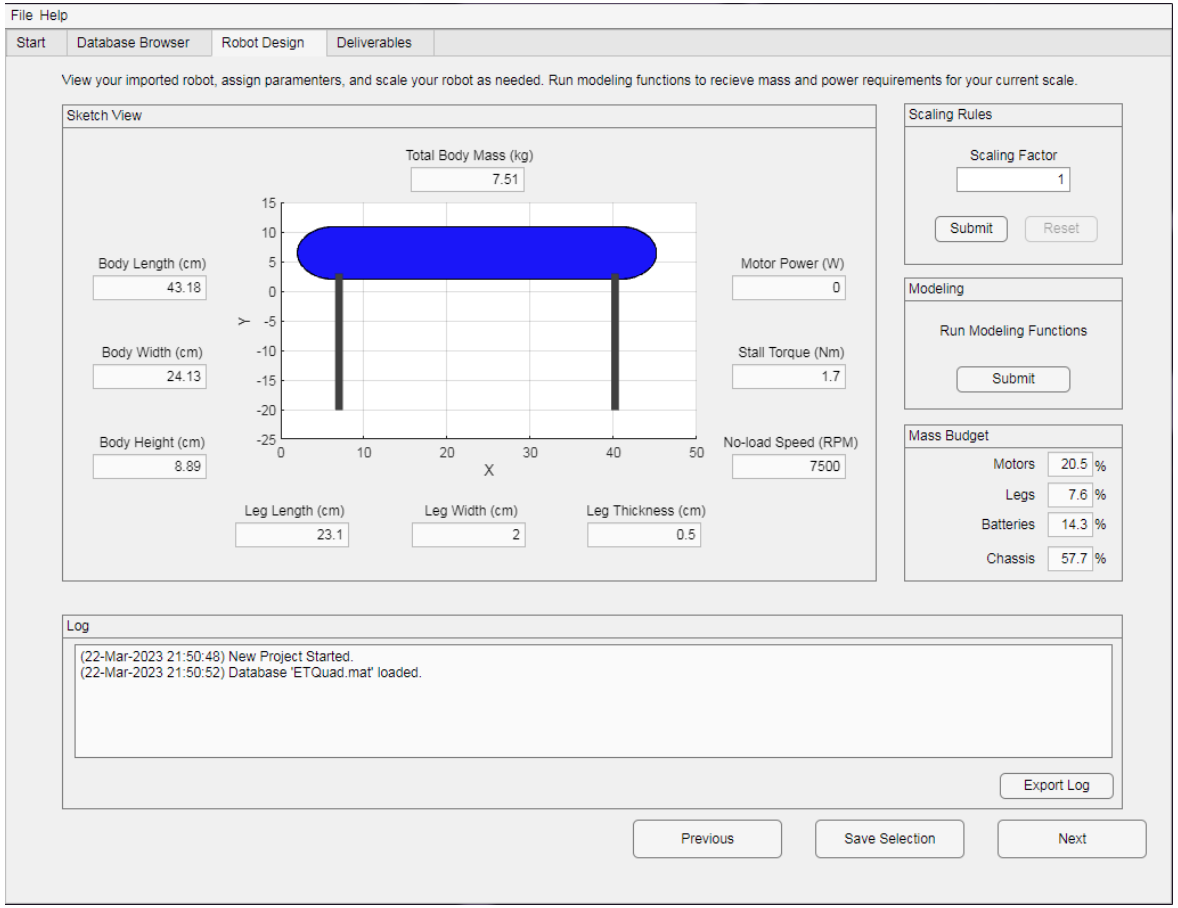
Description: Quadrupedal robot designed by CISCOR, Spring 2022.

Date Modified: 07-Mar-2023 20:28:28

Overview

Restore Defaults | Save Selection | Next

Robot Design



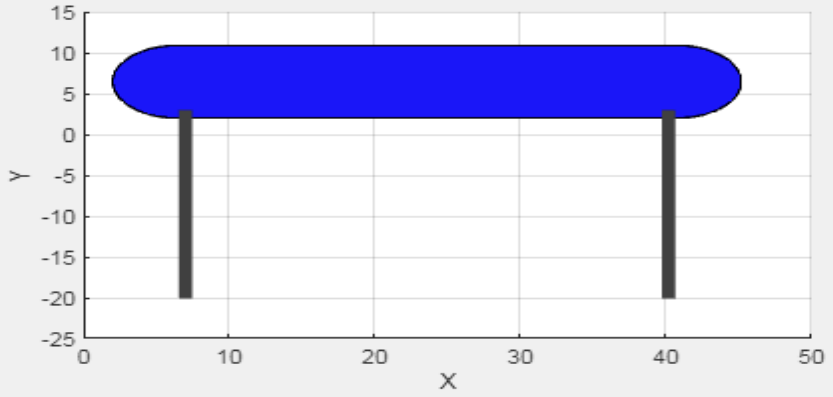
File Help

Start | Database Browser | Robot Design | Deliverables

View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.

Sketch View

Total Body Mass (kg): 7.51



Body Length (cm): 43.18

Body Width (cm): 24.13

Body Height (cm): 8.89

Motor Power (W): 0

Stall Torque (Nm): 1.7

No-load Speed (RPM): 7500

Leg Length (cm): 23.1

Leg Width (cm): 2

Leg Thickness (cm): 0.5

Scaling Rules

Scaling Factor: 1

Submit | Reset

Modeling

Run Modeling Functions

Submit

Mass Budget

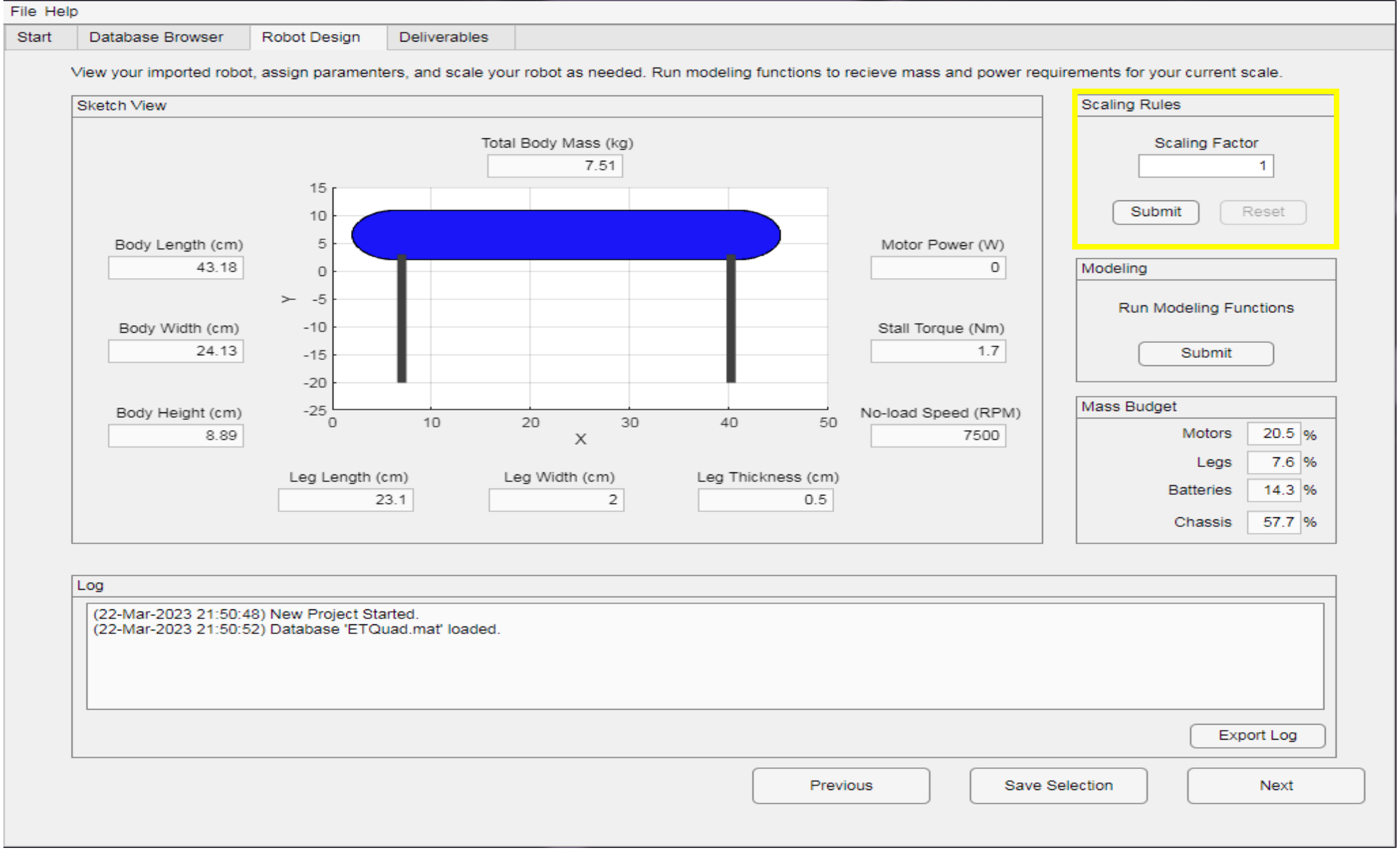
Motors	20.5 %
Legs	7.6 %
Batteries	14.3 %
Chassis	57.7 %

Log

(22-Mar-2023 21:50:48) New Project Started.
(22-Mar-2023 21:50:52) Database 'ETQuad.mat' loaded.

