FAMU-FSU College of Engineering

Solar Wind Generator (K.A.R.E.N)
Final Presentation

Team 303 03/29/2024

Team Introductions

WIlliam Touza
- *Team Lead*

Andrew Putnam
- *Technical Lead*

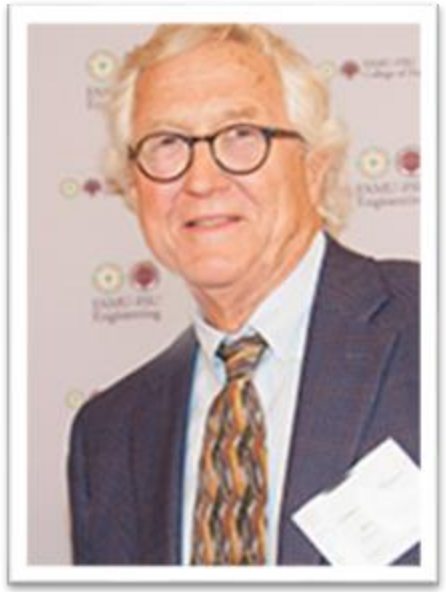
Tristan Witkowski
- *CAD Designer*

Alberto San Segundo
- *CAD Designer*

Brandon Ortiz
- *Treasurer*

Carlos Vilarino
- *Documentation Specialist*

Sponsor and Advisor



Bruce Morrison
-Sponsor

Dr. Simon Foo
-Advisor

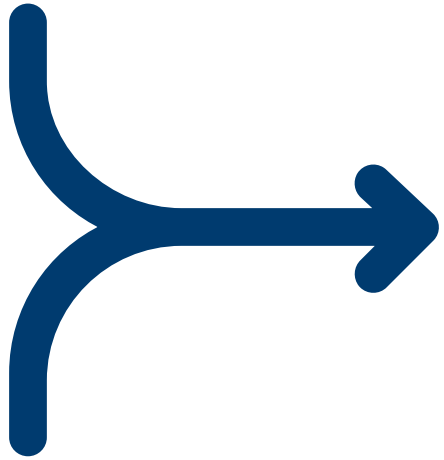
Project Summary

Project Objective

Wind Energy Capture

Solar Energy Capture

Energy Storage

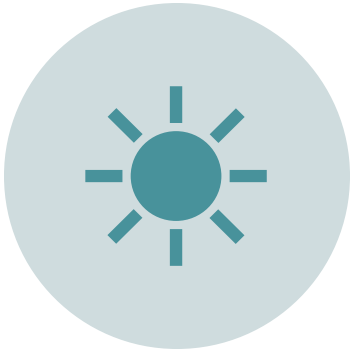


Single Structure Device

Key Goals

GENERATE 100W

SEMI PORTABLE



HARNESSES SOLAR AND WIND ENERGY

Customer Needs

How long will this device last against the elements?	In what places can this device be operated at?	Will this device be portable?
The device will have a minimum lifespan of 5 years and will be durable enough to withstand natural forces	The device will be ground based for reliable energy generation conditions	The device will completely portable, with simple disassembly if necessary to allow for easy transport

Assumptions

Device will be placed outside

Sufficient solar and wind energy provided

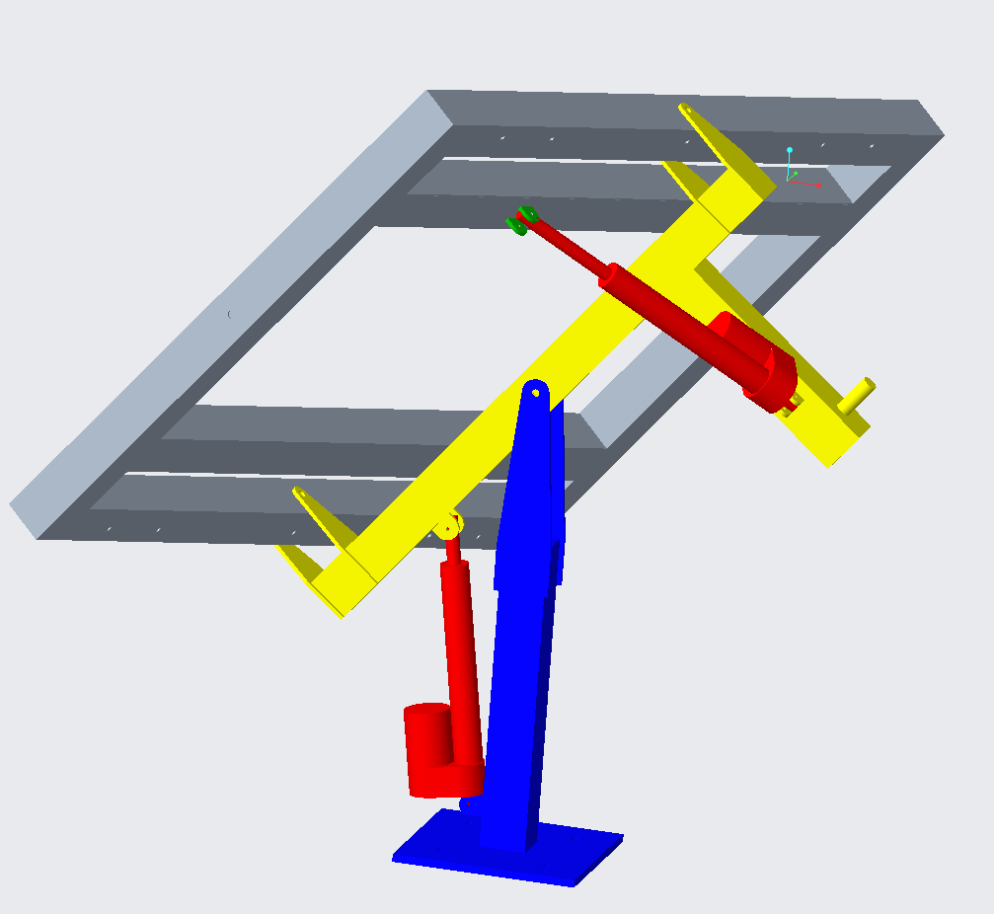
Proper usage of the device is expected

Critical Targets

- 100 W power generation
- 10% max electrical losses
- 45 mph max wind speed
- 5 Year Durability
- 50 m portability

