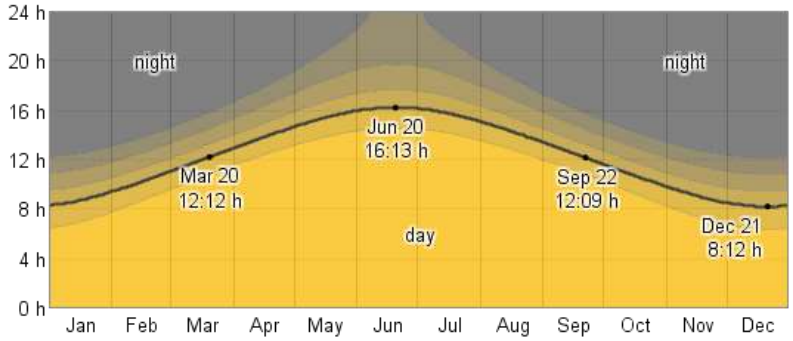
SolarPath™

by

Solentic Energy

BACKROUND

- Climate change concerns; need and market for renewable energy have grown
- The Global Trends for Renewable Energy 2016; "Investments reached nearly $286 billion, more than six times more than in 2004, and, for the first time, more than half of all added power generation capacity came from renewables."
- Vancouver; average hours of sun and busiest pedestrian traffic given below;



Block Rank	Total Pedestrians (10am-6pm)	Block
1	25,042	Granville, S of Georgia (700 block)
2	18,689	Granville, S of Pender (500 block)
3	17,960	Georgia, E of Howe (700W block)
4	17,354	Granville, S of Dunsmuir (600 block)
5	17,266	Burrard, S of Georgia (700 block)

INTRODUCTION AND PURPOSE

- SolarPath™: energy generating tile, combines both solar and kinetic energy capture to maximize use of space
- Captures energy from both sources and outputs to external battery bank
- Modular; can connect to form pathways and sidewalks, generates electricity from all interconnected tiles
- Outdoor, long-life product to be used by municipalities on busy blocks

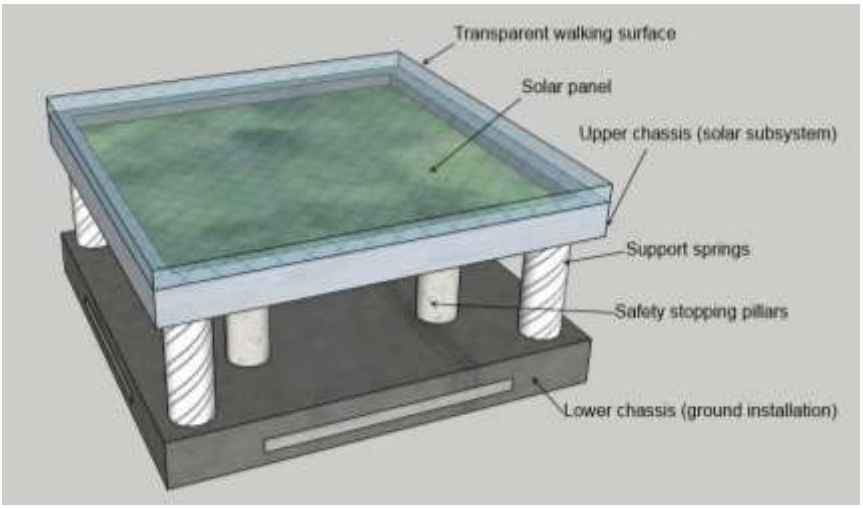
DESIGN AND FUNCTION

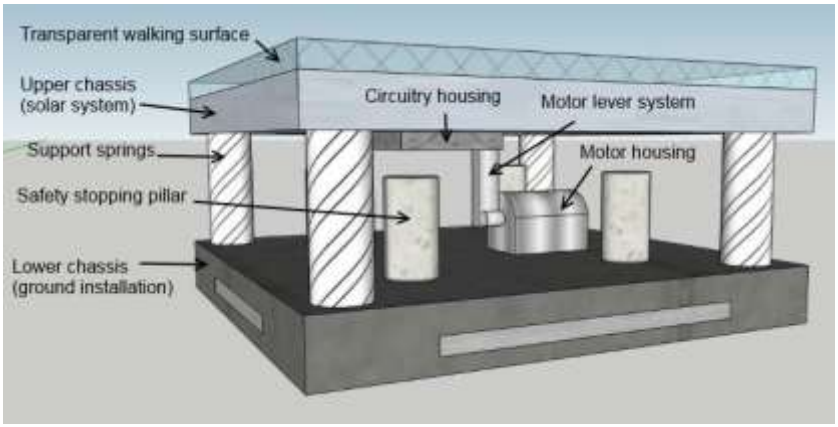
OVERVIEW

- Tile system: provides walking surface and energy generation simultaneously
- Users: any pedestrian, e.g. adults, children, wheelchairs, scooters, cyclists
- Operating conditions shown below;

