

Catch Mine Drift 2018: Results

Bharti School of Engineering
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Sudbury, Ontario, Canada

Winter 2018

Prototype results

Group	Performance				Cost		Total Score
	Front	Back	Total	Score	\$	Score	
1-01	2	0	1	51.9%	\$21.95	78.7%	59.9%
1-02	1	1	2	53.7%	\$20.98	79.6%	61.5%
1-03 [†]	2	1	3	55.6%	\$24.81	75.9%	57.2%
1-04	1	0	1	51.9%	\$33.42	67.5%	56.5%
1-05 [†]	2	1	3	55.6%	\$41.80	59.3%	52.2%
1-06*	0	0	0	50%	\$24.66	76%	54.8%
1-07 [†]	14	13	27	100%	\$45.23	56%	82.3%
1-08	1	0	1	51.9%	\$6.80	93.4%	64.3%
1-09 [†]	1	0	1	51.9%	\$34.73	66.2%	51.7%
1-10	14	13	27	100%	\$15.20	85.2%	95.6%
1-11*	6	0	1	51.9%	\$16.76	83.7%	58.4%
1-12 [†]	1	0	1	51.9%	\$13.83	86.6%	57.8%
1-13 [†]	2	1	3	55.6%	\$51.40	50%	49.4%
2-01*	1	0	1	51.9%	\$30.09	70.7%	54.5%
2-02*	0	0	0	50%	\$33.12	67.8%	52.3%
2-03	0	0	0	50%			
2-04	3	2	5	59.3%	\$28.78	72%	63.1%
2-05	4	4	8	64.8%	\$5.29	94.9%	73.8%
2-06	2	2	4	57.4%	\$7.59	92.6%	68%
2-07	2	2	4	57.4%	\$6.58	93.6%	68.3%
2-08*	2	2	4	57.4%	\$36.42	64.6%	56.6%
2-09 [†]	1	0	1	51.9%	\$24.75	75.9%	54.6%
2-10	0	0	0	50%			
2-11	1	0	1	51.9%	\$0.04	100%	66.3%
2-12	11	10	21	88.9%	\$40.32	60.8%	80.5%
2-13	1	0	1	51.9%	\$28.11	72.7%	58.1%
2-14 [†]	1	0	1	51.9%	\$40.45	60.7%	50%

*Penalty for late cost analysis sheet (-3%).

[†]Penalty for having to resubmit the cost analysis (-4.5%).

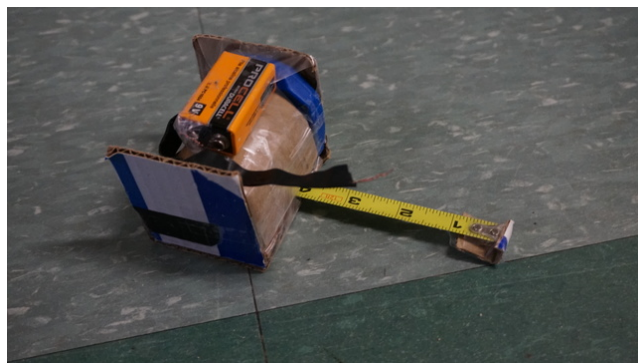
Final testing results

Group	Performance				Cost		Total Score
	Front	Back	Total	Score	\$	Score	
1-01	14	13	27	100%	\$14.38	99.1%	99.7%
1-02	14	13	27	100%	\$25.83	94.6%	98.4%
1-03	2	2	4	36.1%	\$25.23	95.1%	53.8%
1-04	5	4	9	50%	\$18.15	98.3%	64.5%
1-05	8	7	15	66.7%	\$30.52	90.3%	73.8%
1-06	1	0	1	27.8%	\$32.48	87.9%	45.8%
1-07	14	13	27	100%	\$36.82	81%	94.3%
1-08	5	5	10	52.8%	\$10.55	99.6%	66.8%
1-09*	9	8	17	72.2%	\$32.72	87.5%	73.8%
1-10	14	13	27	100%	\$15.20	99%	99.7%
1-11	5	4	9	50%	\$33.99	85.7%	60.7%
1-12	5	4	9	50%	\$12.23	99.4%	64.8%
1-13	2	1	3	33.3%	\$44.62	64%	42.5%
2-01*	2	1	3	33.3%			
2-02*	3	3	6	41.7%	\$20.28	97.6%	55.5%
2-03	14	13	27	100%	\$27.66	93.2%	98%
2-04	3	2	5	38.9%	\$9.83	99.6%	57.1%
2-05	5	4	9	50%	\$5.90	99.8%	65%
2-06	8	7	15	66.7%	\$16.40	98.7%	76.3%
2-07	2	2	4	36.1%	\$6.57	99.8%	55.2%
2-08	9	7	15	66.7%	\$19.95	97.7%	76%
2-09	5	5	10	52.8%	\$12.54	99.4%	66.8%
2-10*	1	1	2	30.6%			
2-11*	3	2	5	38.9%			
2-12	14	13	27	100%	\$27.82	93%	97.9%
2-13*	3	2	5	38.9%	\$25.80	94.7%	52.6%
2-14	1	0	1	27.8%	\$40.67	73.3%	41.4%

*Penalty for late cost analysis sheet (-3%).