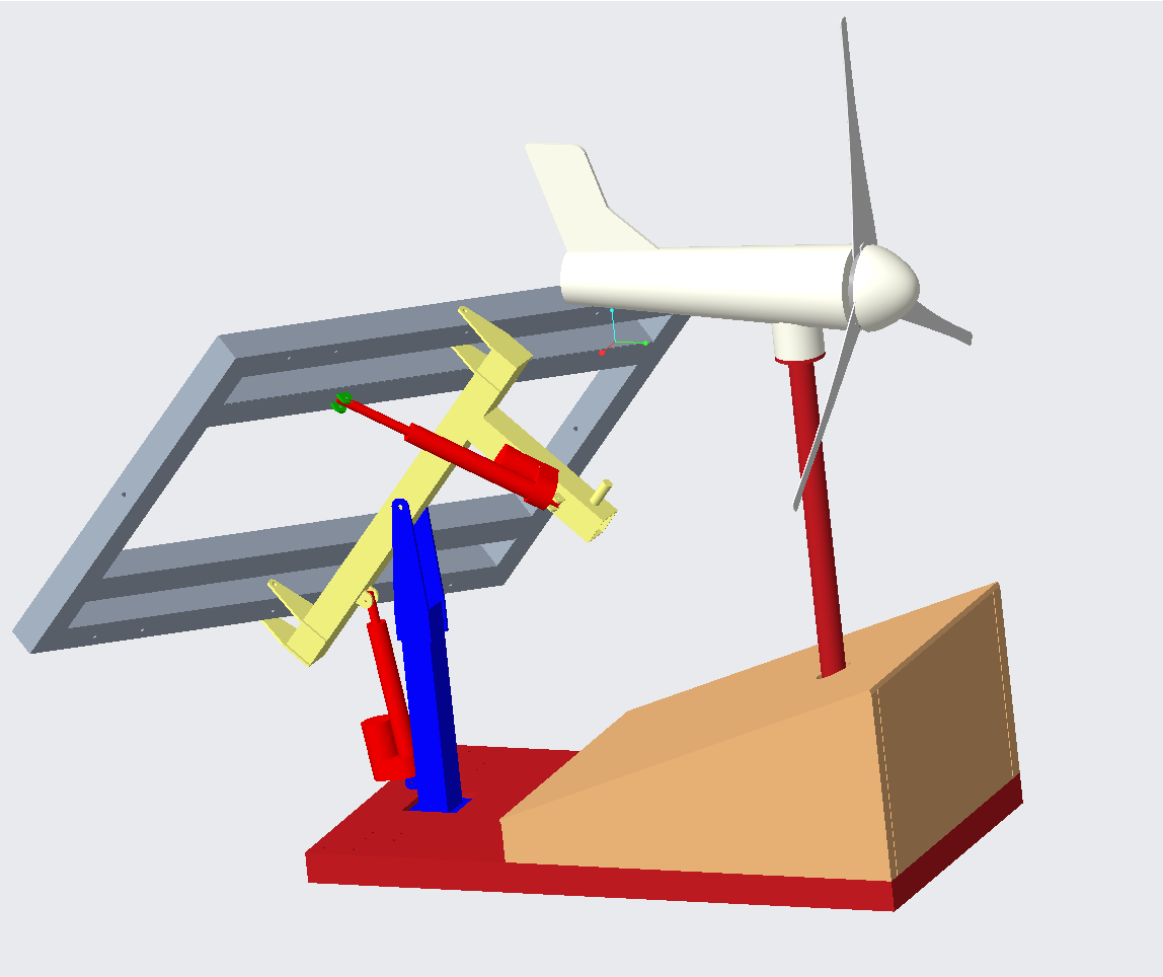
Structural Design

Final Solar Mount Design

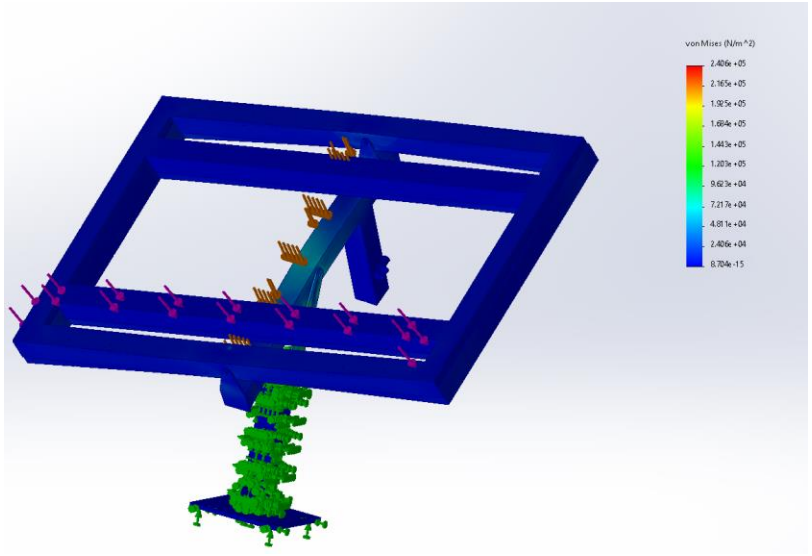


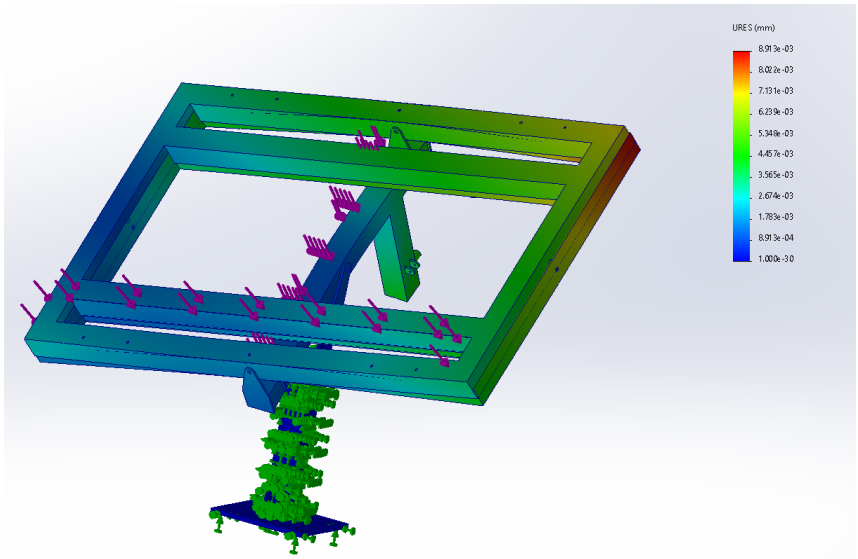
- Uses Two linear actuators X-axis and Y-axis to achieve the desired dual – axis movement