Export Log

Previous | Save Selection | Next


File Help
Start
Database Browser
Robot Design
Deliverables
View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.
Sketch View
Total Body Mass (kg)
7.51
Body Length (cm)
43.18
Body Width (cm)
24.13
Body Height (cm)
8.89
Motor Power (W)
0
Stall Torque (Nm)
1.7
No-load Speed (RPM)
7500
Leg Length (cm)
23.1
Leg Width (cm)
2
Leg Thickness (cm)
0.5
X
Y
Scaling Rules
Scaling Factor
1
Submit
Reset
Modeling
Run Modeling Functions
Submit
Mass Budget
Motors 20.5 %
Legs 7.6 %
Batteries 14.3 %
Chassis 57.7 %
Log
(22-Mar-2023 21:50:48) New Project Started.
(22-Mar-2023 21:50:52) Database 'ETQuad.mat' loaded.
Export Log
Previous
Save Selection
Next

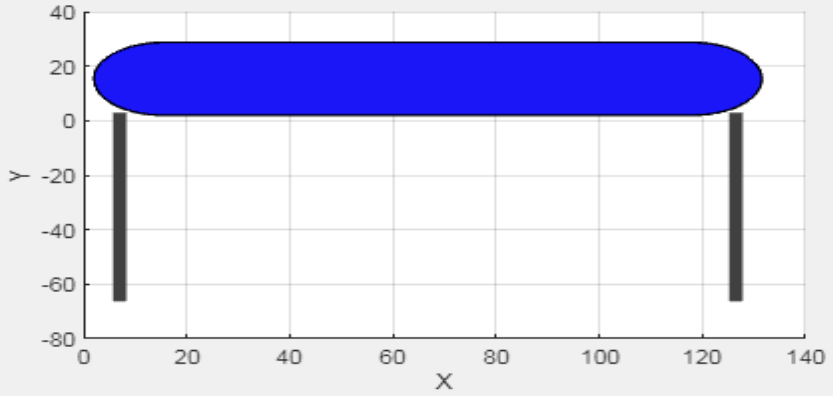
File Help

Start | Database Browser | Robot Design | Deliverables

View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.

Sketch View

Total Body Mass (kg): 202.8



Body Length (cm): 129.5

Body Width (cm): 72.39

Body Height (cm): 26.67

Motor Power (W): 0

Stall Torque (Nm): 41.22

No-load Speed (RPM): 0.08364

Leg Length (cm): 69.3

Leg Width (cm): 6

Leg Thickness (cm): 1.5

Scaling Rules

Scaling Factor: 3

Submit | Reset

Modeling

Run Modeling Functions

Submit

Mass Budget

Motors	20.5	%
Legs	7.6	%
Batteries	0.5	%
Chassis	71.4	%

Log

(22-Mar-2023 21:50:48) New Project Started.
(22-Mar-2023 21:50:52) Database 'ETQuad.mat' loaded.
(22-Mar-2023 21:56:02) Scaling factor of 3 has been applied.

Export Log

Previous | Save Selection | Next

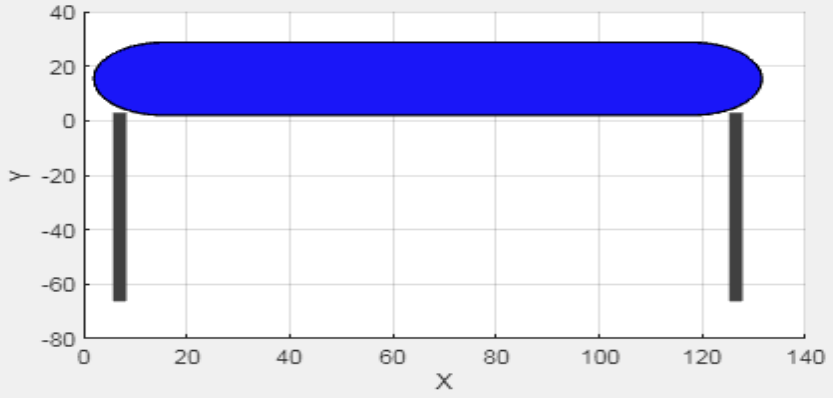
File Help

Start | Database Browser | Robot Design | Deliverables

View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.

Sketch View

Total Body Mass (kg): 202.8



Body Length (cm): 129.5

Body Width (cm): 72.39

Body Height (cm): 26.67

Motor Power (W): 0

Stall Torque (Nm): 41.22

No-load Speed (RPM): 0.08364

Leg Length (cm): 69.3

Leg Width (cm): 6

Leg Thickness (cm): 1.5

Scaling Rules

Scaling Factor: 3

Submit | Reset

Modeling

Run Modeling Functions

Submit

Mass Budget

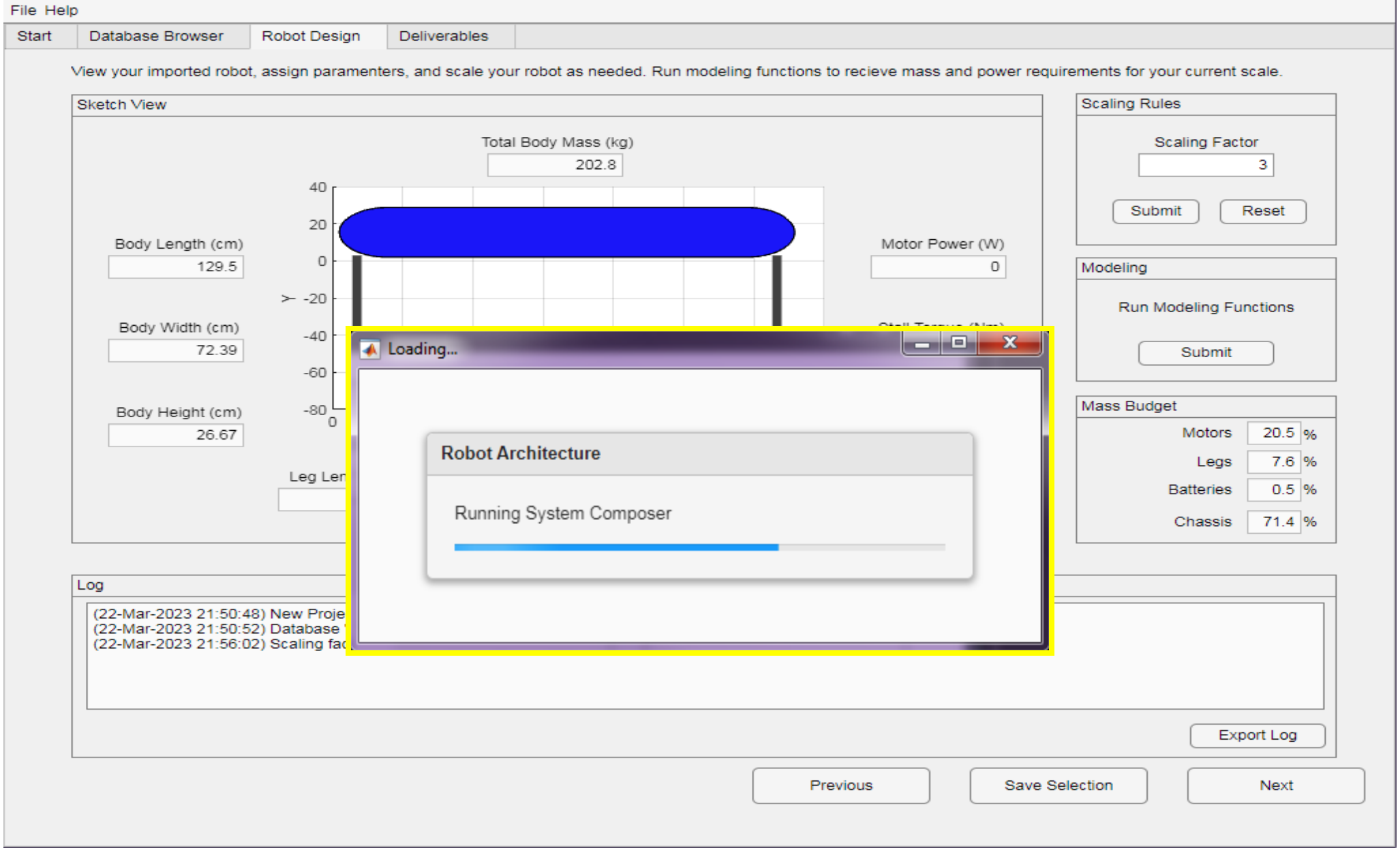
Motors	20.5 %
Legs	7.6 %
Batteries	0.5 %
Chassis	71.4 %

Log

(22-Mar-2023 21:50:48) New Project Started.
(22-Mar-2023 21:50:52) Database 'ETQuad.mat' loaded.
(22-Mar-2023 21:56:02) Scaling factor of 3 has been applied.