Group 1-01

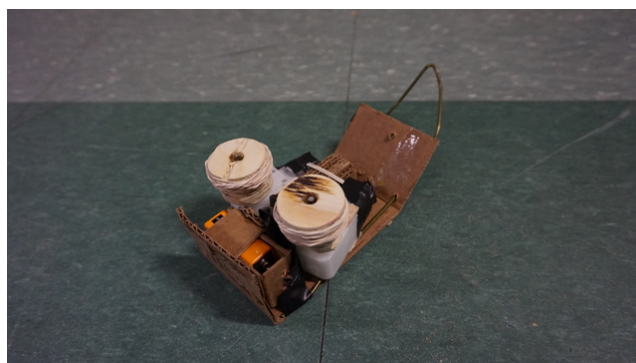
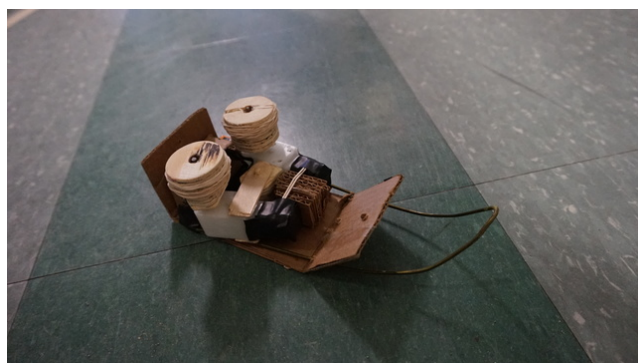
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=19s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
DC 6V 50RPM Micro Gear Box Speed Reduction Motor Electric Geared Motor	\$13.99		100%	\$13.99
Mastercraft Classic Tape Measure, 12-ft	\$4.99		100%	\$4.99
9V Alkaline Battery 1 Pack	\$2.88		100%	\$2.88
Certified 20 AWG Wire, White, 25-ft	\$5.99	Could make 200 devices with one roll, used 6"	0.5%	\$0.03
Transparent Tape	\$0.97	We could make 33 devices with one roll. Used 0.3 meters	2.97%	\$0.03
General Purpose Vinyl Electrical Tape, 19-mm x 18-m	\$0.99	Could make 36 devices with this roll, used half of a meter.	2.7%	\$0.03
Gorilla Glue Adhesive, 4-oz	\$12.99	Could make 8000 devices with one tube, used 0.05% of the tube.	0.05%	\$0.01
			TOTAL	\$21.95

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=19s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$624.00	Used 2 motors form the pack of 100. Could make 50 devices	2%	\$12.48
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Used 1 battery out of a pack of 4. Could make 4 devices with one pack	25%	\$1.49
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Could make 16 devices. Used half of one out of 8	6.25%	\$0.19
Gorilla Glue Adhesive, 4-oz	\$12.99	Could make 236 devices with one tube, used 0.41% of the tube.	0.42%	\$0.06
100 % Rubber Rubber Band #16	\$1.97	Used 9 elastics from a pack of 500. Could make 55 devices with one pack	1.8%	\$0.04
Tree Island 1 1/2-in 15-Gauge Bright Steel Smooth Finish Nail (500-Count)	\$8.49	Used 2 out of a pack of 500. Could make 250 devices with one pack	0.4%	\$0.03
Taiga Building Products 1/2 x 4-ft x 8-ft Standard Spruce Plywood	\$29.55	Used 5 square inches of a 4ft x 8ft sheet. We could make 909 devices with one sheet	0.11%	\$0.03
General Purpose Vinyl Electrical Tape, 19-mm x 18-m	\$0.99	Could make 36 devices with this roll, used half of a meter.	2.78%	\$0.03
Horizon Group USA Jumbo Wood Craft Sticks	\$4.97	Used 1 popsicle sticks out of a pack of 300. Could make 300 devices with one pack	0.33%	\$0.02
Certified 20 AWG Wire, White, 25-ft	\$5.99	Could make 200 devices with one roll, used 2"	0.17%	\$0.01
Mainstays 12" 100 Piece Bamboo Skewers	\$2.50	Used 1/4th of a skewer. Could make 400 devices with one pack	0.25%	\$0.01
			TOTAL	\$14.38

Group 1-02

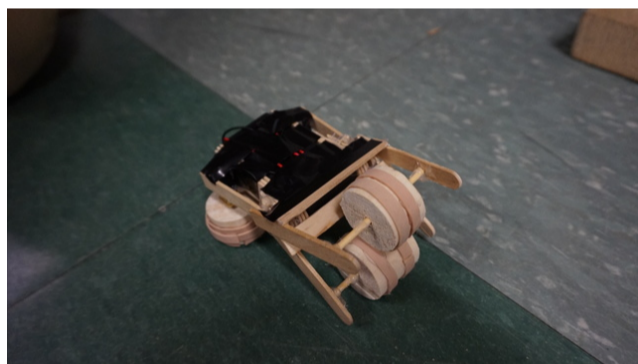
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=22s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
STANDARD MOTOR 11605 RPM 5VDC	\$18.28	4 motors used, each cost \$4.57	100%	\$18.28
Energizer Max AA Batteries, 38 Pack	\$19.97	2 batteries of 38 used	5.26%	\$1.05
Unique Bargains 10 Pairs Flexible Tin Plated Jumper Wires Breadboard Testing Cable 15cm 6"	\$9.99	7.5cm of 90cm used	8.33%	\$0.83
2xAA Battery Holder (3pk)	\$1.65	1 out of the 3 packs used	33.33%	\$0.55
Poplar Dowel 1.1/4x36"	\$6.99	1.2" used, this length can be cut 30 times from 36"	3.3%	\$0.23
Scotch Super 33+ Vinyl Electrical Tape	\$3.48	0.06m of 7.62m used	0.7%	\$0.02
Staples Economy Rubber Bands, Size #16	\$1.56	Used 4 rubber bands or about 0.00220lb (or 1g, since a rubber band weighs about 0.25g) of a 1/4lb bag.	0.88%	\$0.01
			TOTAL	\$20.98

