Batteries for Microcontroller

The following tables and justifications are the basis for the decision making process of selecting a suitable power supply for the microcontroller.

Items Under Consideration

The following items have been considered for use as a power supply for the microcontroller on Roadie. Each product have a unique product ID as well as the vendor and a short description of the product, as depicted in *Table #*

|  |  |  |  |
| --- | --- | --- | --- |
| Item ID | Item Name | Vendor | Description |
| B0027GEY3Y | Venom 800mAh 7.4 LiPo [b1mp] | Amazon | 7.4 volt LiPo battery with a 800 mAh capacity and a 16 A discharge rate. |
| B00DDTKYME | Dynamite 7.4V 180mAh LiPo [b2mp] | Amazon | 7.4 volt LiPo battery with a 180 mAh capacity and a 16 A discharge rate. |
| B0073VCS0O | Eflite Blade 800mAh 7.4V LiPo [b3mp] | Amazon | 7.4 volt LiPo battery with a 800 mAh capacity and a 16 A discharge rate. |

Decision Matrix

The decision matrix used to select a battery for the motors on Roadie is depicted in Table #. The decision weights the power, cost, safety, and battery life of each battery. The highlighted row is the battery selected to power the microcontroller for Roadie.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factor | Power | Cost | Safety | Battery Life | Total |
| Weight | 0.40 | 0.15 | 0.20 | 0.25 |  |
| B0027GEY3Y | 4 | 5 | 3 | 5 | 4.2 |
| B00DDTKYME | 1 | 3 | 3 | 2 | 1.95 |
| B0073VCS0O | 4 | 1 | 3 | 5 | 3.6 |

The weighted matrix, or the matrix computed by multiplying the score in each category by its weight is show in Table #.

Justifications

The following section represents the reasoning behind each category and how their weights were determined.

Cost

This values for cost of the batteries were obtained by giving the most expensive battery a score of one, and the least expensive battery a score of five.

Cost was given a weight of 15% as the cost of items are a very important factor in any budget.

Power

The values for power of the batteries were obtained by a few factors being the voltage of the batteries, how much milliamps per hour the batteries provide. The voltage of the batteries are a key part so we do not fry our motors and microcontroller when using it with the batteries, and we must have enough voltage to power everything. So the weight of the voltage is depend on how far away from the recommend voltage the battery falls on will determine its score. The milliamps per hour was used to determine if the batteries could provide enough amperage to the motors for them to run.

Power was given a weight of 40% as the power of the battery dictates how long Roadie can run without having to spawn or charge the batteries.

Safety

The values for safety of the batteries were obtained by factoring the risk of using each battery type and the environmental impact each type of battery will have. The risk of usage of a battery type rates to how the battery will react to mishaps happening. This could be dropping, shorting out, or overheating the batteries. The environmental impact of each type of battery depends on what the battery is made out of, since most batteries contain some type of heave metal in them that is harmful to humans and the environment. [1mp]

Safety was given a weight of 20% as the safety of the team and the environment when working on Roadie are important aspects of the project.

Battery Life

The values for battery life of the batteries were obtained by given the battery with the lowest battery life a score of 5, and the battery with the highest battery life a score of 1. The other batteries are given a score based on how close they fall toward the high rated battery and the lowest rated battery. The estimated battery life is given by the equation () at maximum load.

|  |  |  |  |
| --- | --- | --- | --- |
| Factor | mAh | mA | Life (Hours) |
| B0027GEY3Y | 800 | 16000 | 0.035 |
| B00DDTKYME | 180 | 16000 | 0.00788 |
| B0073VCS0O | 800 | 16000 | 0.035 |

Battery life was given a weight of 25% as the battery life is how long a battery will last on a single charge.

Batteries for Motors

The following tables and justifications are the basis for the decision making process of selecting a suitable power supply for the motors on Roadie.

Items Under Consideration.

The following items have been considered for use as a power supply for the motors on Roadie. Each product have a unique product ID as well as the vendor and a short description of the product, as depicted in *Table #*

|  |  |  |  |
| --- | --- | --- | --- |
| Item ID | Item Name | Vendor | Description |
| B0027G9F9M | Venom 5000 mAh 14.8V LiPo [b4mp] | Amazon | 14.8 volt LiPo battery with a 5000 mAh capacity and a 125 A discharge rate. |
| B003CUB4QO | Venom 5000 mAh 14.8V Hard Case LiPo [b5mp] | Amazon | 14.8 volt LiPo hard case battery with a 5000 mAh capacity and a 175 A discharge rate. |
| B003CUJ1WI | Venom 3800 mAh 18.5V Hard Case LiPo [b6mp] | Amazon | 18.5 bolt LiPo hard case battery with a 3800 mAh capacity and a 133 A discharge rate. |

Decision Matrix

The decision matrix used to select a battery for the motors on Roadie is depicted in Table #. The decision weights the power, cost, safety, and battery life of each battery. The highlighted row is the battery selected to power the motors for Roadie.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factor | Power | Cost | Safety | Battery Life | Total |
| Weight | .40 | .15 | .20 | .25 |  |
| B0027G9F9M | 5 | 5 | 3 | 5 | 4.6 |
| B003CUB4QO | 1 | 1 | 3 | 3 | 1.9 |
| B003CUJ1WI | 3 | 3 | 3 | 3 | 3 |

The weighted matrix, or the matrix computed by multiplying the score in each category by its weight is show in Table #.