Export Log

Previous | Save Selection | Next


File Help
Start
Database Browser
Robot Design
Deliverables
View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.
Sketch View
Total Body Mass (kg)
202.8
Body Length (cm)
129.5
Body Width (cm)
72.39
Body Height (cm)
26.67
Motor Power (W)
0
Loading...
Robot Architecture
Running System Composer
Scaling Rules
Scaling Factor
3
Submit
Reset
Modeling
Run Modeling Functions
Submit
Mass Budget
Motors 20.5 %
Legs 7.6 %
Batteries 0.5 %
Chassis 71.4 %
Log
(22-Mar-2023 21:50:48) New Proje
(22-Mar-2023 21:50:52) Database
(22-Mar-2023 21:56:02) Scaling fa
Export Log
Previous
Save Selection
Next

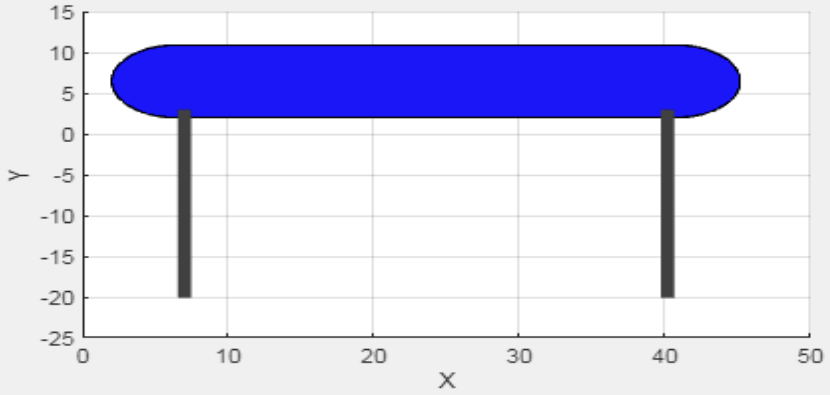
File Help

Start | Database Browser | Robot Design | Deliverables

View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.

Sketch View

Total Body Mass (kg): 7.51



Body Length (cm): 43.18

Body Width (cm): 24.13

Body Height (cm): 8.89

Motor Power (W): 231.8

Stall Torque (Nm): 18.38

No-load Speed (RPM): 481.8

Leg Length (cm): 23.1

Leg Width (cm): 2

Leg Thickness (cm): 0.5

Scaling Rules

Scaling Factor: 1

Submit | Reset

Modeling

Run Modeling Functions

Submit

Mass Budget

Motors	20.5 %
Legs	7.6 %
Batteries	14.3 %
Chassis	57.7 %

Log

```
(22-Mar-2023 22:01:23) Database 'ETQuad.mat' loaded.
(22-Mar-2023 22:01:32) Scaling factor of 3 has been applied.
(22-Mar-2023 22:01:34) Robot scaling restored to its initial state.
(22-Mar-2023 22:01:37) Simulink analysis initialized.
(22-Mar-2023 22:01:43) Simulink analysis completed.
```

Export Log

Previous | Save Selection | Next

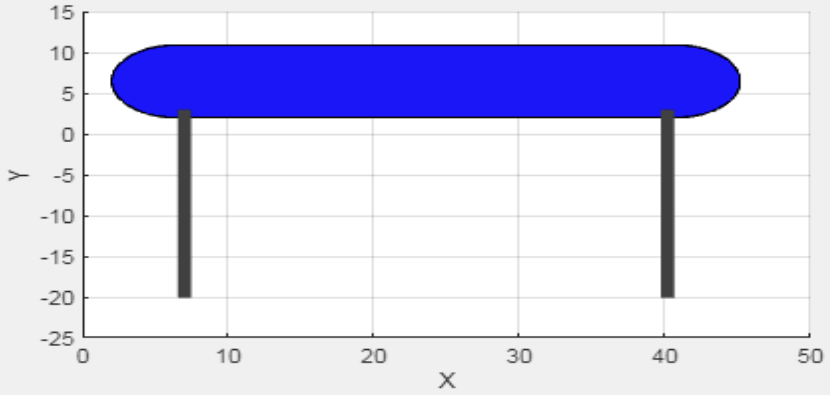
File Help

Start | Database Browser | Robot Design | Deliverables

View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.

Sketch View

Total Body Mass (kg): 7.51



Body Length (cm): 43.18

Body Width (cm): 24.13

Body Height (cm): 8.89

Motor Power (W): 231.8

Stall Torque (Nm): 18.38

No-load Speed (RPM): 481.8

Leg Length (cm): 23.1

Leg Width (cm): 2

Leg Thickness (cm): 0.5

Scaling Rules

Scaling Factor: 1

Submit | Reset

Modeling

Run Modeling Functions

Submit

Mass Budget

Motors	20.5	%
Legs	7.6	%
Batteries	14.3	%
Chassis	57.7	%

Log

```
(22-Mar-2023 22:01:23) Database 'ETQuad.mat' loaded.
(22-Mar-2023 22:01:32) Scaling factor of 3 has been applied.
(22-Mar-2023 22:01:34) Robot scaling restored to its initial state.
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(22-Mar-2023 22:01:43) Simulink analysis completed.
```
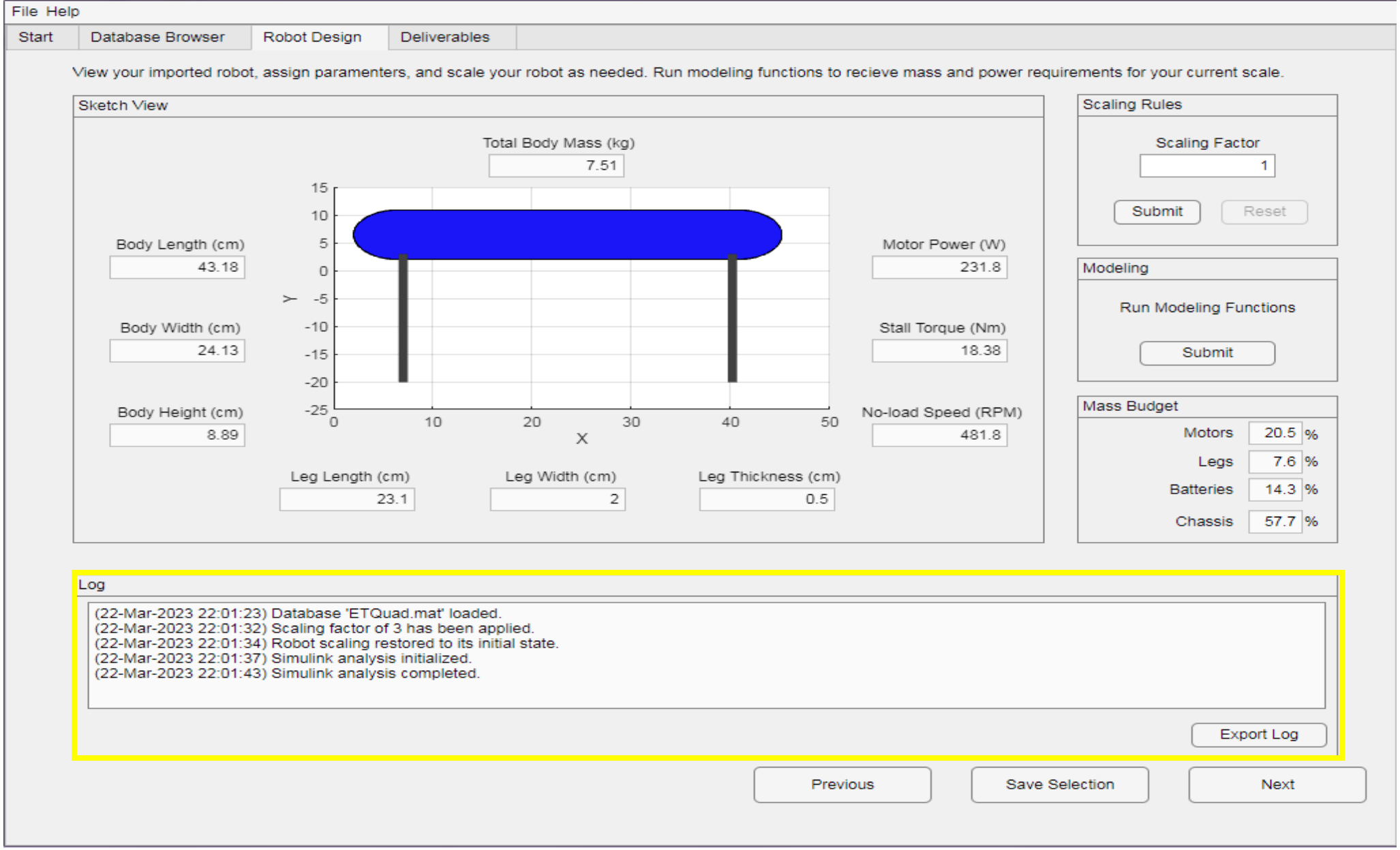