Final design

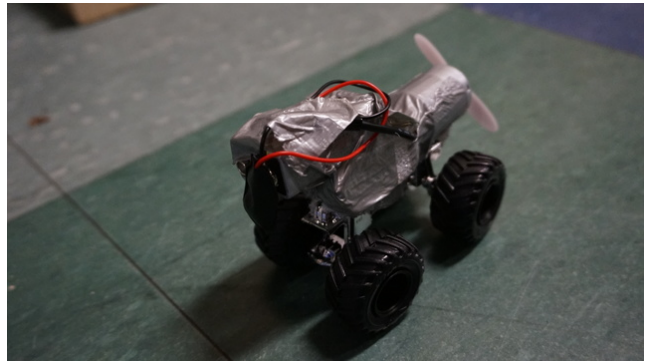


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=35s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
298:1 Gear Ratio Brushed DC Motor Gearmotor 75 RPM 6VDC	\$11.14	Price is for one motor, 2 used	200%	\$21.98
2 AA Battery Holder w/ Switch	\$163.00	item is \$1.63 when you buy 100, only one used	1%	\$1.63
Unique Bargains 10 Pairs Flexible Tin Plated Jumper Wires Breadboard Testing Cable 15cm 6"	\$9.99	6 cm of 90cm used	6.67%	\$0.67
Poplar Dowel 1-1/4x36"	\$6.99	3" of 36" used	8.33%	\$0.58
AA Alkaline Battery 48 Pack	\$11.68	2 batteries of 48 used	4.17%	\$0.49
Chenille Craft Natural Jumbo Wood Craft Sticks, 1000/Pack (CK-377601)	\$36.90	7 out of 1000 used	0.7%	\$0.26
AdTech Mini Glue Sticks (100 Pack)	\$11.47	1 out of 100 used	1%	\$0.11
Chenille Craft Natural Wooden Craft Stick,, 3000/Pack (CK-377401)	\$42.12	4 out of 3000 used	0.13%	\$0.06
Scotch Super 33+ Vinyl Electrical Tape	\$3.48	0.06m of 7.62m used	0.7%	\$0.02
Staples Economy Rubber Bands, Size #16 1/4lb Bag	\$1.56	Used 5 rubber bands or about 0.00220lb (or about 1g, since a rubber band weighs about 0.20g) of a 1/4lb bag.	0.88%	\$0.01
Mainstays 12" 100 Piece Bamboo Skewers	\$2.50	One half a skewer used out of 100	0.5%	\$0.01
			TOTAL	\$25.83

Group 1-03

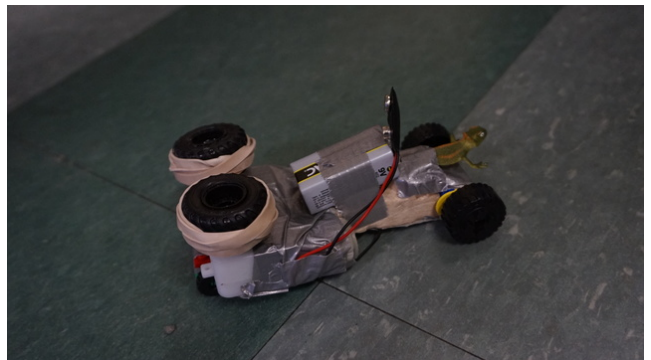
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=26s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
9 volt battery	\$12.97		100%	\$12.97
1:64 MONSTERJAM	\$5.77		100%	\$5.77
DC motor - Product #: 1528-1150-ND	\$2.68		100%	\$2.68
DROE1111 Prop Set Red Ominus Quadcopter	\$6.99	1 of 4 fans used	25%	\$1.75
9 Volt snap connector - Product #: BS6I-ND	\$0.91		100%	\$0.91
LePage Super Glue Ultra Gel Control	\$7.07	1 drop used	5%	\$0.35
Golda's Kitchen Square Cake Dummy - 6" x 4"	\$3.25	10% used	10%	\$0.33
Gorilla Duct Tape - 2" x 30 yds, White	\$12.99	6cm used	0.4%	\$0.05
			TOTAL	\$24.81

Final design

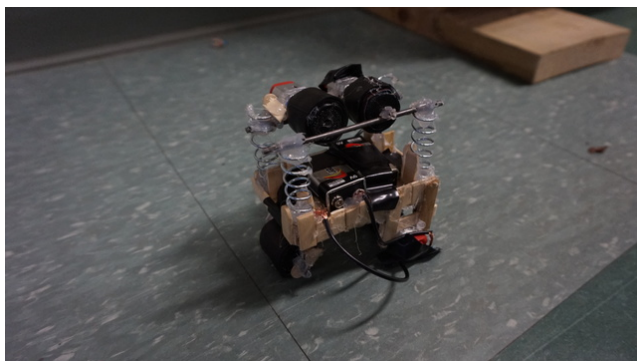
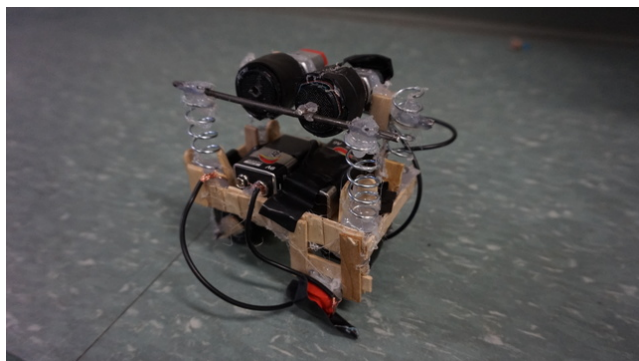