Justifications

The following section represents the reasoning behind each category and how their weights were determined.

Cost

This values for cost of the batteries were obtained by giving the most expensive battery a score of one, and the least expensive battery a score of five.

Cost was given a weight of 15% as the cost of items are a very important factor in any budget.

Power

The values for power of the batteries were obtained by a few factors being the voltage of the batteries, how much milliamps per hour the batteries provide. The voltage of the batteries are a key part so we do not fry our motors and microcontroller when using it with the batteries, and we must have enough voltage to power everything. So the weight of the voltage is depend on how far away from the recommend voltage the battery falls on will determine its score. The milliamps per hour was used to determine if the batteries could provide enough amperage to the motors for them to run.

Power was given a weight of 40% as the power of the battery dictates how long Roadie can run without having to spawn or charge the batteries.

Safety

The values for safety of the batteries were obtained by factoring the risk of using each battery type and the environmental impact each type of battery will have. The risk of usage of a battery type rates to how the battery will react to mishaps happening. This could be dropping, shorting out, or overheating the batteries. The environmental impact of each type of battery depends on what the battery is made out of, since most batteries contain some type of heave metal in them that is harmful to humans and the environment. [1mp]

Safety was given a weight of 20% as the safety of the team and the environment when working on Roadie are important aspects of the project.

Battery Life

The values for battery life of the batteries were obtained by given the battery with the lowest battery life a score of 5, and the battery with the highest battery life a score of 1. The other batteries are given a score based on how close they fall toward the high rated battery and the lowest rated battery. The estimated battery life is given by the equation () at maximum load.

|  |  |  |  |
| --- | --- | --- | --- |
| Factor | mAh | mA | Life (hours) |
| B0027G9F9M | 5000 | 125000 | 0.028 |
| B003CUB4QO | 5000 | 175000 | 0.02 |
| B003CUJ1WI | 3800 | 133000 | 0.02 |

Battery life was given a weight of 25% as the battery life is how long a battery will last on a single charge.

|  |  |  |
| --- | --- | --- |
| ID | Requirement Text | Fulfillment |
| 4.2.1 | The system shall operate for a minimum of [TBD] minutes when the power source starts with a full charge. | By choosing batteries that provide more amperage than what is required to run the microcontroller and motors, it will be possible to ensure that Roadie will be able to operate for a [TBD] mintues. |

Risk Analysis

Batteries

Lithium Polymer batteries (LiPo) are extremely energy dense for a chemical battery. However since LiPo batteries are energy dense it also means they are unstable under abuse. When a LiPo battery is damage in anyway the battery has a chance to ignite and catch on fire, this is known as thermal runaway. This could come from the battery being physically damage or if the battery is shorted out. But the chances of LiPo to have a thermal runaway is every small. [4mp]

Environment Impacts

All batteries contain some sort of heavy metal or toxic and hazardous chemicals. Each battery should be disposed of properly to reduce the environmental impact of batteries. LiPo batteries are one of the few battery types that environment friendly meaning as long as the proper procedure is used to discharge the battery it can throw away in the normal trash. [4mp]

[1mp] <http://www.uwsa.edu/ehs/environmental-affairs/waste-management/batteries/>

[4mp] <http://oes.tamu.edu/web/guidelines/battery/LiPo%20Procedures.pdf>

[3mp] <http://www.digikey.com/en/resources/conversion-calculators/conversion-calculator-battery-life>

[2mp]

[b1mp] http://www.amazon.com/Venom-800mAh-LiPO-Battery-Plug/dp/B0027GEY3Y/ref=pd\_sxp\_f\_r

[b2mp] <http://www.amazon.com/Dynamite-B0005-7-4V-180mAh-LiPo/dp/B00DDTKYME/ref=sr_1_1?ie=UTF8&qid=1412627434&sr=8-1&keywords=B00DDTKYME>

[b3mp] <http://www.amazon.com/Eflite-Blade-800mAh-7-4V-20AWG/dp/B0073VCS0O/ref=sr_1_1?ie=UTF8&qid=1412618869&sr=8-1&keywords=B0073VCS0O>

[b4mp] http://www.amazon.com/Venom-5000mAh-14-8-LiPO-Battery/dp/B0027G9F9M/ref=sr\_1\_fkmr0\_1?ie=UTF8&qid=1412619260&sr=8-1-fkmr0&keywords=Venom+5000mAh+14.8V+Quad+Cell+4S+25C+LiPo+Pack

[b5mp] http://www.amazon.com/Venom-5000mAh-14-8-Battery-Approved/dp/B003CUB4QO/ref=sr\_1\_fkmr1\_3?s=toys-and-games&ie=UTF8&qid=1412620651&sr=1-3-fkmr1&keywords=Venom+25C+14.8

[b6mp] http://www.amazon.com/gp/product/B003CUJ1WI/ref=pd\_lpo\_sbs\_dp\_ss\_3?pf\_rd\_p=1944687762&pf\_rd\_s=lpo-top-stripe-1&pf\_rd\_t=201&pf\_rd\_i=B0027GEYS4&pf\_rd\_m=ATVPDKIKX0DER&pf\_rd\_r=1M34TEEZ6W4XJF1RVXGX