Export Log

Previous | Save Selection | Next


File Help
Start
Database Browser
Robot Design
Deliverables
View your imported robot, assign paramenters, and scale your robot as needed. Run modeling functions to recieve mass and power requirements for your current scale.
Sketch View
Total Body Mass (kg)
7.51
Body Length (cm)
43.18
Body Width (cm)
24.13
Body Height (cm)
8.89
Motor Power (W)
231.8
Stall Torque (Nm)
18.38
No-load Speed (RPM)
481.8
Leg Length (cm)
23.1
Leg Width (cm)
2
Leg Thickness (cm)
0.5
X
Y
Scaling Rules
Scaling Factor
1
Submit
Reset
Modeling
Run Modeling Functions
Submit
Mass Budget
Motors 20.5 %
Legs 7.6 %
Batteries 14.3 %
Chassis 57.7 %
Log
(22-Mar-2023 22:01:23) Database 'ETQuad.mat' loaded.
(22-Mar-2023 22:01:32) Scaling factor of 3 has been applied.
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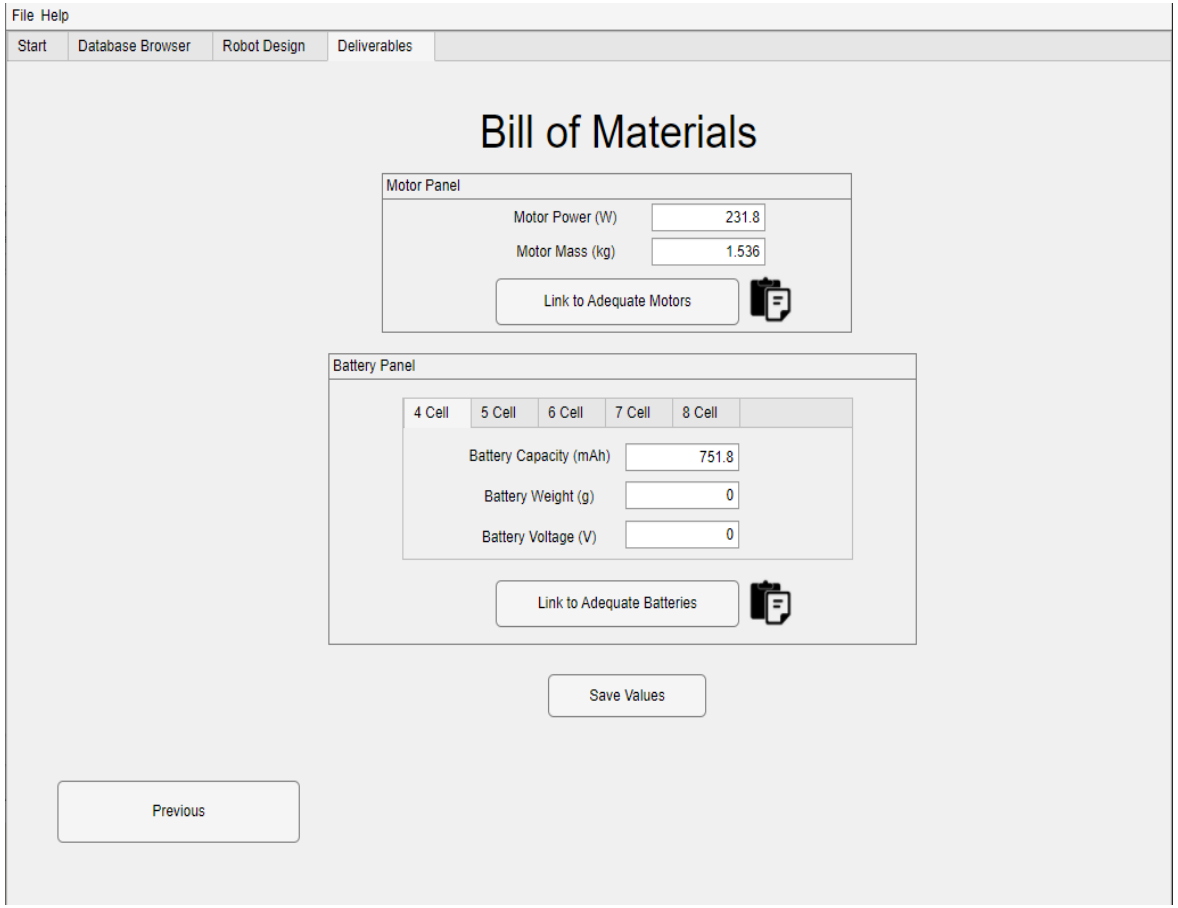
(22-Mar-2023 22:01:43) Simulink analysis completed.
Export Log
Previous
Save Selection
Next

Deliverables



File Help

Start | Database Browser | Robot Design | Deliverables

Bill of Materials

Motor Panel

Motor Power (W)	231.8
Motor Mass (kg)	1.536

Link to Adequate Motors 

Battery Panel

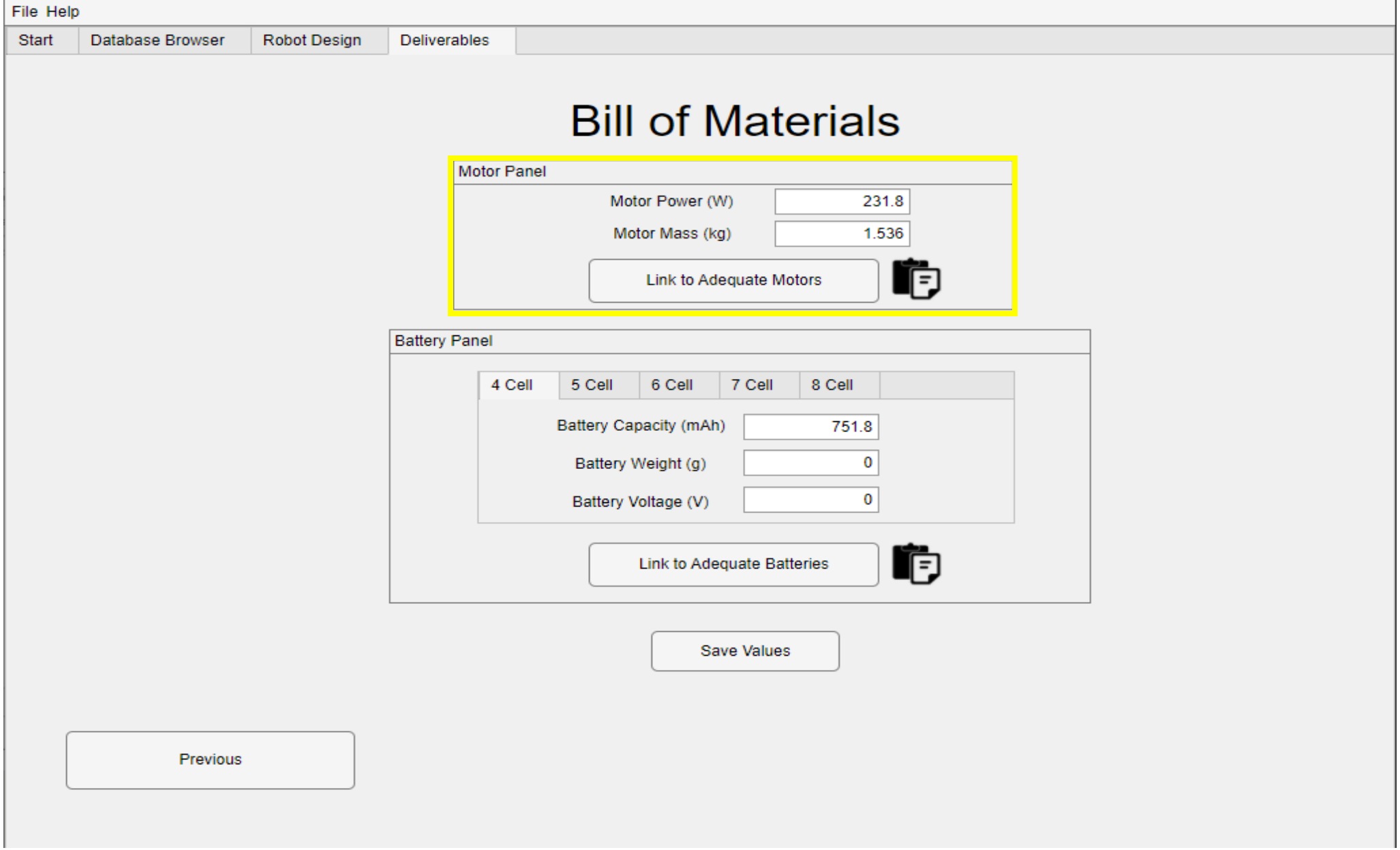
4 Cell | 5 Cell | 6 Cell | 7 Cell | 8 Cell