Final Design



Structural Simulations





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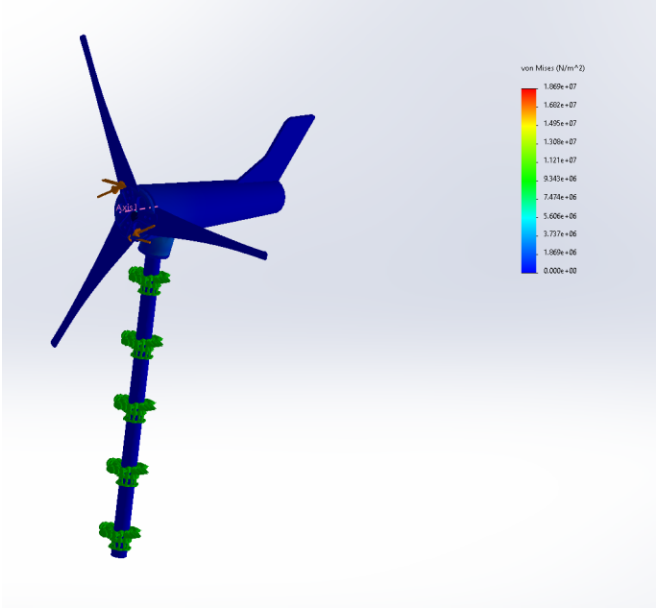
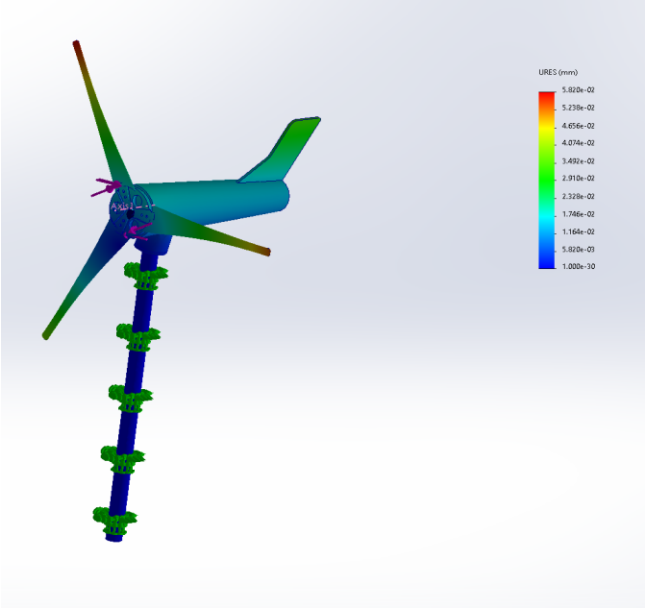
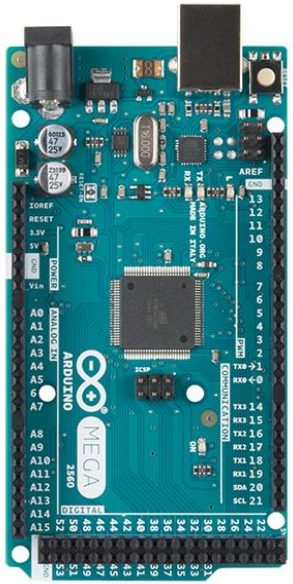


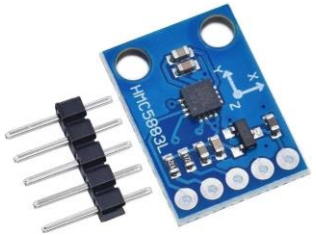


Technical Design

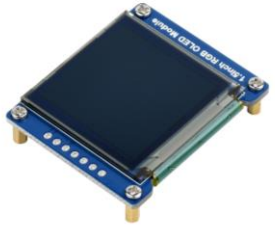
Arduino and Components



Arduino Mega



Analog Compass



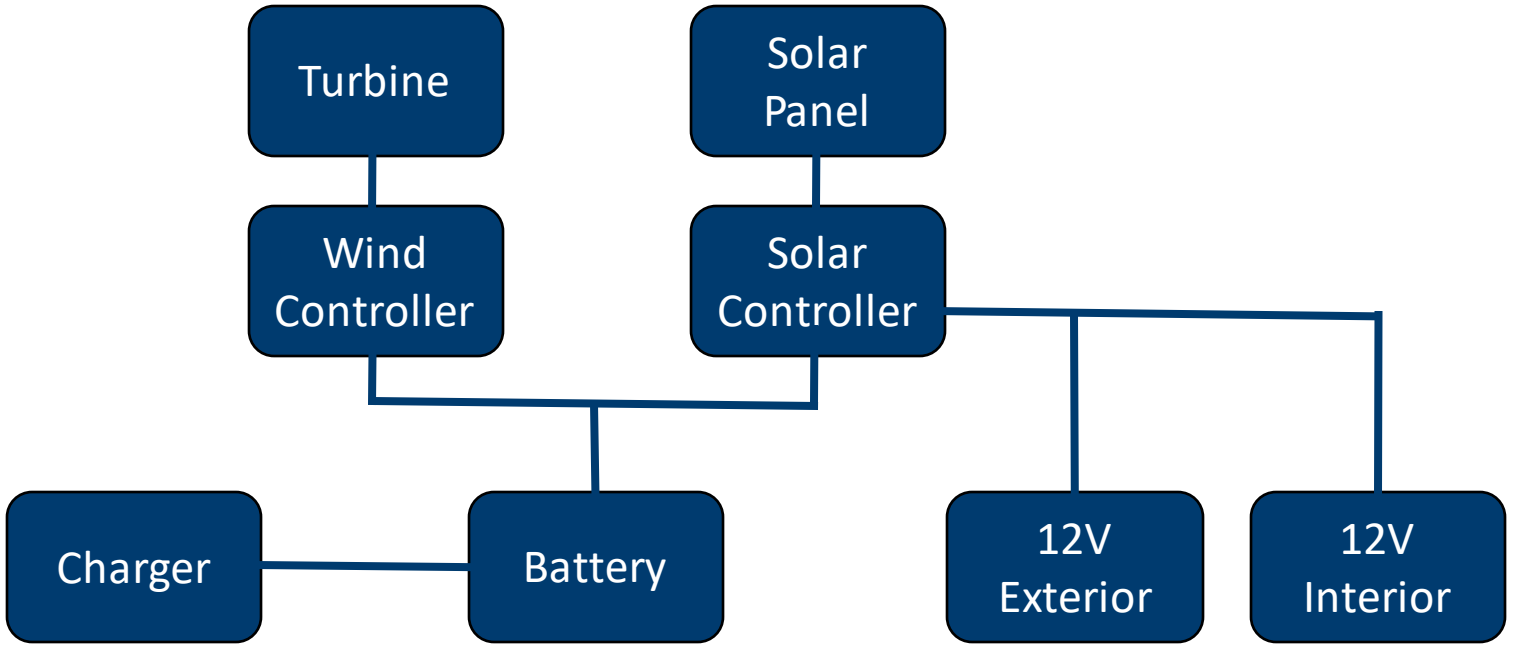
1.5''OLED

Linear Actuator

Motor controller

Anemometer

Final Electrical Design



K.A.R.E.N. Psuedo Code

- Initialize libraries, pins, and variables
- Start Continuous Loop
  - Read switch values
  - If (solarTrack == HIGH)
    - Enter Solar Tracking function
  - Ifelse (navMode == HIGH)
    - Enter navigation function
  - Ifelse (batLevel == HIGH)
    - Enter battery indicator function
  - Enter wind speed function
  - End

