**Project Economics Analysis and Budget**

The budget plan given below in the table is the expected cost to build the battlebot. The team will start ordering the parts by the mid of December 2018: after finalizing the design. As for now, the budget is under control with estimated cost of 72.63% of the total budget limit. As progress, if the budget exceeds the limit; the design can be altered in order to reduce the parts and materials used to manufacture the Bot, as the design contain more empty space.

Table 1 : Materials need to be Purchased

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part Number** | **Description** | **Quantity** | **Unit cost** | **Total Expected Cost** |
| 1 | 165 RPM HD Premium Planetary Gear Motor | 2 | $39.99 | $79.98 |
| 2 | **Cytron 13A, 5-30V Single DC Motor Controller** | 3 | $13.82 | $41.46 |
| 3 | Raspberry Pi Zero W | 1 | $10.00 | $10.00 |
| 4 | Tenergy NiMH 12V 4200mAh Rechargeable Battery Pack | 2 | $69.99 | $139.98 |
| 5 | 1,621 RPM HD Premium Planetary Gear Motor | 1 | $39.99 | $39.99 |
| 6 | 6063-T52 Aluminum Rectangle Tube (2X1X1/8 Wall) | 1 | $32.15 | $32.15 |
| 7 | 11 GA. (.120 thick) Hot Rolled Steel Sheet (2'X4') | 1 | $77.00 | $77.00 |
| 8 | 5/8" Hot Rolled A-36 Steel Round | 1 | $5.14 | $5.14 |
| 9 | 1/2" Hot Rolled A-36 Steel Round | 1 | $6.60 | $6.60 |
| 10 | Bearing | 4 | $11.00 | $44.00 |
| 11 | Roller Bearing | 2 | $10 | $20.00 |
| 12 | Pulley | 4 | $16.00 | $64.00 |
| 13 | Driving Belt | 2 | $6.00 | $12.00 |
| 14 | Gears | 2 | $22.00 | $44.00 |
| 15 | Gears | 2 | $13.00 | $26.00 |
| 16 | 5" wheels/hubs | 4 | $16.00 | $64.00 |
| 17 | Screws | 1 | $20.00 | $20.00 |
|  |  | **Total** |  | $726.30 |

There is a possibility to change the design with some modification of sizes as the metals cost more than the team expected. Initially the top and bottom plate; which will act as the body armor was considered to be Aluminum as it is the light weight material than steel. But the minimum cost of the Aluminum of the required size was $101.00. So, the team have decided to purchase 11 Gauge Hot rolled Steel sheet which will cost $24.00 less than the Aluminum. It also adds the advantage of strong protection than Aluminum to the Bot. on the other hand, the total weight of the Bot has to reconsider with the design.

The manufacturing plan is mostly based on CNC machining and welding. The screws will be used to fasten the components to the base. So, the estimated manufacturing expenses are listed below in the table. Fortunately, these manufacturing costs are waived by allowing the team to work and use the materials in the university makerspace for free.

Table 2: Manufacturing Cost

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **units** | **Unit cost** | **Total expected cost** |
| CNC lathe | 3 hrs | $90/ hr | $ 270.00 |
| CNC milling | 3 hrs | $90/ hr | $ 270.00 |
| Welding | 5 hrs | $60/ hr | $ 300.00 |
| Electrodes for welding | 2 boxes | $19.97/ Box | $ 39.94 |
| Conventional milling | 4 hrs | $75/ hr | $ 300.00 |
| Conventional turning | 4 hrs | $75/ hr | $ 300.00 |

Note that for the machining, two processes: CNC machining and Lathe machining are listed. But the team will mostly target to work on the CNC machine to get an accurate and easy manufacturing of parts. Also, these machining costs are based on the information provided on the internet and these are the average price ranges in the US and the hours mentioned in the table are rough approximate of how long it will take to manufacture the parts.