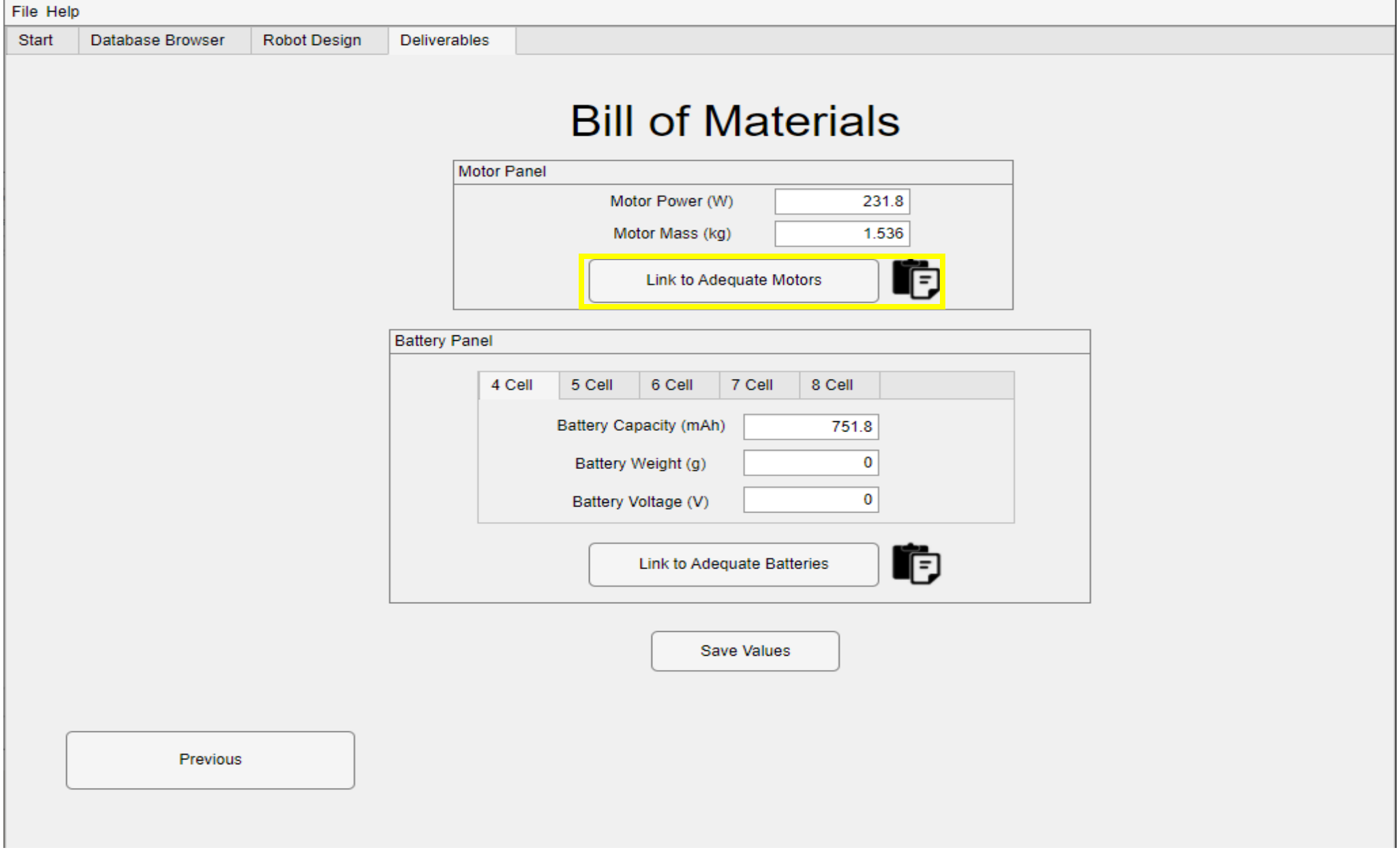
Battery Capacity (mAh)	751.8
Battery Weight (g)	0
Battery Voltage (V)	0

Link to Adequate Batteries 

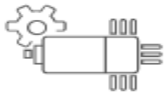
Save Values

Previous


File Help
Start
Database Browser
Robot Design
Deliverables
Bill of Materials
Motor Panel
Motor Power (W)
231.8
Motor Mass (kg)
1.536
Link to Adequate Motors
Battery Panel
4 Cell
5 Cell
6 Cell
7 Cell
8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous

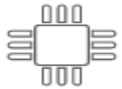

File Help
Start
Database Browser
Robot Design
Deliverables
Bill of Materials
Motor Panel
Motor Power (W)
231.8
Motor Mass (kg)
1.536
Link to Adequate Motors
Battery Panel
4 Cell
5 Cell
6 Cell
7 Cell
8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous

Products (2706) additional results (294)


COMPACT DRIVES (73)


MOTOR (2706)


GEAR (2643)


CONTROLLER (94)


SENSOR (219)


ACCESSORIES (202)