Solar Tracking Psuedo Code

- Solar Tracking function
  - Read Photoresistor and switch values
  - Calculate photoresistor ratio and sums
  - If(Sumed Photoresistor Values < Night)
    - Adjust linear actuators to standby position
    - Enter Low power mode for set time
  - If else(vert > 1 + Error)
    - Extend vertical linear actuator
  - If else(vert < 1 – Error)
    - Retract vertical linear actuator
  - If else(horz > 1 + Error)
    - Extend horizonal linear actuator
  - If else(horz < 1 – Error)
    - Retract horizonal linear actuator
  - End

Battery level Psuedo Code

- Battery Level Function
  - Read Analog value of voltage divider
  - Calculate true voltage level
  - Calculate Battery Level based on voltage
  - If (battery level > 20 %)
    - Display Battery Level
  - Else
    - Display "Charge me"
  - End

Anemometer Pseudo Code

- Wind Speed Function
  - Read Analog input
  - Calculate analog voltage
  - If (volatage <= minimum)
    - Output 0 m/s
  - Else
    - Calculate wind speed
    - Output calculated value
    - If (wind speed > maximum)
      - Sound buzzers
      - Output 32 m/s
  - End

Up and Coming

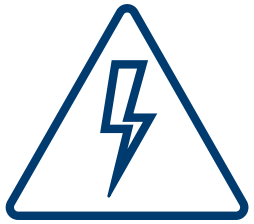
Future Work

- Complete Construction
- Test Code and Implement
- System Testing

Questions?

