FAMU/FSU College of Engineering

Department of Electrical and Computer Engineering

<u>Concept Selection</u>

Team 301 – FPL Pole Health Detection

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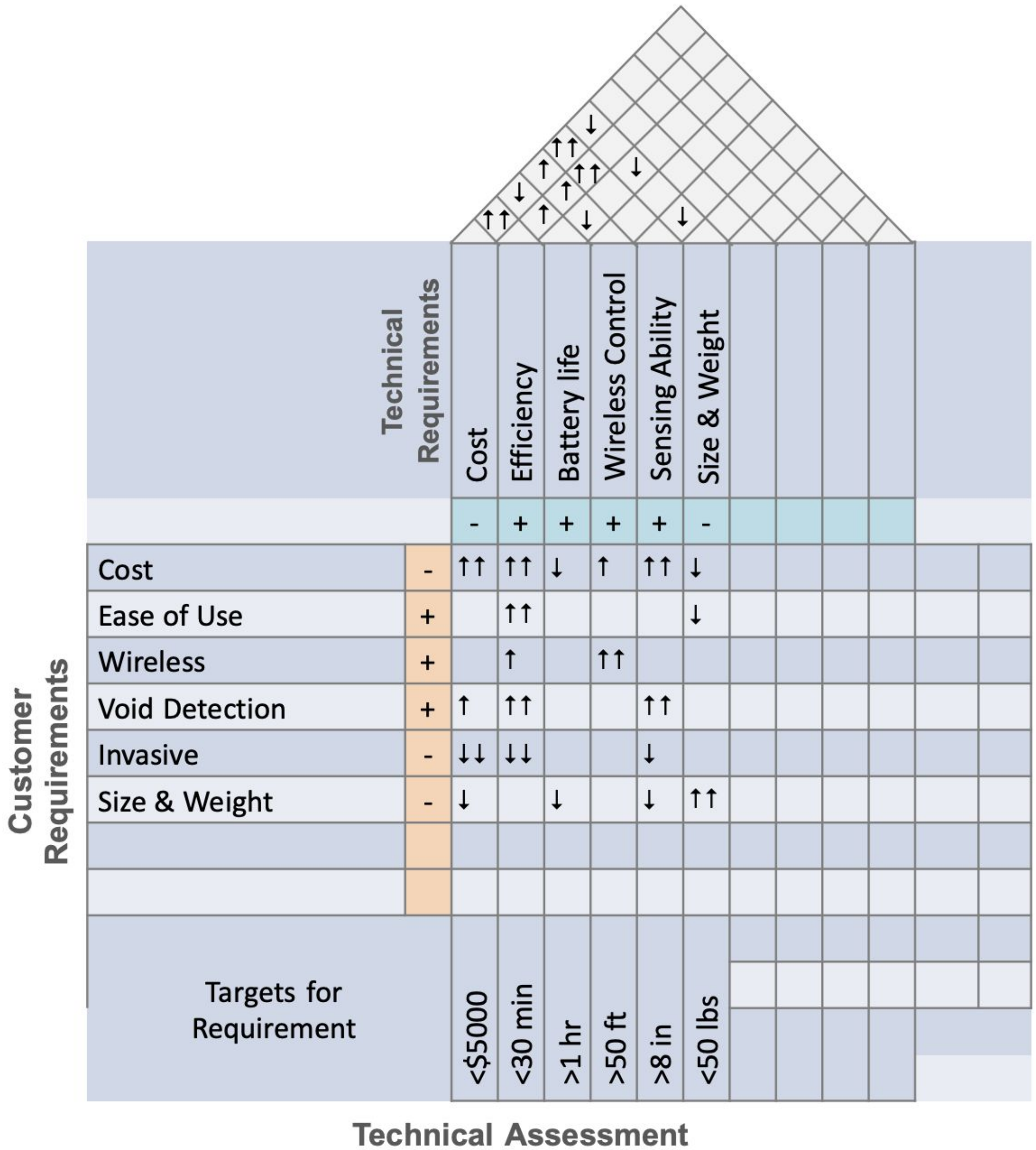
House of Quality

The House of Quality was used to identify the factors considered when choosing the design. The chart below compares the customer requirements against the design requirements and states the targets for each technical requirement. The “roof” compares each of the technical requirements against themselves. Factors such as size and weight, cost, ease of use, and others were then used in the Pugh Charts and AHP.