Watch video of the device in action: https://youtu.be/niUaM_l9Xos?t=1m2s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	2 Motors Used	200%	\$14.90
Hot Wheels Assorted 1:64 Monster Jam Vehicles	\$5.77	4 wheels used	100%	\$5.77
Defiant 9V Alkaline Battery PDQ (8-Pack)	\$16.98	1 used	12.5%	\$2.12
Nexxtech Rigid Battery Snap for a 9V Battery	\$5.99	1 of 5 used	20%	\$1.20
Basswood Carving Block-2" X2" X12"	\$11.54	1"x1"x4" used	8.33%	\$0.96
Block Tech Assorted Mixed Colours Building Blocks	\$9.97	6 of 250 pieces used	2.4%	\$0.24
Seal-It Premium Duct Tape 1.88 in x 60 yd	\$5.97	30 cm used	0.55%	\$0.03
100 % Rubber Rubber Band #32	\$2.97	4 used (approx 5g of 2268g)	0.22%	\$0.01
			TOTAL	\$25.23

Group 1-04

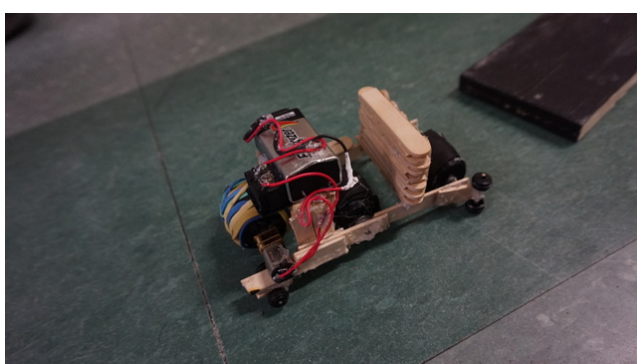
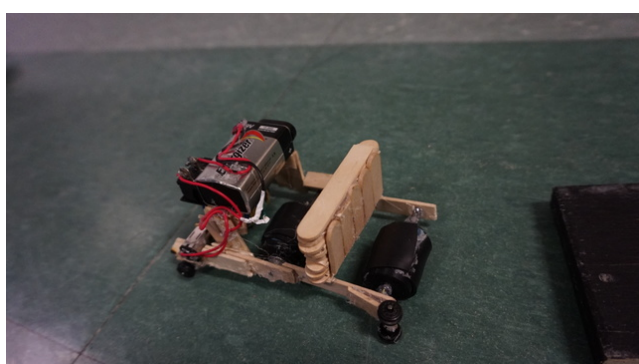
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=30s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Energizer "9V" 2-Pack Batteries	\$14.99	used both bateries	100%	\$14.99
Brushed DC Motor 6V, 11500rpm	\$2.29	used 4 singular units	400%	\$9.16
Supercycle Kenda K905 K-RAD BMX Bike Tire, 20 x 2-1/8-in 1/8" x 36" Plain Unthreaded Rod	\$15.99	15 " of a circumfurance 63.86"	23.48%	\$3.75
axGear 3D Printer ABS Filament 1.75mm 1KG 2.2LB Premium Material Spool Roll Black	\$3.69	used 30cm of 91.44cm	32.8%	\$1.21
3 Pack 5mm x 036mm Compression Springs	\$29.99	used 40g of 1000g	4%	\$1.20
Plumber's Sanding Roll, 120-Grit, 1-1/2 in x 15 ft	\$1.59	used 2 springs cut in half	66%	\$1.05
Stanley Bostitch Glue Gun Sticks, 24/Pack	\$4.99	used 80cm of 15 feet	17.49%	\$0.87
Rockville R14GSBR100 Red/Black 14 Gauge 100-Foot Mini Spool Car Audio Speaker Wire	\$9.99	used 1 full glue stick	4.16%	\$0.42
Elmer's Craft Sticks, 150/Pack (EC61080)	\$37.99	used about 30 cm of wiring 3040cm	0.99%	\$0.37
General Purpose Vinyl Electrical Tape, 19-mm x 18-m	\$3.46	used 15 sticks cut up	10%	\$0.35
	\$0.99	used 45 cm of 10m	4.5%	\$0.04
TOTAL				\$33.42

Final design

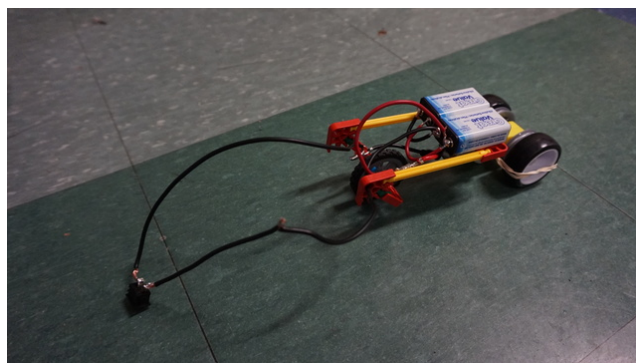
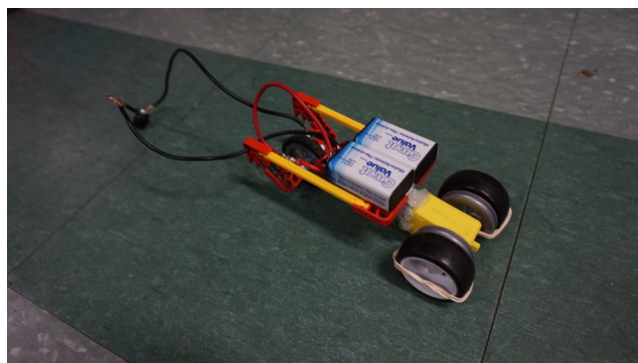