Backup Slides

Technical Challenges



Designing a device that can capture both wind and solar energy efficiently

Creating a structurally sound device that is also portable

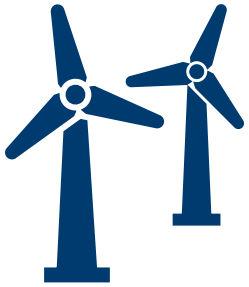
Expected markets

Industrial Companies

Residential Off-Grid Systems

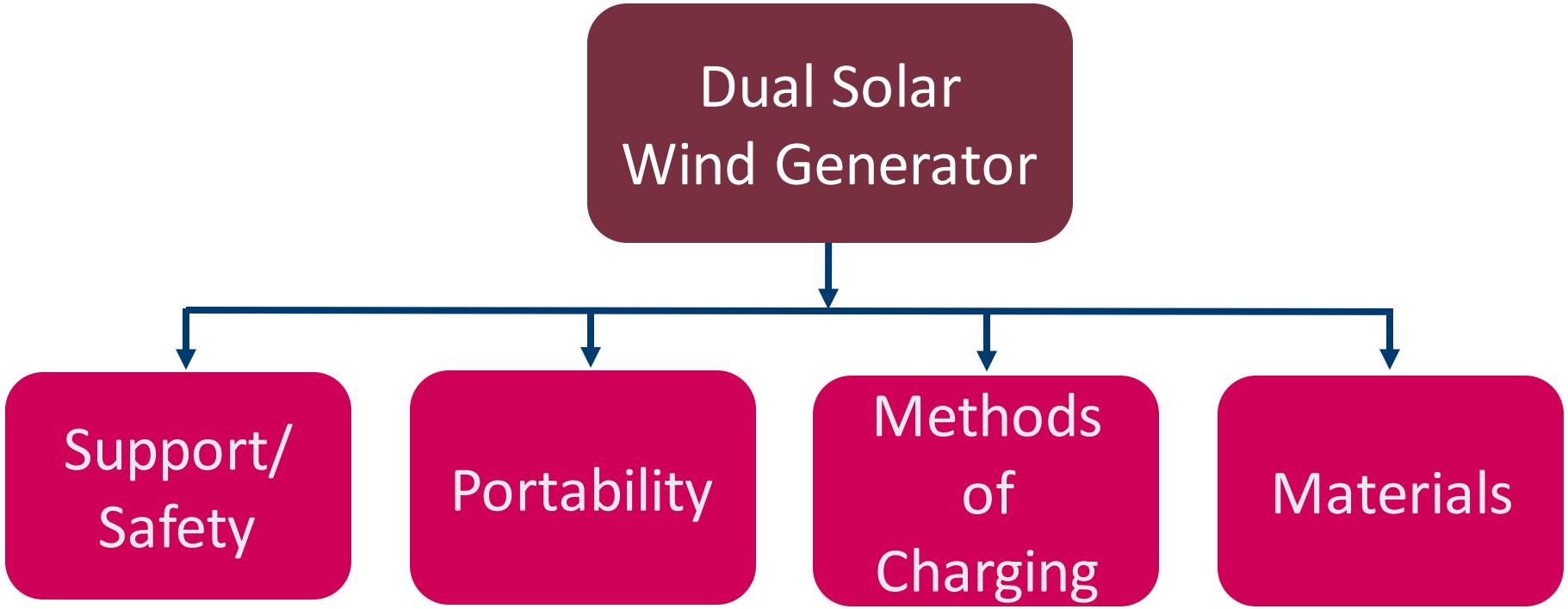
Rural Areas

Agricultural Sectors

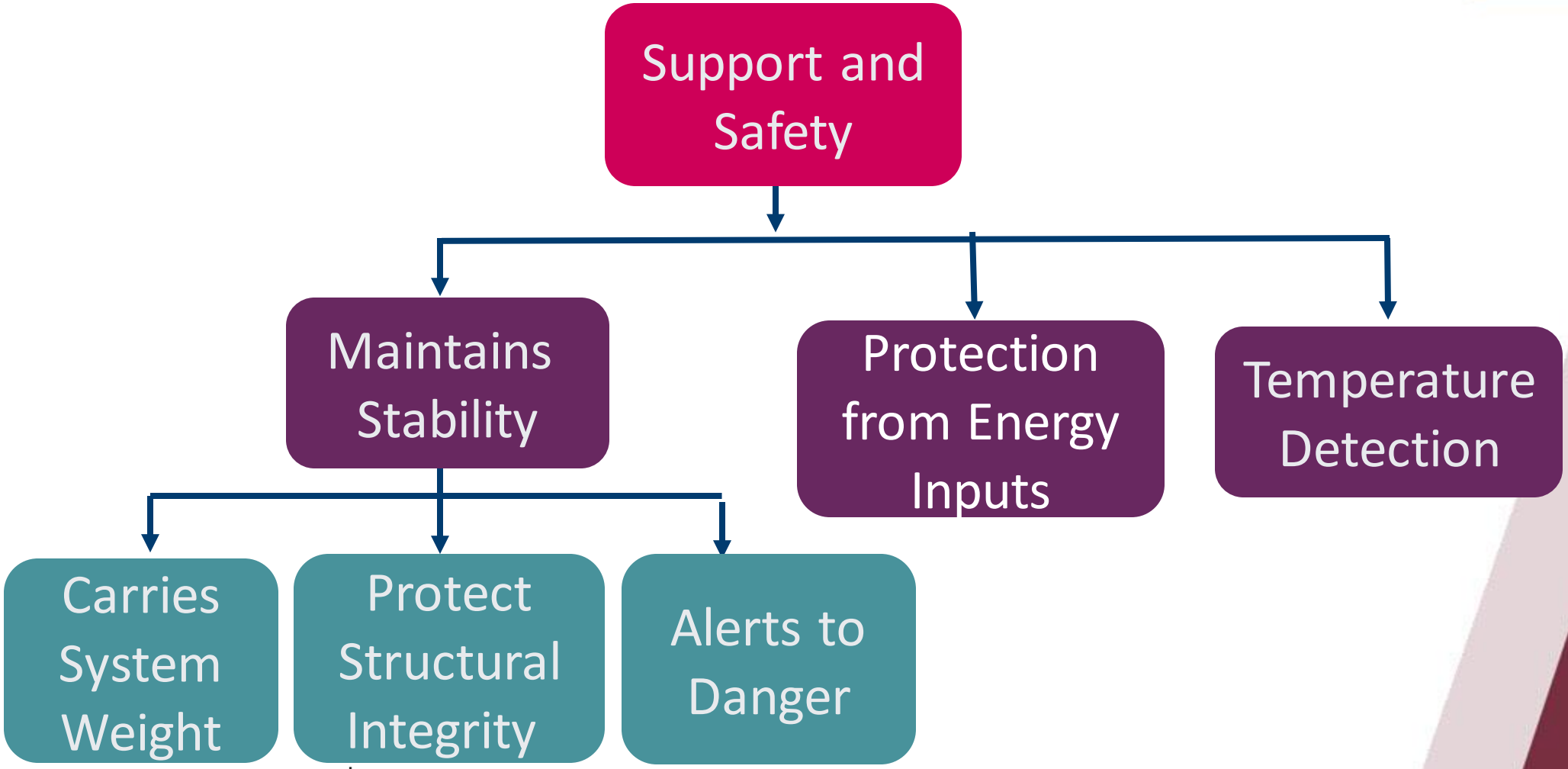


Developing Countries

Functional Decomposition



Functional Decomposition



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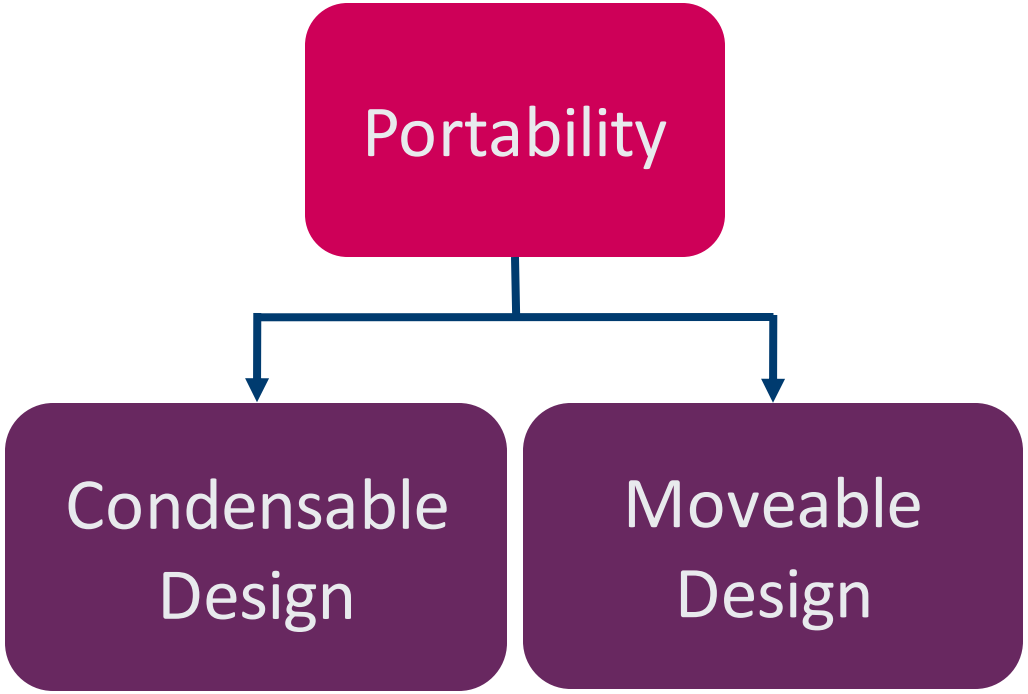

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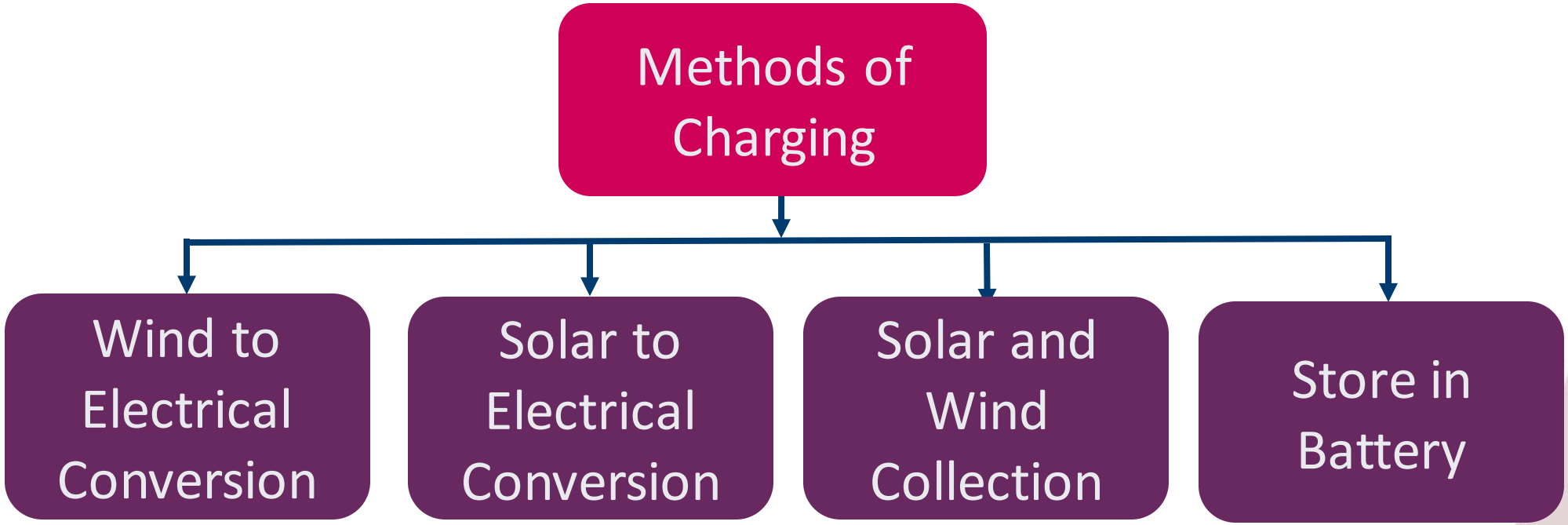