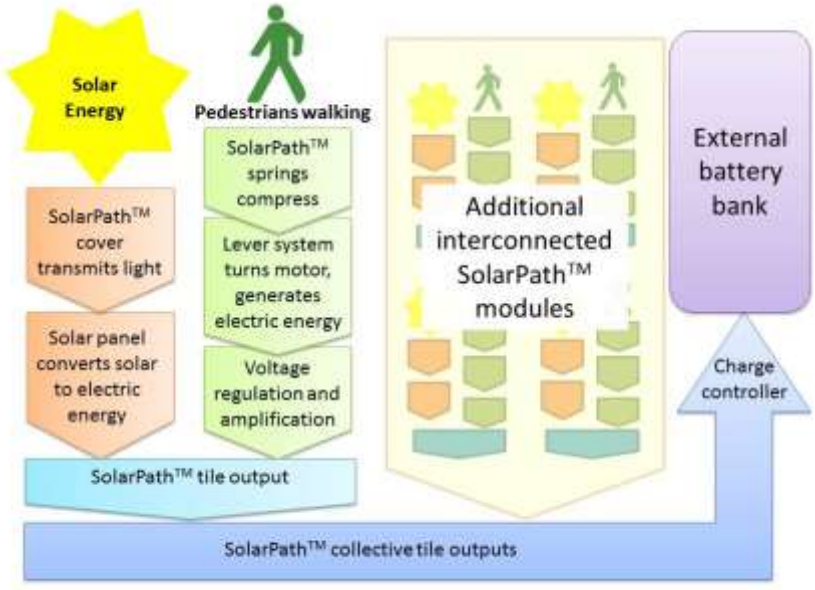
Operational Temperature:	-10°C to 80°C (14°F to 176°F)
Weight Capacity:	181 kg (400 lb)
Estimated Life Cycle:	Approx. 10 years
Dimensions:	Approx. 12 cm x 60 cm x 60 cm (1'x2'x2')

- Two integrated subsystems ; upper solar energy layer, lower kinetic energy layer
- Upper solar energy layer:
    - *Transparent surface* - allows light to reach solar panel and provides walking surface
    - *Solar panel* - captures solar energy and converts to electricity
    - *Upper chassis* - houses solar panel and protects lower system
- Lower kinetic energy layer:
    - *Support springs* - supports upper tile, allows 2 cm compression
    - *Safety stoppers* - prevents further/sudden compression, keeps user and product safe if springs fail
    - *Lever system* - translates vertical to rotational motion, turns motor shaft
    - *Motor* - captures kinetic energy
    - *Circuitry housing* - holds motor circuit to transform 5V AC to 12 V DC
    - *Lower chassis* - allows product to be installed into ground