Pugh Chart

The following charts were one of the techniques used to identify which design choices best suited the project needs and requirements. The criteria and weights were derived from the needs and requirements and one design choice was designated as the reference. Based on the research performed, each design option was assigned a +1 if it performed better than the reference option, a -1 if it performed worse than the reference option, and a zero if the performance was equal.

These charts show that, based on the project needs and requirements, the best design choices are the ground penetrating radar (GPR) for the sensor, the IOS app for the controller, and the lithium-ion battery for the power source. Additionally, research showed that when combined, electrical resistance tomography and sonar tomography have the potential to be a better option for the project.

Sensor:

Criteria	Weight	***GPR (Reference)***	***Shigometry***	***Tomography***
Cost	2	-	+1	-1
Size & Weight	1	-	0	0
Invasiveness	4	-	-1	-1
Power Consumption	4	-	-1	+1
Adaptability	3	-	-1	-1
Effectiveness	3	-	-1	-1
Score		-	-12	-8
Continue?		Yes	Combine?	Combine?

Controller:

Criteria	Weight	***IOS App (Reference)***	***Button Controller***
Cost	2	-	-1
Size & Weight	2	-	-1
Power Consumption	3	-	-1
Operation Distance	4	-	0
Ease of Use	4	-	0
Score		-	-7
Continue?		Yes	No

Power:

Criteria	Weight	***Li-ion (Reference)***	***Ni-Cd***
Cost	1	-	+1
Charge Duration	4	-	-1
Power Density (Wh/liter)	4	-	-1
Size/Weight	3	-	-1
Time to full charge	3	-	-1
Score		-	-13
Continue?		Yes	No

Analytical Hierarchy Process

The following charts were another method used to select our final design. Similar to the Pugh Charts, the needs and requirements were used to determine the criteria and weights. Based on research, each design choice was rated on a scale from one to five, with five being the best and one being the worst. The ratings of each criteria were summed to produce the overall score.

The charts show that the best design options are the GPR for the sensor, an IOS app for the controller, and a lithium-ion battery for the power source.

Sensor:

Criteria	Weight	***GPR***	***Shigometry***	***Tomography***
Cost	2	3	4	2
Size & Weight	1	3	2	2
Invasiveness	4	5	2	2
Power Consumption	4	3	2	4
Adaptability	3	5	3	3
Effectiveness	3	4	2	2
Score		68	41	45

Controller:

Criteria	Weight	***IOS App***	***Button Controller***
Cost	2	4	2
Size & Weight	2	5	2
Power Consumption	3	4	3
Operation Distance	4	3	3
Ease of Use	4	4	4
Score		58	45

Power:

Criteria	Weight	***Li-ion***	***Ni-Cd***
Cost	1	3	5
Charge Duration	4	5	2
Power Density (Wh/liter)	4	3	3
Size/Weight	3	4	2
Time to full charge	3	4	2
Score		59	37

Final Selection

After going through the concept selection process, it was apparent that the GPR option was the best choice for our sensor, the IOS app was the best option for the required controller and finally, the Li-ion was the best power source for our robot. Each design choice was considered using the criteria identified in the House of Quality. In the Pugh Charts, one design choice was designated as the reference option. The other design choices were then given a +1 or -1 if the design performed better or worse than the reference design. In a similar manner, the Analytical Hierarchy Process compared the designs against each other and rated them on a scale from one to five, with one being the worst and five being the best. For both sets of charts, the GPR sensor, IOS app controller, and lithium-ion battery were assigned the highest scores.

Therefore, the selected design will attach a GPR sensor to the climbing robot to analyze the internal structural integrity of the utility pole. The robot will be controlled using an IOS app downloaded on an iPhone or iPad. This app will control the robots movement and sensing ability as well as inform the user of important information. A rechargeable lithium-ion battery will be used to power both the movement and sensing abilities of the robot. Ideally, this battery will be in the form of a power tool battery similar to the batteries used for impact drills. This would allow the user to have multiple batteries and provide the user with an easy way to charge the batteries.