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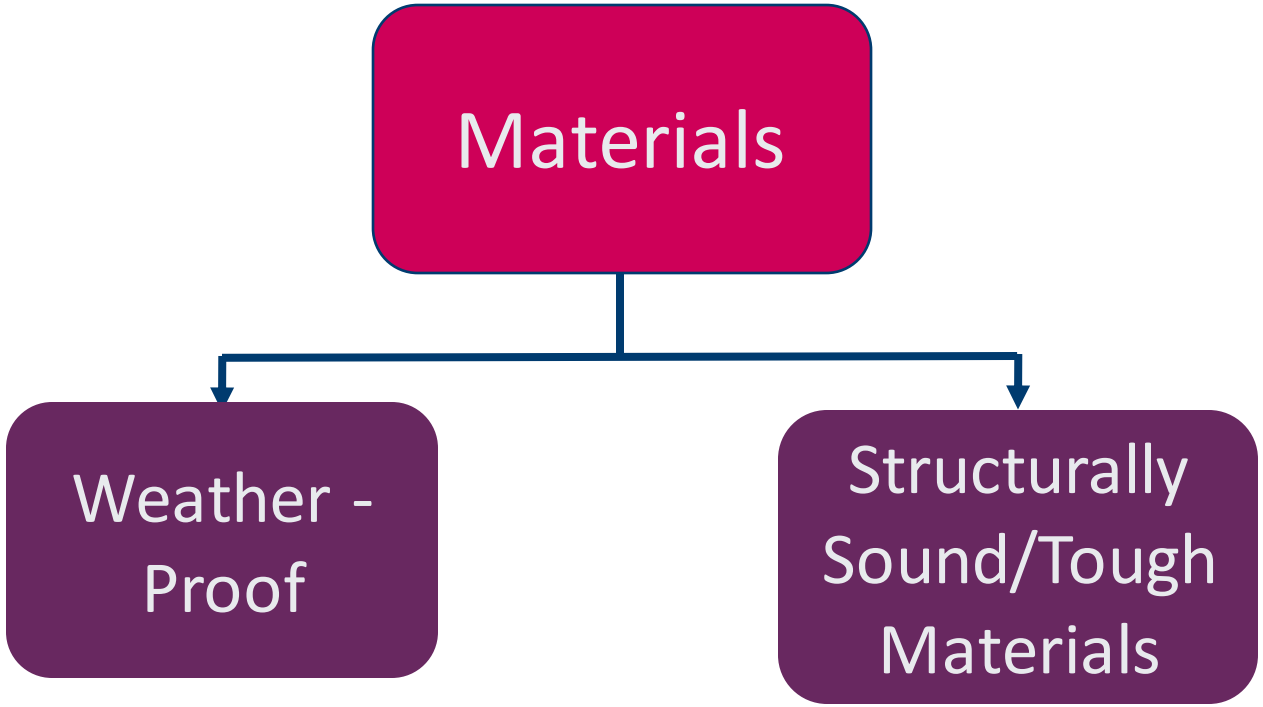

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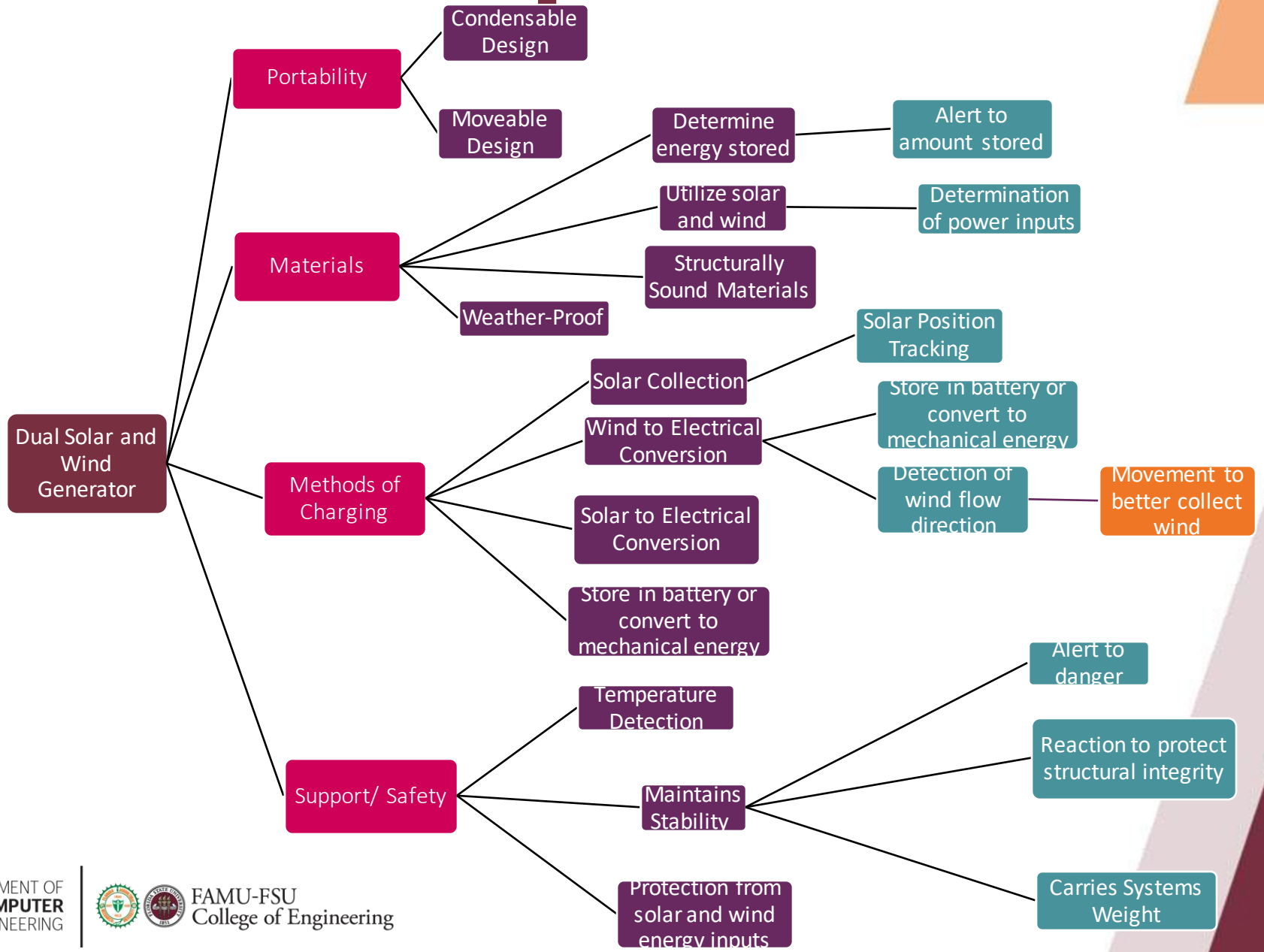