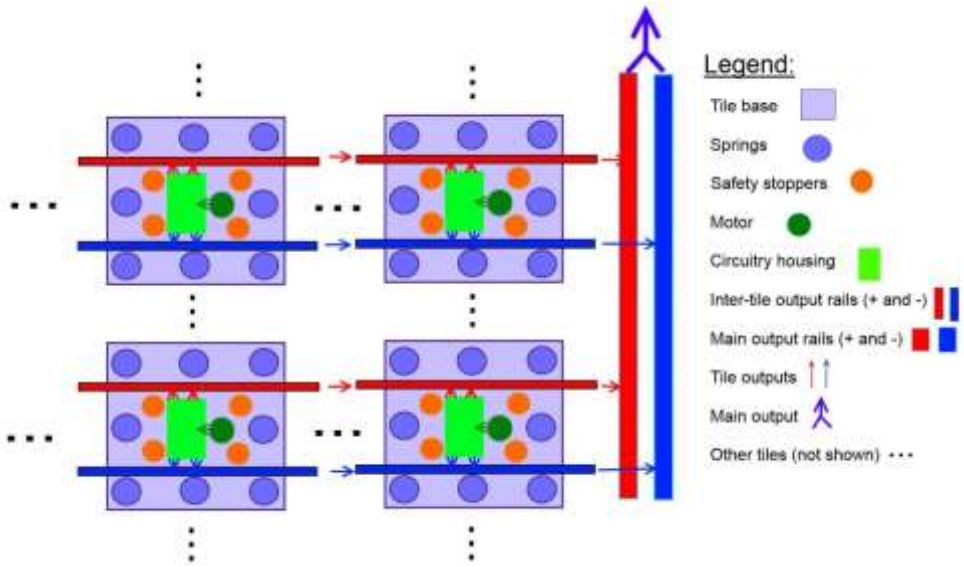




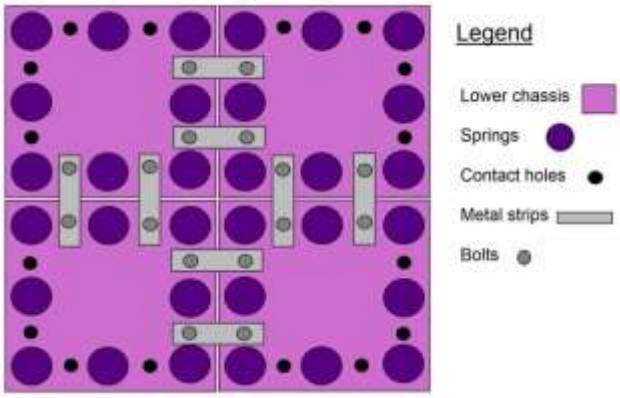
INTERCONNECTION



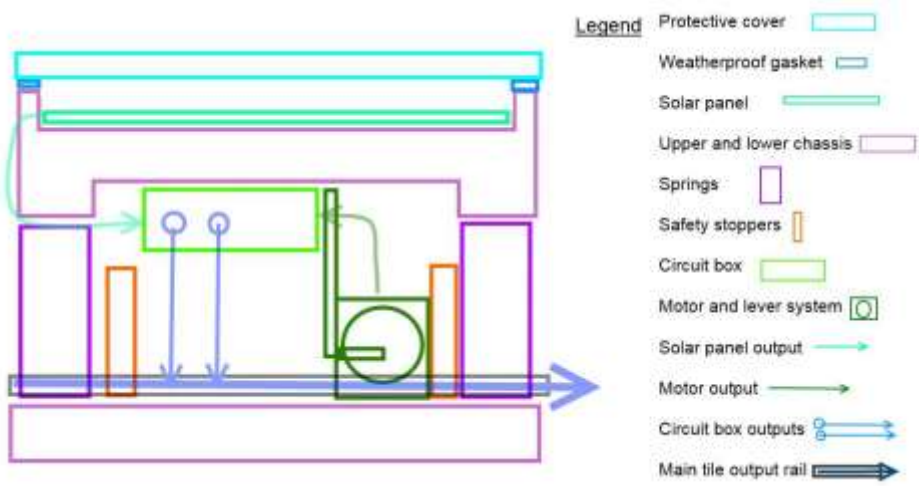
- Energy flow in system: solar and kinetic energy captured independently in each tile, output from tile in parallel. Each tile in pathway connected in parallel with one another to battery bank via unified output
- Electrical connections between tiles via system of rails (positive and negative), which thread through the lower portion of the tiles between springs and stoppers, and have outlets for both solar and kinetic outputs
- Rows of rails connect to main output rail to connect to battery bank's charge controller, placing entire pathway in parallel (prevent voltage from becoming too high)
- Physical interconnections: tiles can be bolted together along all four sides using steel plates and bolts to secure together. Each tile also mounts firmly in soft ground via post spikes along bottom chassis