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=1m26s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
298:1 Micro Metal Gearmotor	\$12.18	used 1	100%	\$12.18
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	used 1 battery	25%	\$1.49
Hot Wheels Assorted 10 Car Pack	\$9.97	1 of 10	10%	\$1.00
Supercycle Bike Tire Tube, 27.5 x 1.9 / 2.3-in	\$8.99	used 3 inches cut In strips of 27.5	10.9%	\$0.98
Rocker Switch (10pk)	\$6.40	used 1 of 10	10%	\$0.64
1/8" x 36" Plain Unthreaded Rod	\$3.69	used 12cm of 91.44cm	13.1%	\$0.48
Stanley Bostitch Glue Gun Sticks, 24/Pack	\$9.99	used 1 full glue stick	4.16%	\$0.42
axGear 3D Printer ABS Filament 1.75mm 1KG 2.2LB Premium Material Spool Roll Black	\$29.99	used 10g of 1000g	1%	\$0.30
Lynxmotion Steel 4-40 Washers - 5/16" x 4-40 (100)	\$6.73	used 4	4%	\$0.27
9V Battery Snap (10 pk)	\$1.67	used 1 full connector and 1 wire out of 6	15%	\$0.25
Horizon Group USA Wood Craft Sticks	\$6.97	used 10 sticks cut up	1%	\$0.07
Staples Economy Rubber Bands, Size #16	\$1.56	used 6 (5 grams) out of 113g	4.4%	\$0.07
TOTAL				\$18.15

Group 1-05

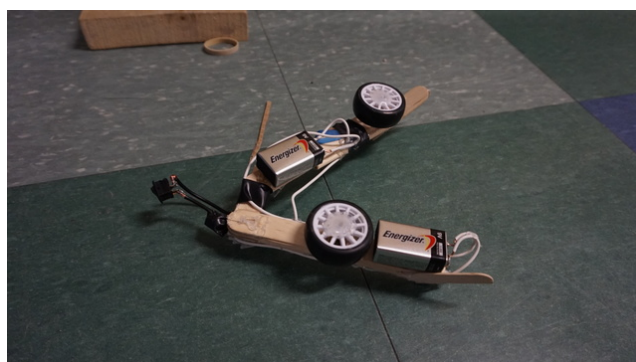
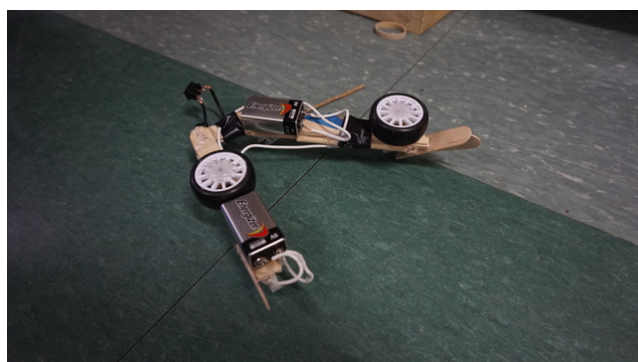
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=33s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
6-12VDC Motor	\$18.25	used 1 motor	100%	\$18.25
Large Rubber Wheels	\$4.99	used 2 wheels of 1	200%	\$9.98
9V Battery	\$45.99	2 batteries used out of 12 pack	16.7%	\$7.68
Gorilla Epoxy	\$7.88	used a 5th of a bottle	20%	\$1.58
Gear Box	\$5.13	used only the gear box about 25% of cost	25%	\$1.28
Switch	\$1.22	used 1 switch of 1	100%	\$1.22
K'NEX	\$19.96	used 20 pieces out of 527	3.8%	\$0.76
16 Gauge Wire	\$6.99	used 2 feet of 25 feet	8%	\$0.56
Soldering Wire	\$9.26	used 0.5 gram of 10 grams	5%	\$0.46
Elastics	\$1.56	used 2 elastics of 114	1.8%	\$0.03
TOTAL				\$41.80

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=1m36s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
298:1 Micro Metal Gearmotor	\$10.13	In bulk, when buying 100 motors each costs \$10.13. Bought 100 used 2	200%	\$20.26
DUB145MS Micro Sport Wheels 1.45" (2)	\$4.99	used 2 wheels of 2	100%	\$4.99
Energizer Max Alkaline 9V Batteries	\$5.49	2 batteries used out of 6 pack	33%	\$1.81
Rocker Switch	\$1.22	used 1 switch of 1	100%	\$1.22
Multi-Temp Mini Glue Sticks-.27" X4" 30/Pkg 16837	\$11.19	used 2 of 30 sticks	6.67%	\$0.75
Southwire GPT Primary Wire 16-Gauge, 7.5 M, Red	\$6.99	used 2 feet of 25 feet	8%	\$0.56
Unique Bargains 0.8mm 10g 63/37 Rosin Core Flux Tin Lead Roll Soldering Solder Wire Reel	\$9.26	used 0.5 gram of 10 grams	5%	\$0.46
Horizon Group USA Jumbo Wood Craft Sticks	\$4.97	used 16 pieces out of 300	5.33%	\$0.27
K'NEX 521 Piece Value Tub	\$19.96	used 4 pieces out of 521	0.77%	\$0.15
Staples Economy Rubber Bands, Size #24	\$1.56	used 2 elastics of 114	1.8%	\$0.03
Stanley PVC Electrical Tape	\$4.98	used 4 inches out of 828 inches	0.5%	\$0.02
TOTAL				\$30.52