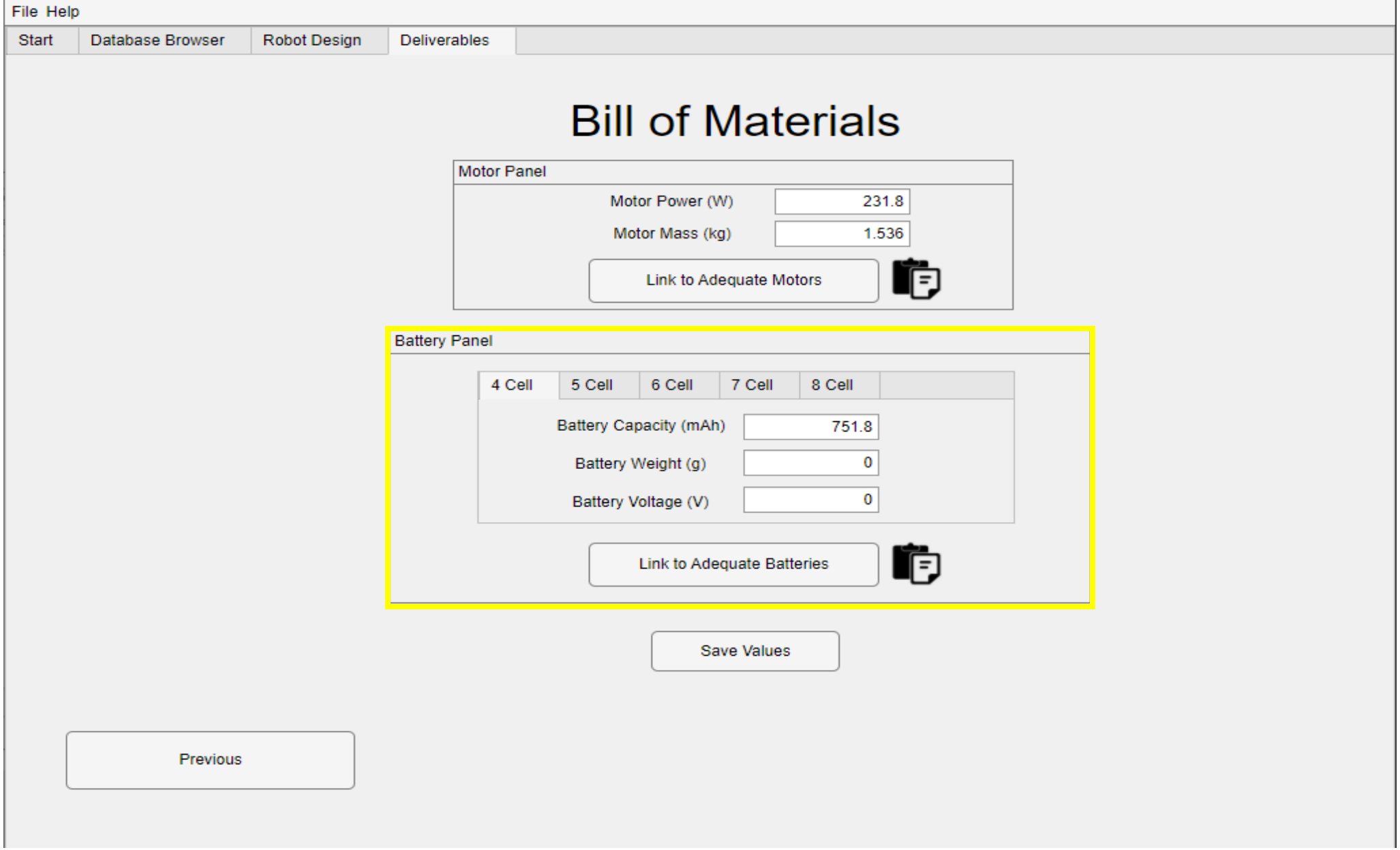

FILTER

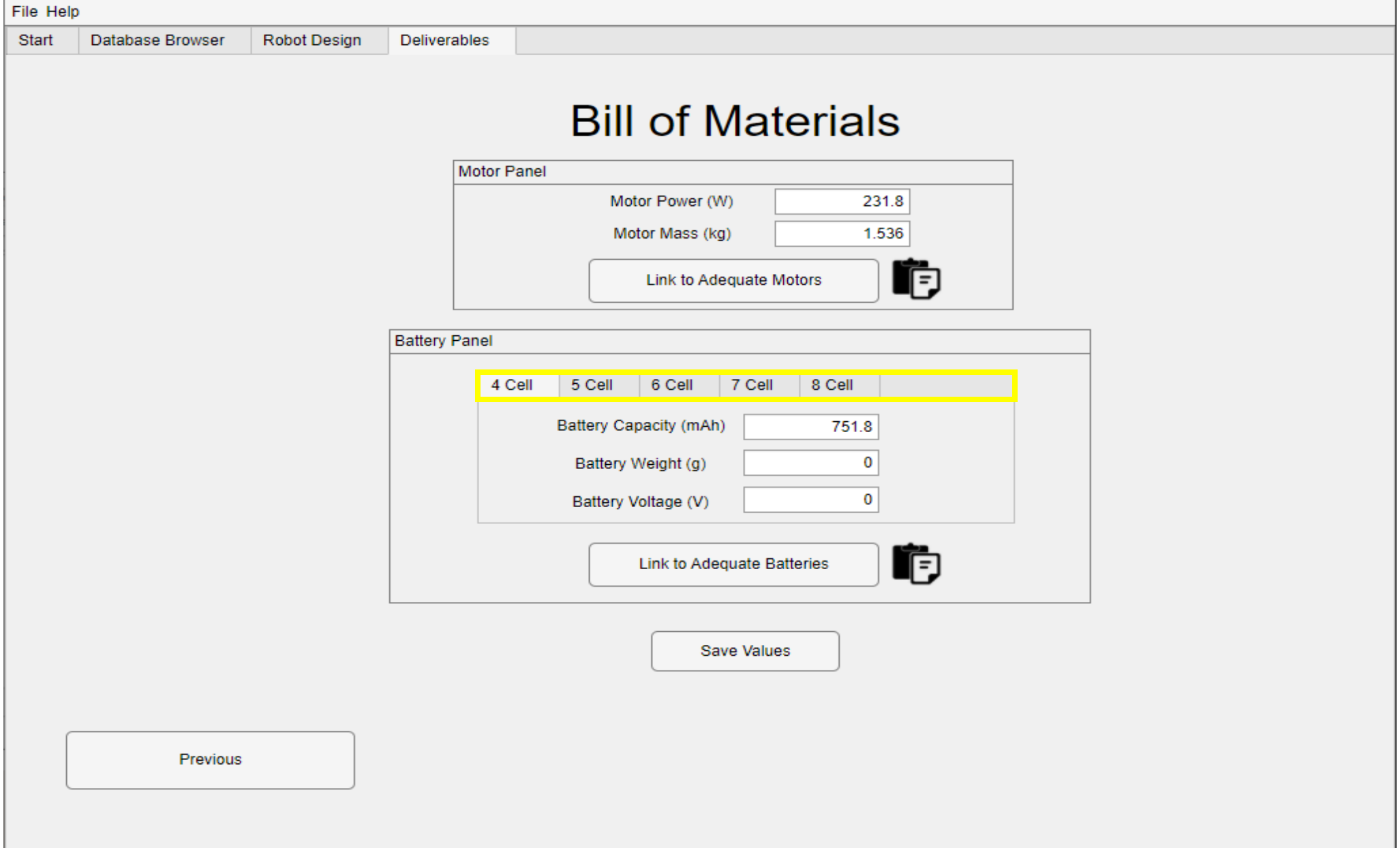
- [x] All (2706)
- [ ] maxon DC motor (1395)
- [ ] maxon EC motor (739)
- [ ] Configurable (572)

PARAMETER

Price ($)	Power (W)	Diameter (mm)
Length (mm)	Number of autoclave cycles	Speed constant (min^{-1}/V)
No load speed (min^{-1})	Nominal torque (mNm)	Nominal Voltage (V)
Commutation		


Reset all


File Help
Start
Database Browser
Robot Design
Deliverables
Bill of Materials
Motor Panel
Motor Power (W)
231.8
Motor Mass (kg)
1.536
Link to Adequate Motors
Battery Panel
4 Cell
5 Cell
6 Cell
7 Cell
8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous


File Help
Start
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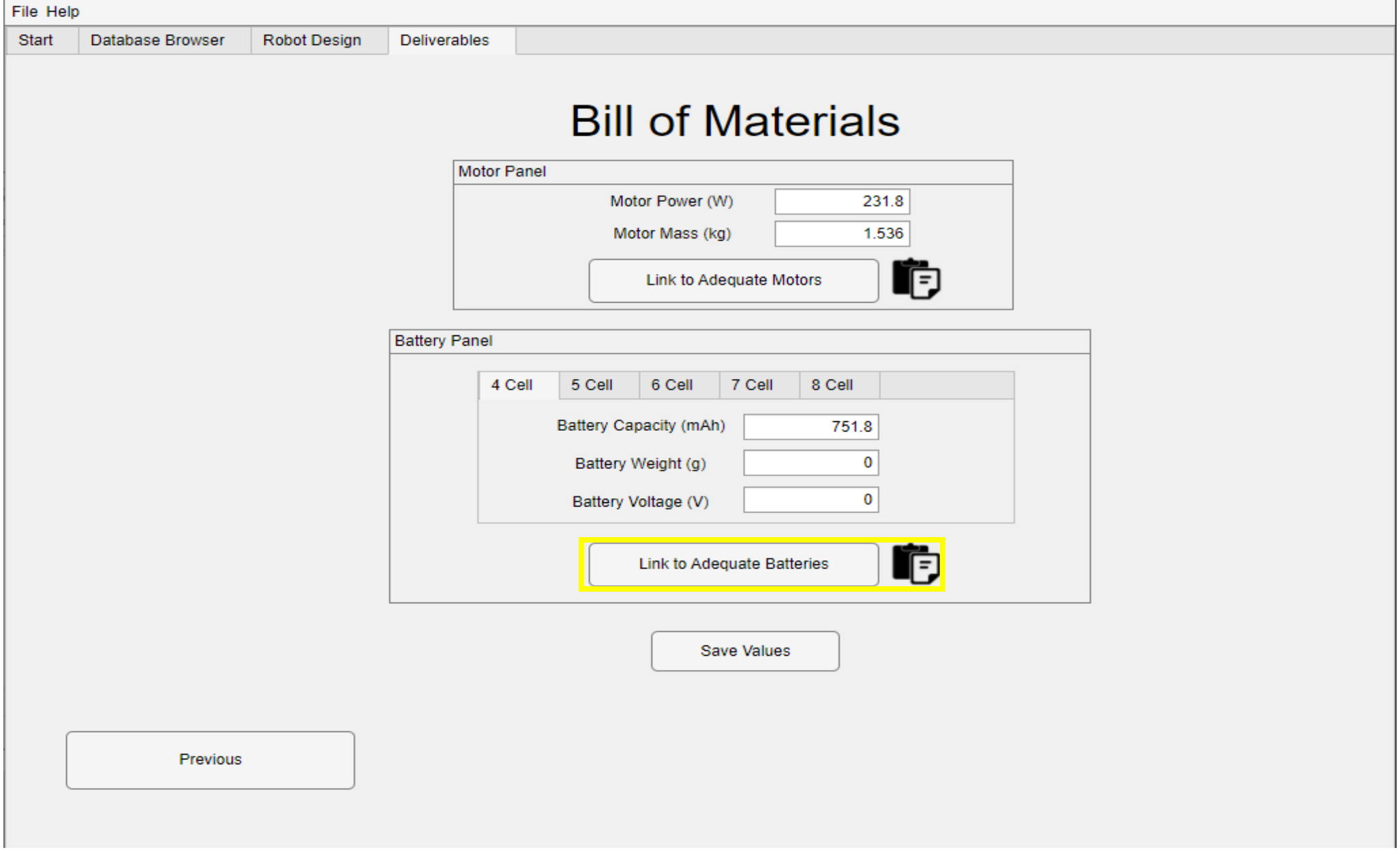
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous


File Help
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8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous

MAXAMPS LITHIUM BATTERIES

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All Products | Lithium Batteries | Information | Contact Us

LiPo 860mAh Packs

These MaxAmps LiPo batteries are 860mAh (milliamps) or .86Ah in capacity. As with all our LiPo pouch batteries, they are assembled in the USA by our Battery Builders here at MaxAmps.

5 Products

Slider Filter

VOLTAGE

7.4 - 14.8

7.4 14.8

WATT HOURS (WH)