Electrical interconnections

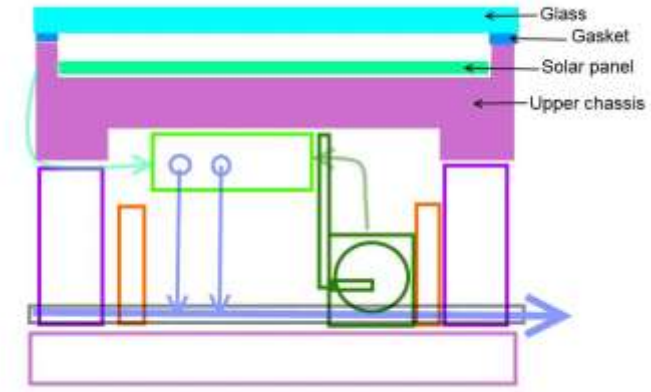


Physical interconnections

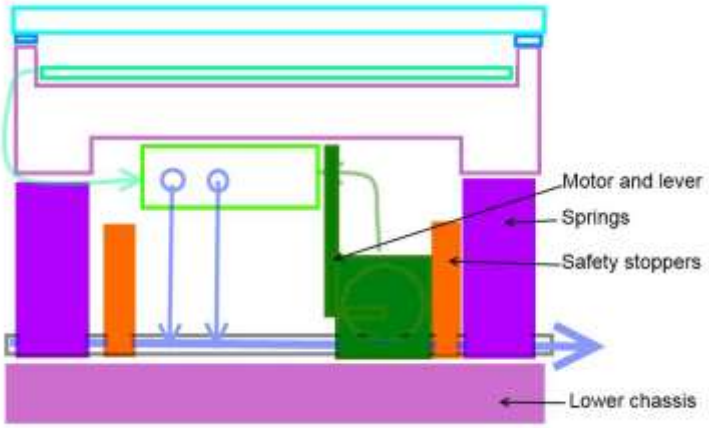


Cross-sectional view

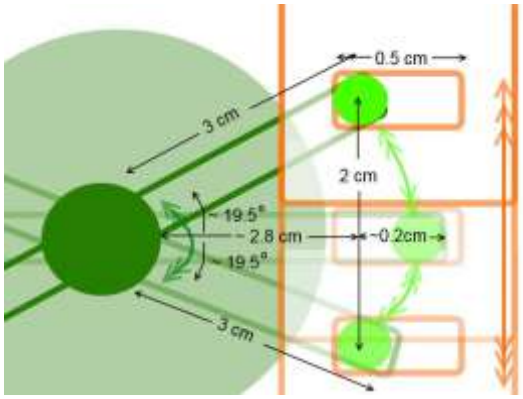
HARDWARE



Solar subsystem		
Cover	Tempered glass	• High clarity vs polycarbonate (which scratch and yellow under UV) • Withstands over 65 MPa/9400 psi (car = 4.1 MPa/600 psi) • Weather and chemical-resistant • Safety glass: cracks instead of shatters
Gasket	Silicon foam	• Temp. range -67°F to 392°F (-55°C to 200°C) • Water and dust sealing • Oxygen, ozone, UV light, thermal, chemical, electrical and aging resistant
Solar panel	Monocrystalline silicon, 12 V, 50 W	• Highest-quality silicon: best low-light and high-temp performance and longest life (25 years) • Waterproof and semi-flexible
Upper chassis	Galvanized steel	• More rigid and durable than aluminum • Corrosion protection for 70+ years in outdoor environments (better than stainless steel



Kinetic subsystem		
Motor	Wind-driven DC generator dynamo	• 0.6 RPM in a compact size • Generates 5-24 V depending on speed of shaft rotation
Lever system	Steel bracket and bolts	• Transforms vertical motion into rotational motion (see diagram below for example calculations)
Springs	Heavy-duty chrome silicon die springs	• Max temperature tolerance 245°C • K-constant rating: 4.0 lb per 1/10" (28 N/cm^2)
Safety stoppers	CPVC tubes	• Strong and rigid, acid and base resistant • Higher operating temp. range than PVC (82°C vs 60°C)
Lower chassis	Galvanized steel and zinc-plated chrome spikes	• More durable than aluminum and corrosion-resistant than stainless steel