Group 1-06

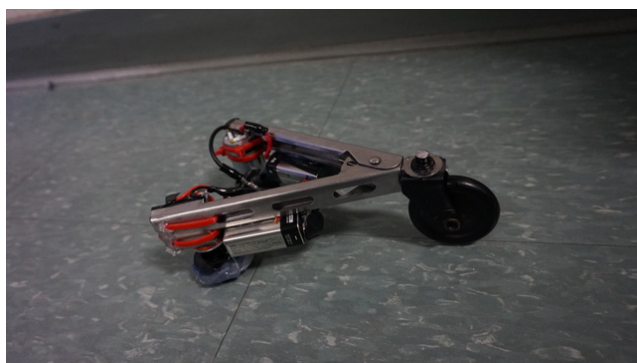
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=38s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Tamiya Sports Tire Set	\$8.22	Price of 4 & we used all 4	100%	\$8.22
Banebots RS-540 12V 17200 RPM Brushed DC Motor	\$7.77	1 motor and we used all of it	100%	\$7.77
HS-85BB/MG Replacement Metal Gears	\$10.38	comes in sets of 4	50%	\$5.19
9V Alkaline Battery	\$1.78	1 piece	100%	\$1.78
Tamiya 3mm Diameter Shaft Set	\$5.50	Comes in a set of 8	25%	\$1.38
Horizon Group USA Jumbo Wood Craft Sticks	\$4.97	comes in a set of 300, we used 10	3.33%	\$0.17
9V Battery Snap (10 pk)	\$1.54	used 1 out of 10	10%	\$0.15
Great Value Neon Flexible Plastic Straws	\$1.23	1 of 150	0.67%	\$0.01
TOTAL				\$24.66

Final design

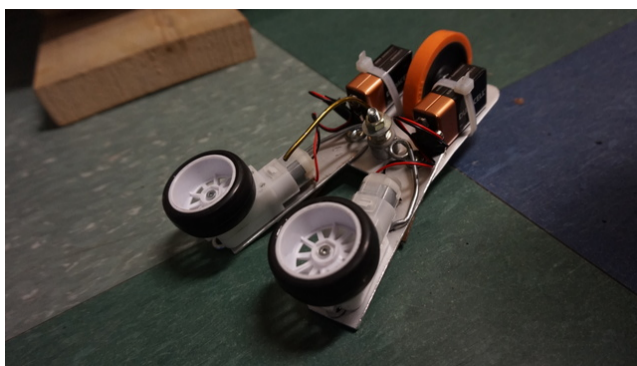
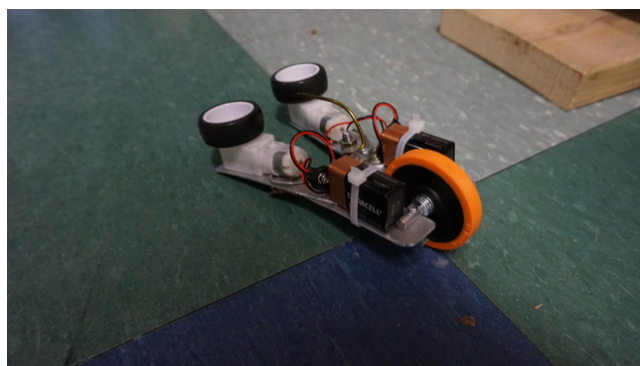


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=1m48s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Banebots RS-540 12V 17200 RPM Brushed DC Motor	\$8.01	Used 2	200%	\$16.02
Energizer Max Alkaline 9V Batteries	\$17.99	Used 2 of 6	33.33%	\$6.00
80mm Silicone Wheel for TT Motor	\$2.24	Used 2	200%	\$4.48
MASTER Chef Stainless Steel Tongs	\$5.99	Used Half	50%	\$3.00
Rigid Rubber Caster, 1-1/4-in	\$1.99	Used 1 of 1	100%	\$1.99
Marr 11-in Cable Ties, 10-pk	\$2.49	Used 4 of 10	40%	\$1.00
TOTAL				\$32.48