6 - 13

LiPo 860 3S2P 11.1v Saddle Battery Pack

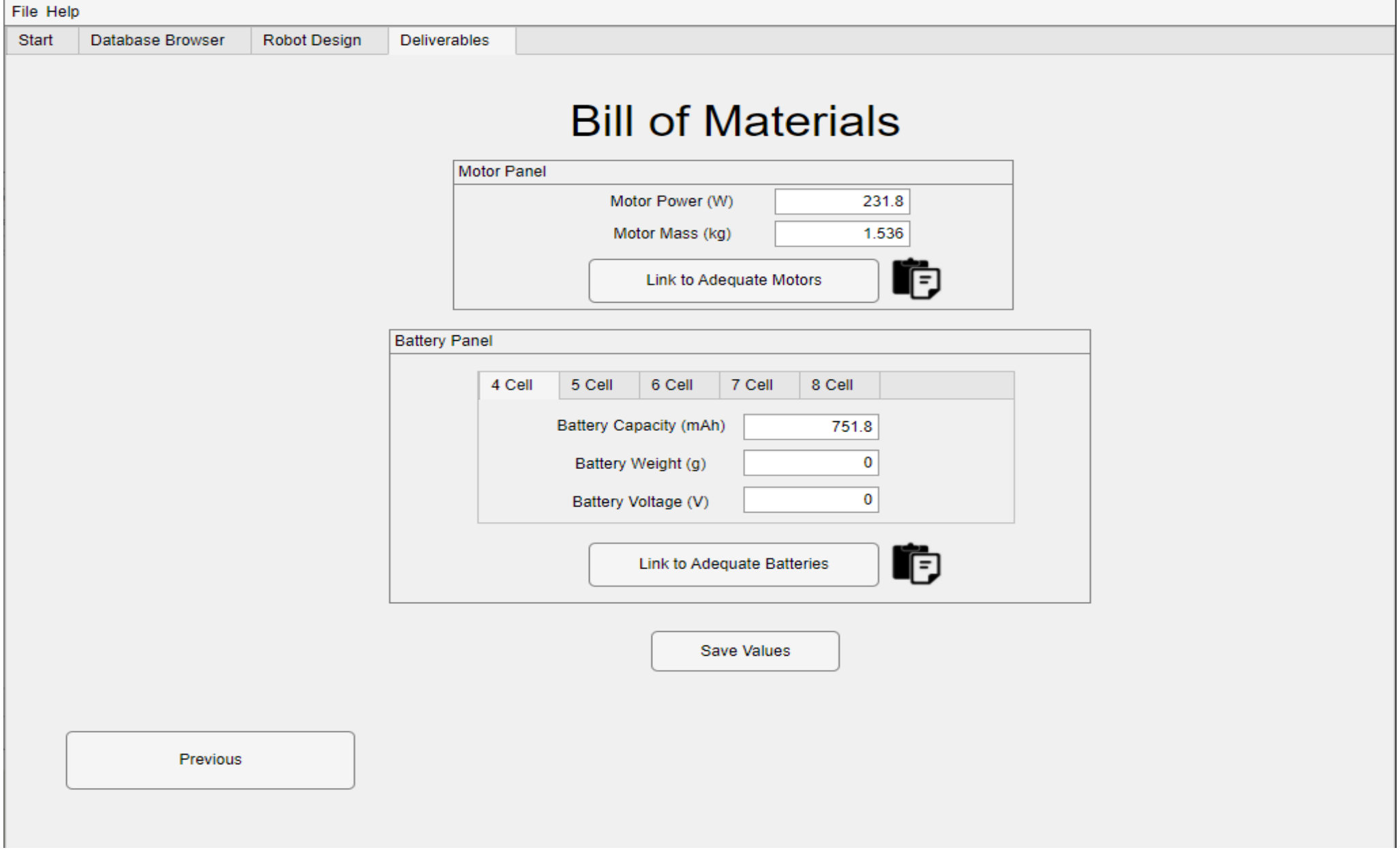
$114.99

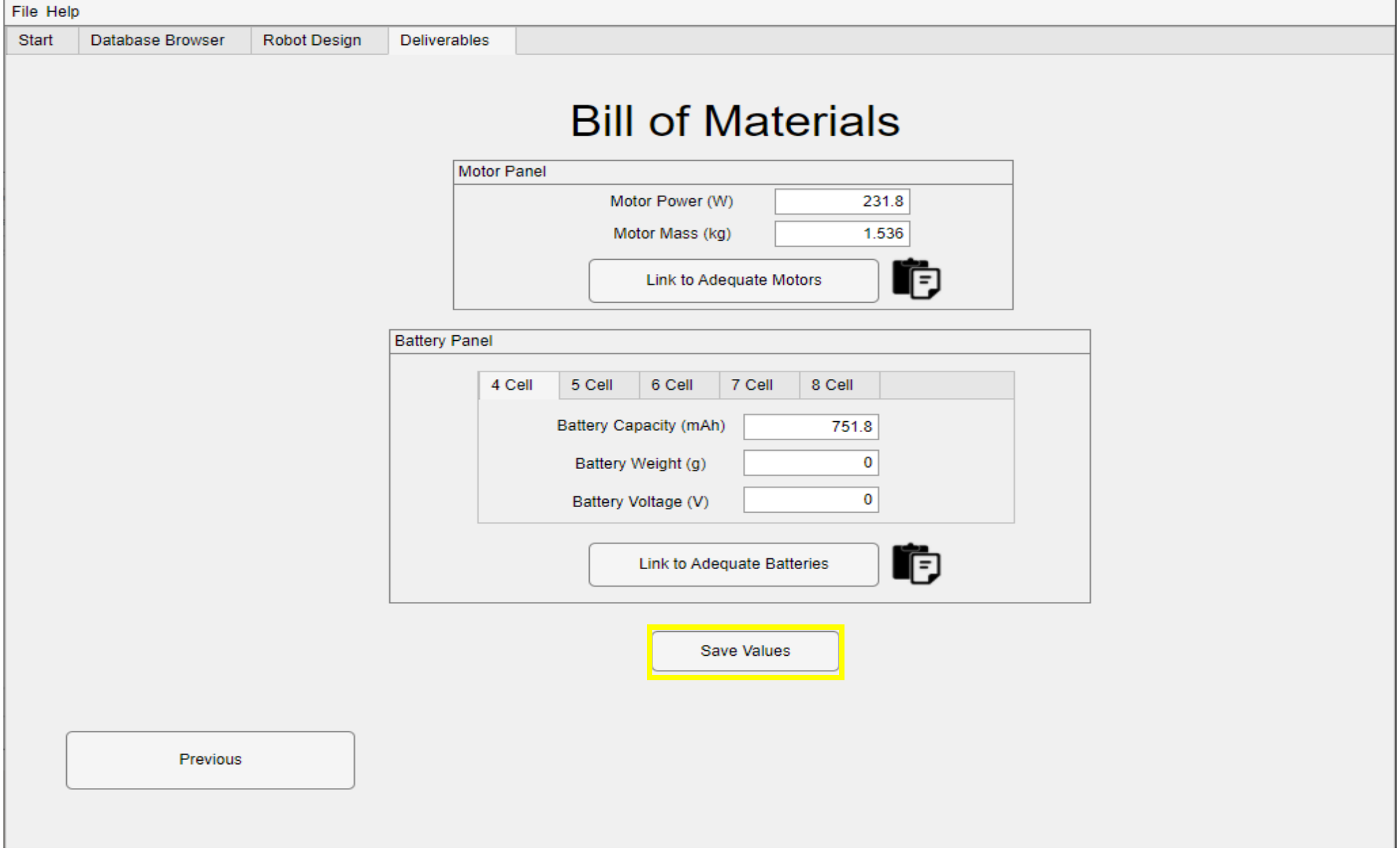
LiPo 860 2S2P 7.4v Saddle Battery Pack

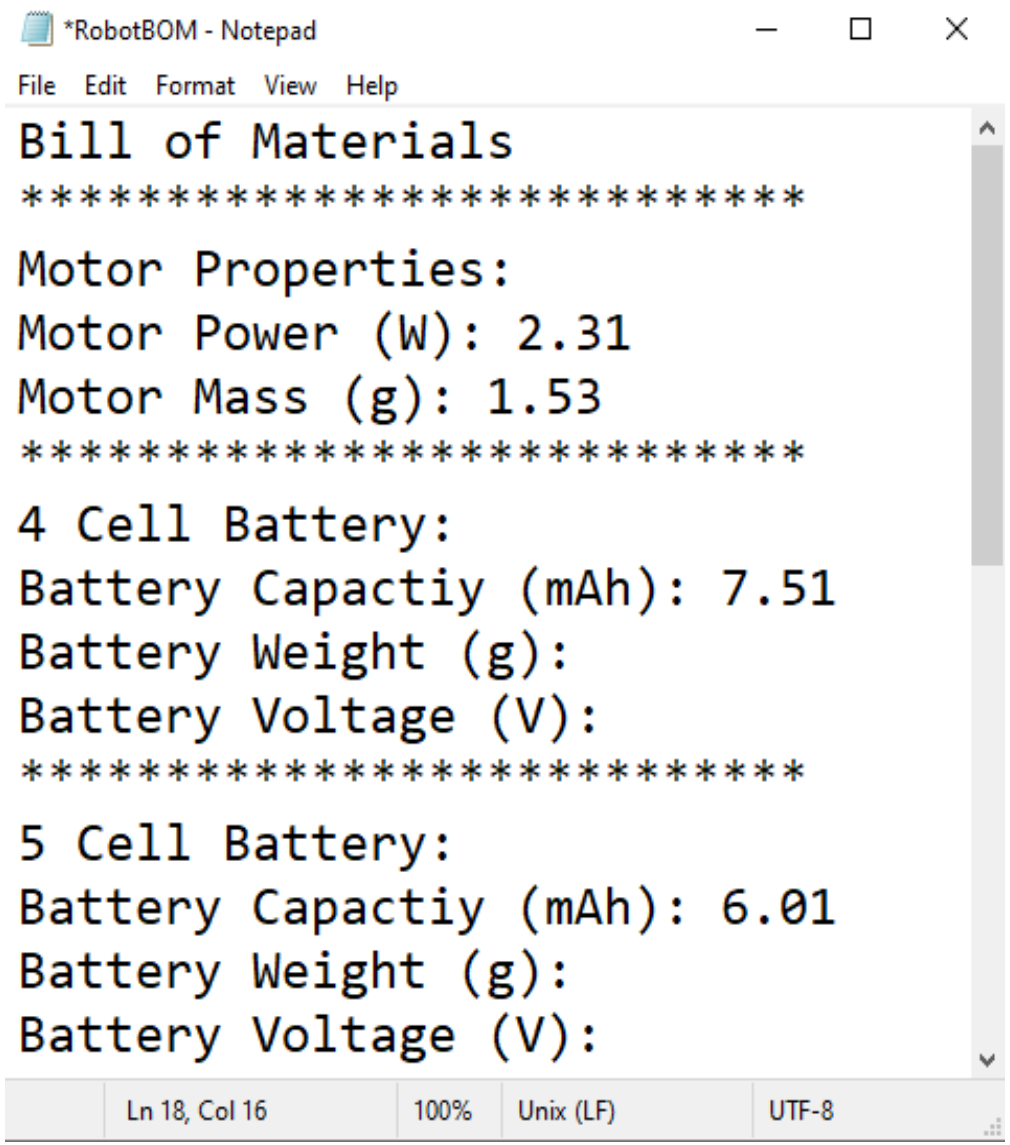
$99.99

LiPo 860 4S2P 14.8v Battery Pack

$79.99


File Help
Start
Database Browser
Robot Design
Deliverables
Bill of Materials
Motor Panel
Motor Power (W)
231.8
Motor Mass (kg)
1.536
Link to Adequate Motors
Battery Panel
4 Cell
5 Cell
6 Cell
7 Cell
8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous


File Help
Start
Database Browser
Robot Design
Deliverables
Bill of Materials
Motor Panel
Motor Power (W)
231.8
Motor Mass (kg)
1.536
Link to Adequate Motors
Battery Panel
4 Cell
5 Cell
6 Cell
7 Cell
8 Cell
Battery Capacity (mAh)
751.8
Battery Weight (g)
0
Battery Voltage (V)
0
Link to Adequate Batteries
Save Values
Previous


*RobotBOM - Notepad
File Edit Format View Help
Bill of Materials
****
Motor Properties:
Motor Power (W): 2.31
Motor Mass (g): 1.53
****
4 Cell Battery:
Battery Capactiy (mAh): 7.51
Battery Weight (g):
Battery Voltage (V):
****
5 Cell Battery:
Battery Capactiy (mAh): 6.01
Battery Weight (g):
Battery Voltage (V):
Ln 18, Col 16
100%
Unix (LF)
UTF-8

Lessons Learned

Software documentation difficulties

Project documentation

Properly defining scope while mitigating ambition

Lessons Learned

Software documentation difficulties

Project documentation

Properly defining scope while mitigating ambition

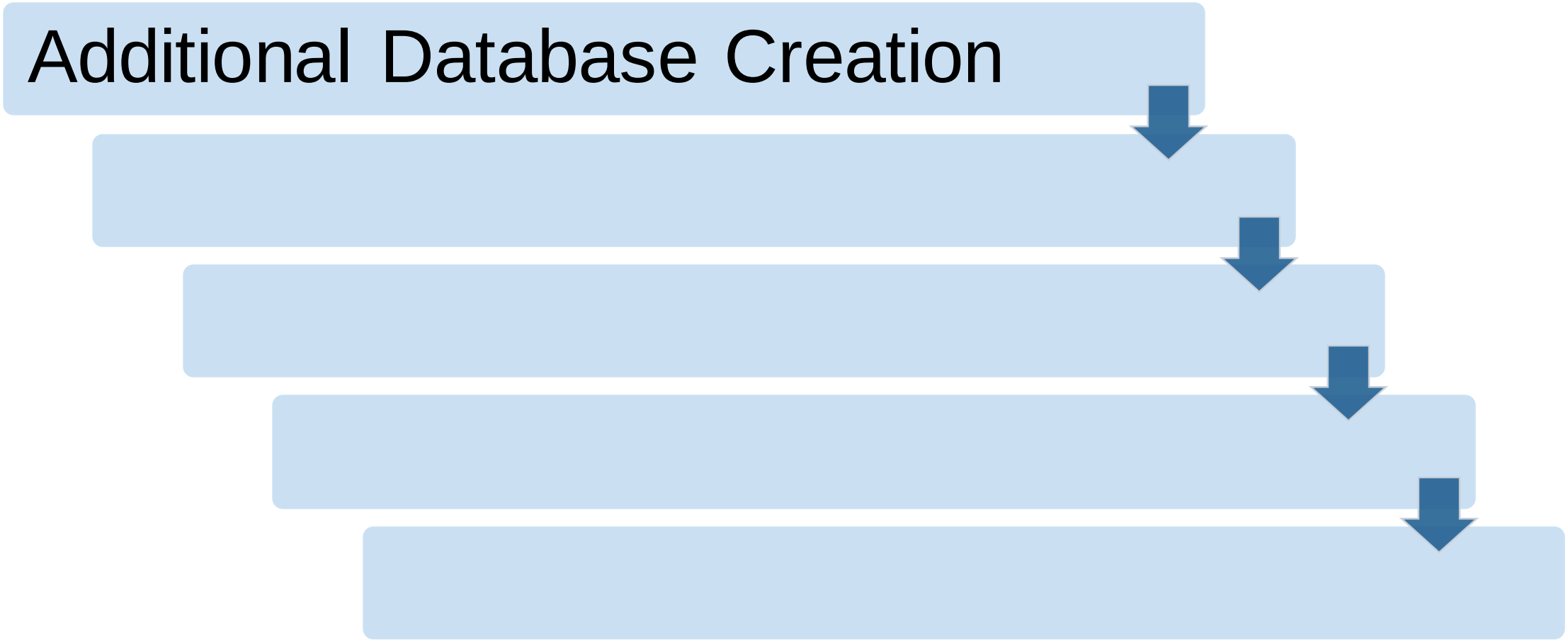
Lessons Learned

Software documentation difficulties

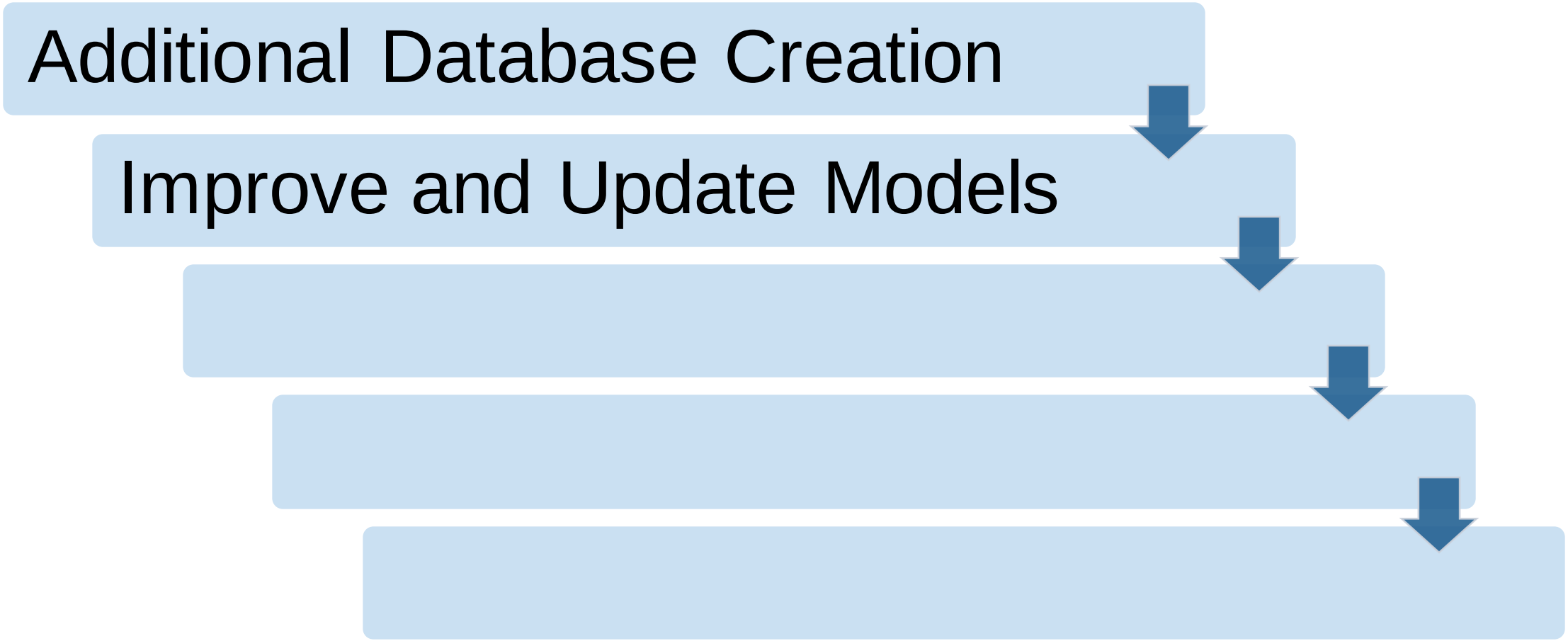
Project documentation

Properly defining scope while mitigating ambition

Suggestions for Improvement



Suggestions for Improvement



Suggestions for Improvement

Additional Database Creation

Improve and Update Models

Enhance User Interface

Suggestions for Improvement

- Additional Database Creation
- Improve and Update Models
- Enhance User Interface
- Sensitivity Analysis

Suggestions for Improvement

- Additional Database Creation
- Improve and Update Models
- Enhance User Interface
- Sensitivity Analysis
- Design Optimization

LinkedIn Profiles

Milton Bouchard
Modeling Engineer

Michael Dina
Systems Engineer

Onoriode Onokpise
User Interface Engineer

Jackson Raines
Testing Engineer

Zachary Shapiro
Testing Engineer