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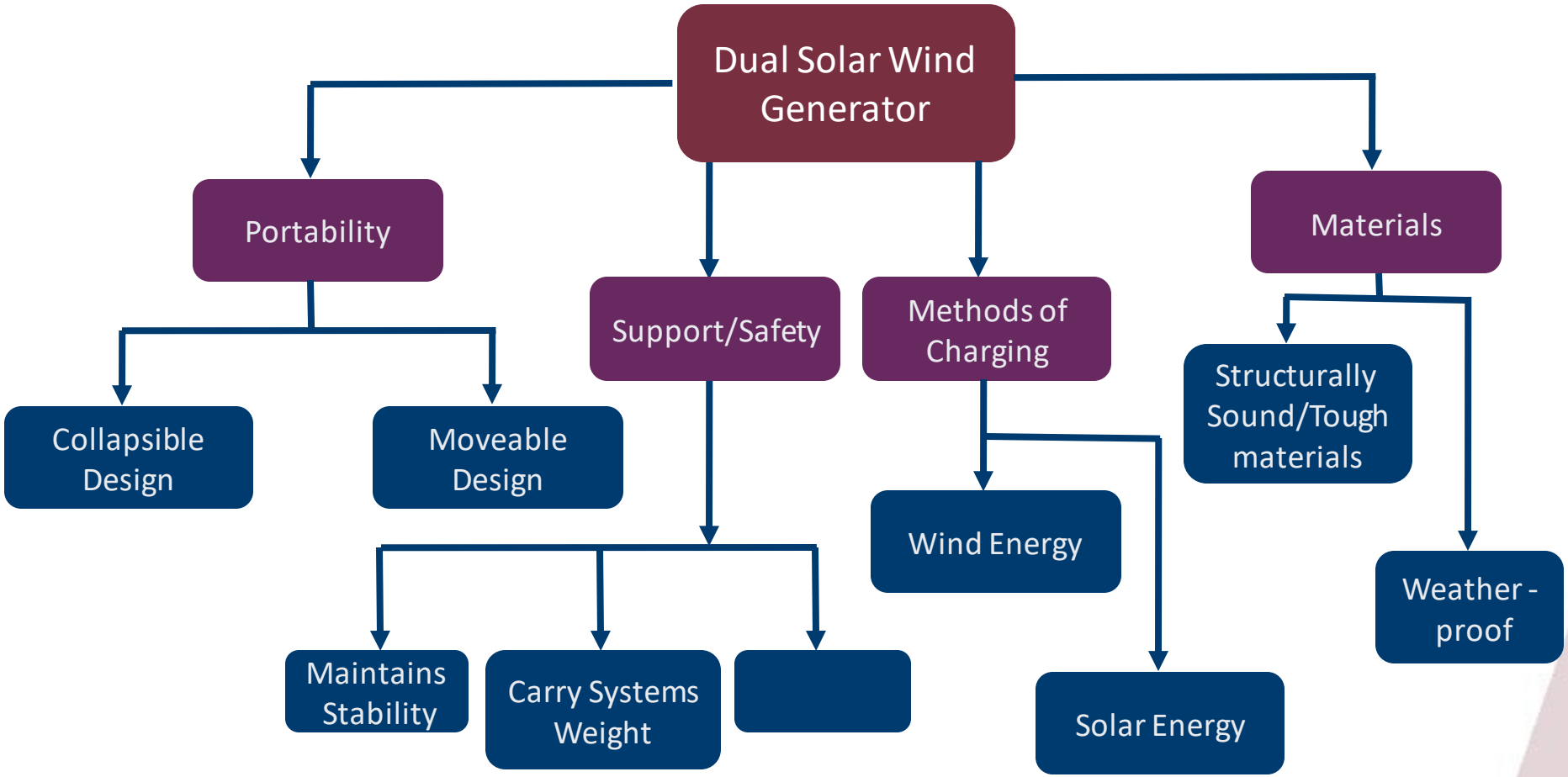
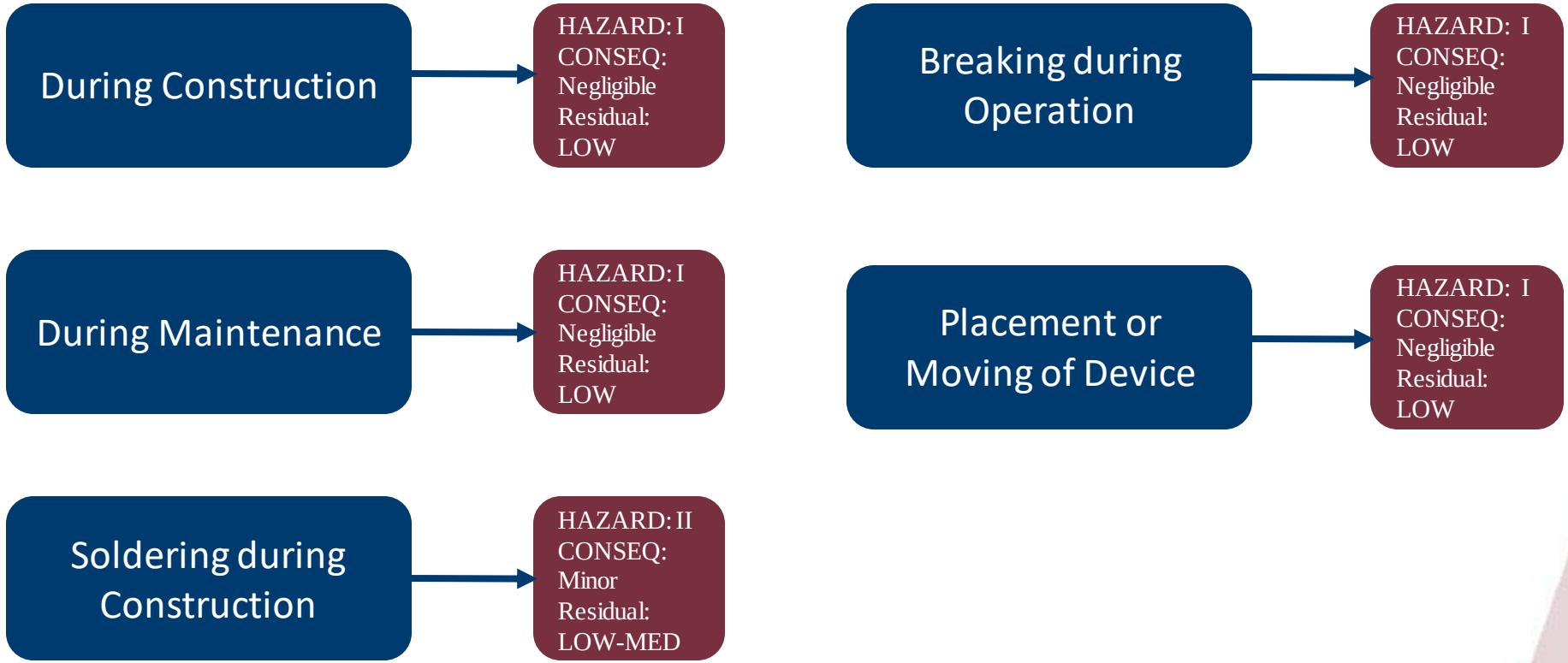