Group 1-07

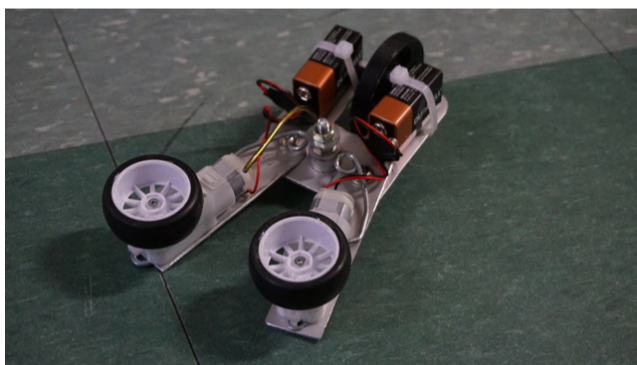
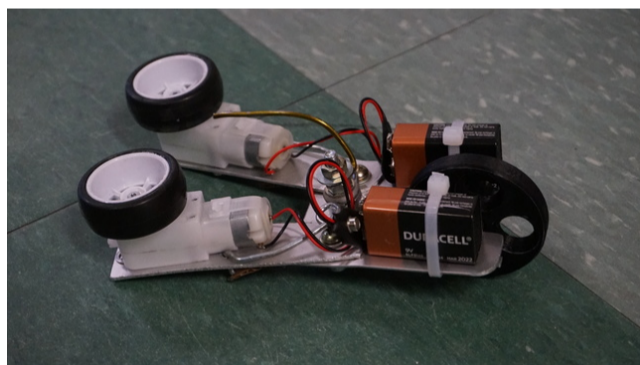
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=51s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$624.00	Per 100,used 2	2%	\$12.48
Supercycle Short Side-Pull Bike Brake Calipers	\$12.99	Used 1 of 2 Calipers	50%	\$6.50
Micro Sport Wheels 1.45in	\$4.99	Per 2, used 2	100%	\$4.99
Threshold Transition 1/2 In. X 5 In. X 3'	\$26.98	Per 36", Used 6"	16.67%	\$4.50
BaneBots Wheel, 2-3/8" x 0.4", 1/2" Hex Mount, 40A, Black/Orange	\$345.00	Per 100, used 1	1%	\$3.45
1/4 inch Shaft Collar	\$2.99	Per 1, used 1	100%	\$2.99
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Per 4, used 2	50%	\$2.98
5 Pack M3 x 16mm Zinc Plated Pan Head Machine Screws	\$2.79	Per 5,used 4	80%	\$2.23
M6 x 16mm Zinc Plated Pan Head Machine Screws	\$3.39	Per 5, used 2	40%	\$1.36
250 pc Stainless Steel Flat & Lock Washer Assortment	\$18.49	Per 250, used 12	4.8%	\$0.89
20 pc Clevis Pin Set	\$12.99	Per 20, used 1	5%	\$0.65
M3 x 12mm 304 Stainless Steel Crosshead Phillips Pan Head Screws Bolt 60pcs	\$11.99	Per 60, used 2	3.3%	\$0.40
1/4-20 Nylon Insert Lock Nuts	\$0.19	Used 4	200%	\$0.38
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Per 8, used 1	12.5%	\$0.37
10 Pack #4 x 3/8" Flat Head Socket Zinc Plated Wood Screws	\$1.69	Per 10, used 2	20%	\$0.34
9V Battery Snap (10 pk)	\$1.67	Per 10, used 2	20%	\$0.33
Krazy Glue Adhesive, Single Use Tubes	\$4.99	Per 4 tubes ,Used 1/4 of one tube	6.25%	\$0.31
4IN UV BLACK CABLE TIE 100 PACK	\$4.19	Per 100, used 2	2%	\$0.08
ArtSkills White Poster Board 22x28	\$0.59	Used 1"² of 616"²	0.16%	\$0.00
TOTAL				\$45.23

Final design

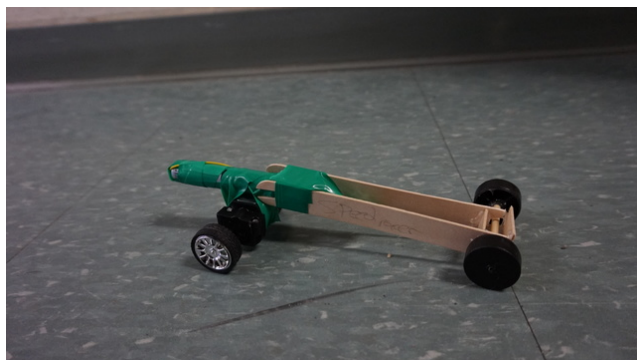


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=1m58s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$624.00	Per 100,used 2	2%	\$12.48
Supercycle Short Side-Pull Bike Brake Calipers	\$12.99	Used 1 of 2 Calipers	50%	\$6.50
Threshold Transition 1/2 In. X 5 In. X 3'	\$26.98	Per 36", Used 6"	16.7%	\$4.51
Micro Sport Wheels 1.45in	\$4.10	Per 2, used 2	100%	\$4.10
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Per 4, used 2	50%	\$2.98
5 Pack M3 x 16mm Zinc Plated Pan Head Machine Screws	\$2.79	Per 5,used 4	80%	\$2.23
M6 x 16mm Zinc Plated Pan Head Machine Screws	\$3.39	Per 5, used 2	40%	\$1.36
1/4-20 Nylon Insert Lock Nuts	\$0.19	Used 4	400%	\$0.76
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Per 8, used 1	12.5%	\$0.37
10 Pack #4 x 3/8" Flat Head Socket Zinc Plated Wood Screws	\$1.69	Per 10, used 2	20%	\$0.34
9V Battery Snap (10 pk)	\$1.67	Per 10, used 2	20%	\$0.33
Krazy Glue Adhesive, Single Use Tubes	\$4.99	Per 4 tubes ,Used 1/4 of one tube	6.25%	\$0.31
250 pc Stainless Steel Flat & Lock Washer Assortment	\$18.49	Per 250, used 4	1.6%	\$0.30
Black PLA 1.0kg Spool 1.75mm Filament	\$31.99	per 1000g used 5.32g for Front wheel and Axle	0.53%	\$0.17
4IN UV BLACK CABLE TIE 100 PACK	\$4.19	Per 100, used 2	2%	\$0.08
ArtSkills White Poster Board 22x28	\$0.59	Used 1"² of 616"²	0.16%	\$0.01
TOTAL				\$36.82