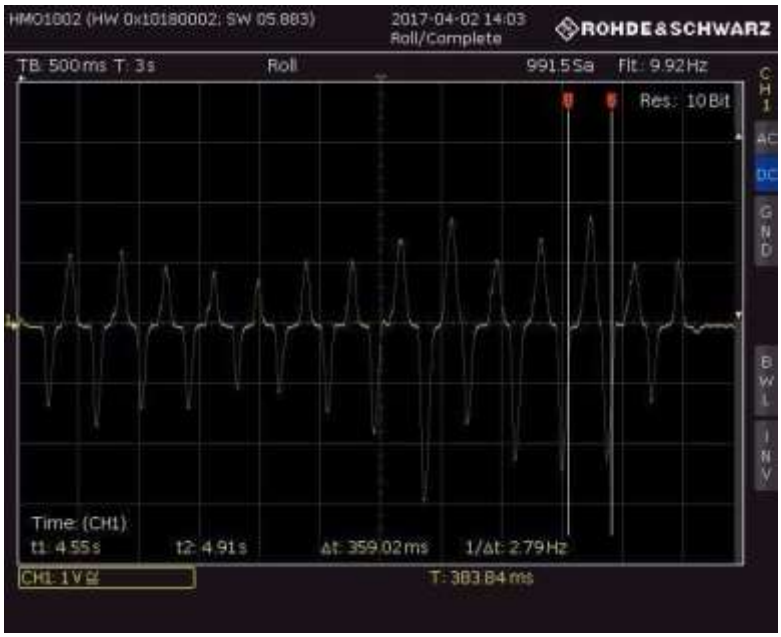
ELECTRICAL

Solar Panel Electrical Properties	
Voltage	12 V
Power	50 W
Current	4.2 A
Cell efficiency	22%

- Solar panels output power via MC4 connectors (shown below), UV and weather-protected cables with a plug-and-socket design

Motor Electrical Properties	
Motor output voltage:	3V-24V
Max output current exceeds:	1500 mA
Max load voltage:	40 V
Max load power:	20 watts

- Motor outputs approx. 3V AC due to bidirectional rotation (direct output shown below)



- Intermediary circuit required to bring up to 12 V DC;

  - *RS604 bridge rectifier*: four diodes in a loop with a smoothing capacitor, turns AC into DC

  - *LM2587 step-up DC-DC converter module*: amplifies DC voltage from 3 V up to 35 V with 92% efficiency and max 50mV ripple current

  - *1N5402 diode rectifier*: restricts current flow to one direction, prevents back charging of motor

PROGRESS AND PLAN

Prototype	Date	Implemented Features
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Alpha	May 30	• Construct metal chassis • Attach protective covering
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CONCLUSION

- Temporary body constructed to replicate final model; solar panel and motors both fit and generate energy
- Solar panel generates suitable level of output under outdoor sunlight
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- Need to work on solid chassis, interconnections, and perfecting motor and panel mounting

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COMPANY AND CONTACT INFORMATION

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The following pages show the actual poster used in the presentation;

Solentic Energy presents SolarPath™

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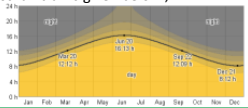

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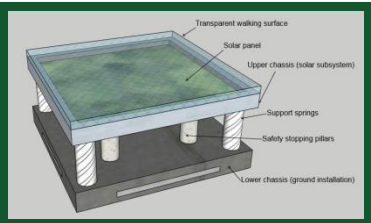

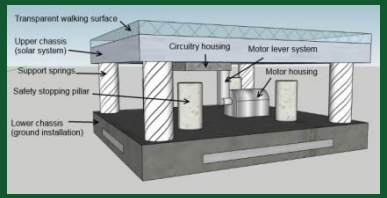

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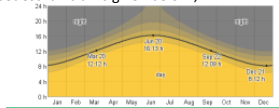

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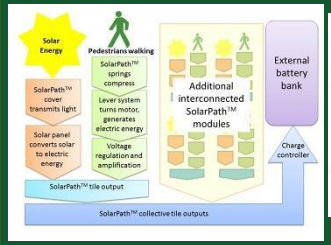
DESIGN AND FUNCTION



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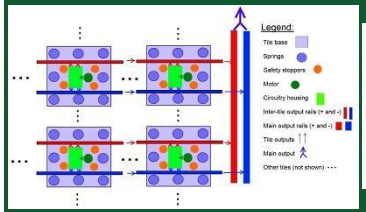
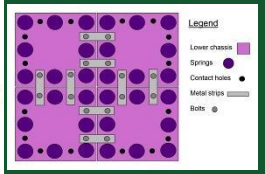
INTERCONNECTION