Risk Assessment



Binary Pairwise Chart

Customer Need	Priority
Generating Solar/Wind Energy	7
Charges Battery	6
Transportable	5
Single Structure	4
Environmental Forces	3
5 Year Durability	2
Ground Based	1
Doesn't Need Scalability	0

House of Quality Results

Engineering Characteristic	Criteria Weight
Structurally Sound (MPa/m^2)	16.88%
Energy Generated by Solar (Wh)	13.96%
Energy Generated by Wind (Wh)	13.96%
Energy Stored (Wh)	12.50%
Force Required to Move (N/m)	10.71%

Pugh Chart Results

Concept	Fish Turbines	Solar Cylinders	Sunflower
Number of Pluses	2	3	1
Number of Minuses	1	0	2

Analytical Hierarchy Process

Concept	Alternative Value
Fish Turbines	0.250
Solar Cylinders	0.329
Sunflower	0.421

Concept Generation

Medium Fidelity:

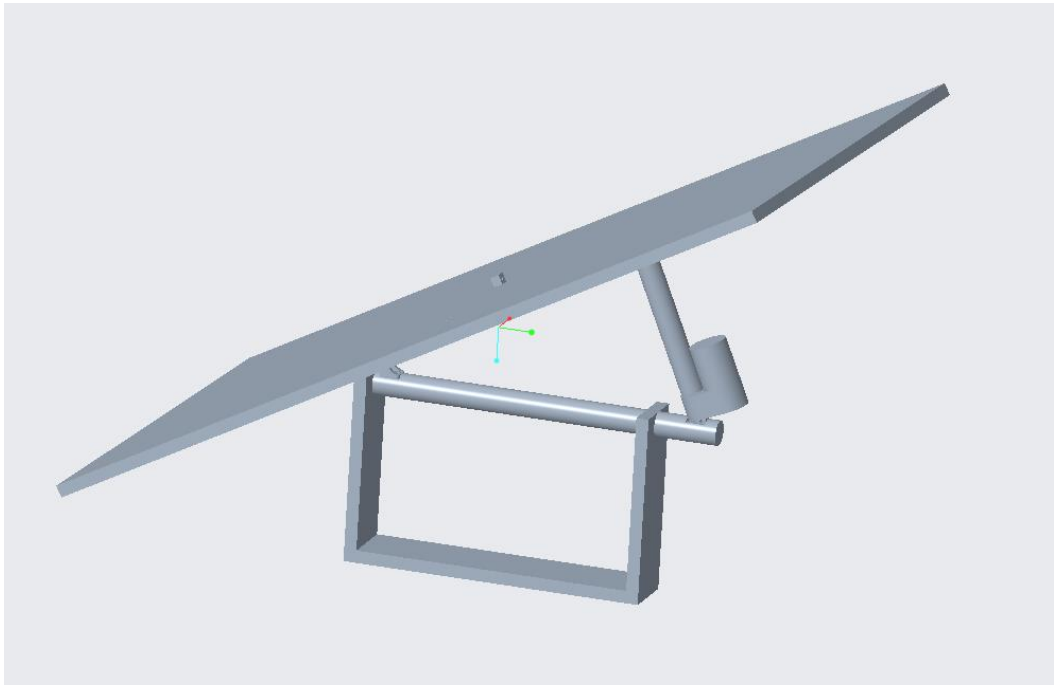
- Heat Cylinders
- Fish Turbines
- Solar Cylinders
- Turtleneck
- Car Spinner

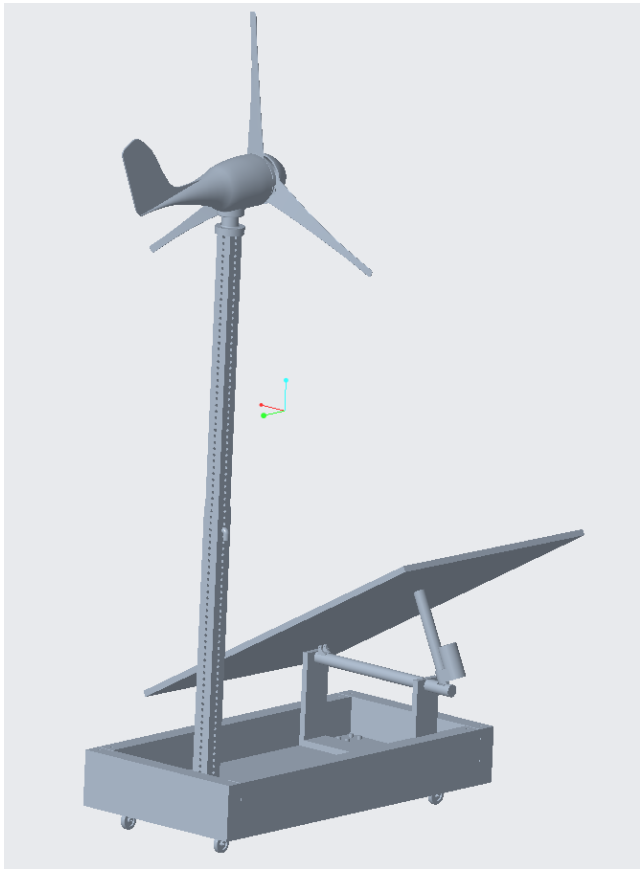
High Fidelity:

- Parallel Solarness
- Box Man
- Sunflower

Old Solar Mount Design

Old Solar Mount Design





Critical Targets

- 100 W power generation
- 10% max electrical losses
- 45 mph max wind speed
- 5 Year Durability
- 50 m portability

Bill of Materials

	Vendor	Item	Part Number	Quantity	Unit Cost	Total
2	Amazon	US stainless steel 316 square pad eye ring 5/16''	USS320-0080	4	$10.98	$43.92
3	Amazon	Wind Direction Sensor 5v DC Supply 0-5V Output	YGC-FX-5V	1	65	65
4	Amazon	LiTime 30 Amp MPPT 12V/24V/Auto DC Input Solar Charge Controller	B0BJ75NLRM	1	109.98	109.98
5	Amazon	BougeRV 20 Feet 10AWG Solar Extension Cable with Female and Male Connector	B075424L8R	1	29.99	29.99
6	Amazon	Bayco KW-110 Cord Reel, Orange	BAYKW-110	1	8.15	8.15
7	Amazon	Maximm Extension Cord 30 Ft Black Power Cords	B0CLFF3VMR	1	$16.49	16.49
8	Amazon	waveshare 1.5inch RGB OLED Display Module	B07DBXMFSN	1	$18.59	18.59