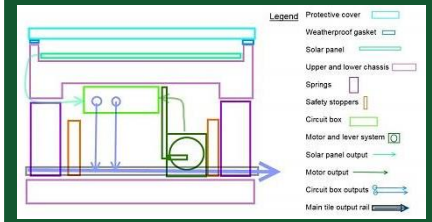


Electrical interconnections



Physical interconnections

Cross-sectional view



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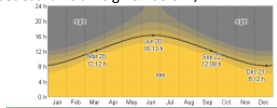

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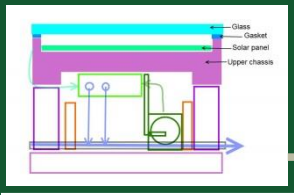

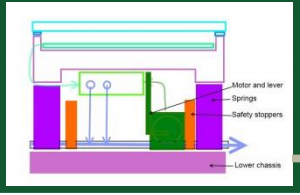

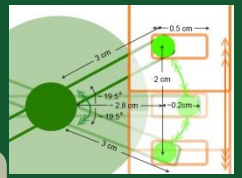

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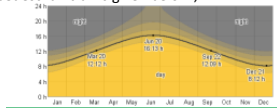
- The Global Trends for Renewable Energy 2016; "Investments reached nearly $286 billion, more than six times more than in 2004."
- Vancouver; average hours of sun and busiest pedestrian traffic given below ;

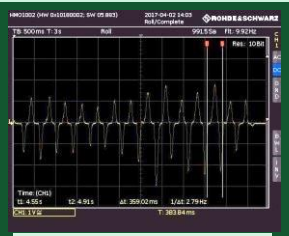


Rank	Total Pedestrians	Block
1	25,042	Granville, S of Georgia (700 block)
2	18,689	Granville, S of Pender (500 block)
3	17,960	Georgia, E of Howe (700W block)
4	17,354	Granville, S of Dunsmuir (600 block)
5	17,266	Burrard, S of Georgia (700 block)

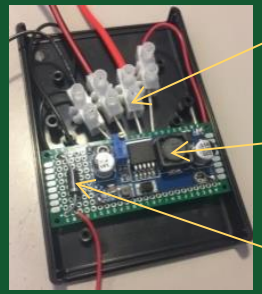
INTRO AND PURPOSE

- SolarPath™: energy generating tile, combines both solar and kinetic energy capture to maximize use of space
- Captures energy and outputs to external battery bank
- Modular; can connect to form pathways and sidewalks, generates electricity from all interconnected tiles
- Outdoor, long-life product to be used by municipalities on busy blocks

DESIGN AND FUNCTION



Motor output, average 3V amplitude



RS604 bridge rectifier

LM2587 step-up DC-DC converter module

1N5402 diode rectifier

ELECTRICAL

Solar Panel Electrical Properties	
Voltage	12 V
Power	50 W
Current	4.2 A
Cell efficiency	22%

- Solar panel output: MC4 connectors (shown above), UV and weather-protected cables with plug-and-socket design

Motor Electrical Properties	
Motor output voltage:	3V-24V
Max output current exceeds:	1500 mA
Max load voltage:	40 V
Max load power:	20 watts

- Motor outputs approx. 3V AC due to bidirectional rotation (direct output shown in top left)
- Intermediary circuit required to bring up to 12 V DC;
  - *RS604 bridge rectifier*: four diodes in a loop with a smoothing capacitor, turns AC into DC
  - *LM2587 step-up DC-DC converter module*: amplifies DC voltage from 3 V up to 35 V with 92% efficiency and max 50mV ripple current
  - *1N5402 diode rectifier*: restricts current flow to one direction, prevents back charging of motor

PROGRESS AND PLAN

Prototype	Date	Implemented Features
Proof-of Concept	Apr 5	• Simple chassis (wood) • Solar energy generation • Kinetic energy generation • Charging a simple battery
Alpha	May 30	• Construct metal chassis • Attach protective covering
Beta	Jun 30	• Module connectivity - linking two tiles physically and electrically
Gamma	Aug 8	• Final chassis construction • Final weatherproofing • Circuit finalization and weatherproofing

CONCLUSION

- Temporary body constructed to replicate final model; solar panel and motors both fit and generate energy
- Solar panel generates suitable level of output under outdoor sunlight
- Motor generates approx. 3 V with lever system which is then rectified and amplified
- Need to work on solid chassis, interconnections, and perfecting motor and panel mounting

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