Group 1-08

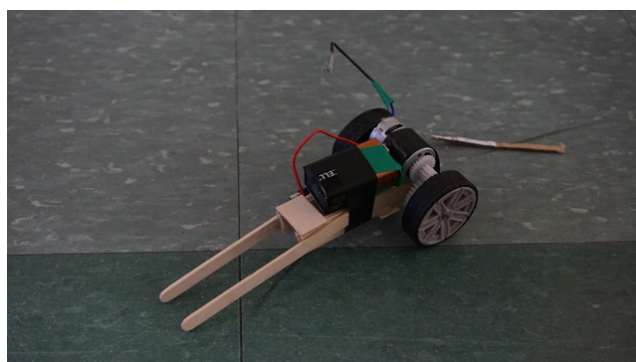
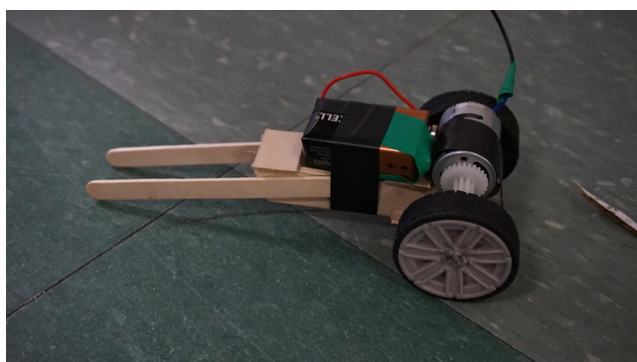
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=55s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
STANDARD MOTOR 11605 RPM 5VDC	\$4.57		100%	\$4.57
Nestl Pure Life Water, 500ml Bottles, 35-Pack	\$9.99	USED 4 BOTTLE CAPS FOR WHEELS OUT OF A PACK OF 35	11.43%	\$1.14
CHENILLE KRAFT COMPANY CK-3358 GLUE STICKS BONUS BAG 100 PC	\$73.17	USED 1 OF 100	1%	\$0.73
BATTERY ALKALINE 1.5V AA 2=2	\$0.45		100%	\$0.45
TAPE ELECTRICAL VINYL 3/4" X 20'	\$5.19	USED ONLY A COUPLE PIECES	3%	\$0.16
Horizon Group USA Wood Craft Sticks	\$1.00	USED 5 OF 50	10%	\$0.10
Mainstays 12" 100 Piece Bamboo Skewers	\$2.50	USED 2/5 OF ONE STICK OF A PACK OF 100	0.04%	\$0.00
			TOTAL	\$6.80

Final design

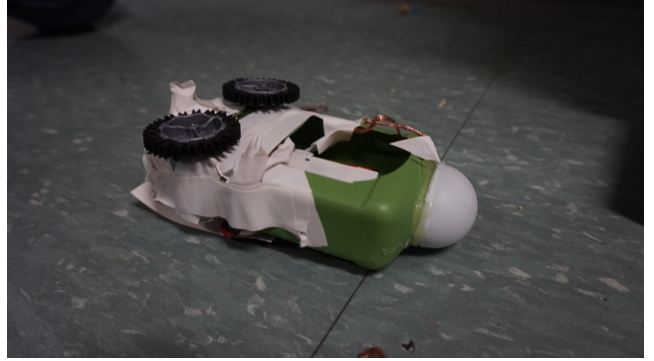
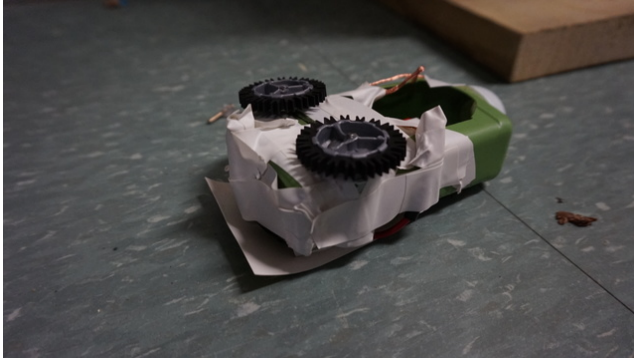


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=2m12s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
5 Pcs DC 1.5V-9V 7400RPM Micro Motor RF-130CH-09520 for RC DIY Toys	\$20.89	USED 1 OF 5	20%	\$4.18
Jada 1:32 Metals Die Cast Assortment Toy Car	\$7.97	USED 2 OF 4 WHEELS	50%	\$3.98
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	USED 1 OF 4	25%	\$1.49
CHENILLE KRAFT COMPANY CK-3358 GLUE STICKS BONUS BAG 100 PC	\$76.37	USED 1 OF 100	1%	\$0.76
Horizon Group USA Wood Craft Sticks	\$1.00	USED 4 OF 50	8%	\$0.08
TAPE ELECTRICAL VINYL 3/4" X 20'	\$5.34	USED ONLY A COUPLE PIECES	1%	\$0.05
			TOTAL	\$10.55

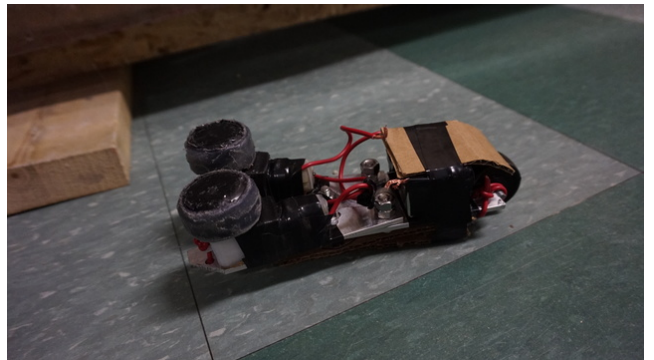
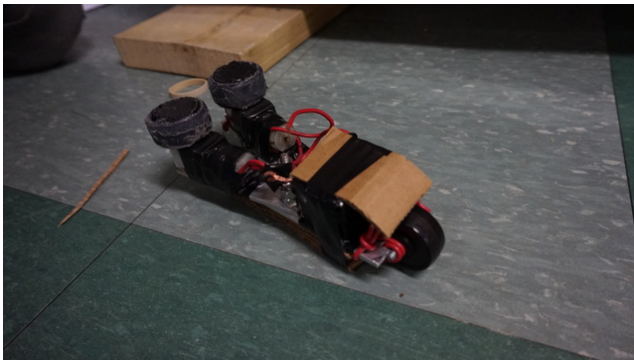
Group 1-09

Prototype



Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
RS-550 Motor 19300rpm 12V 62.49oz-in	\$6.40	2 motors to drive 2 wheels	200%	\$12.80
Pixar Cars 3 Talking Lightning McQueen Vehicle	\$19.97	Wheels to move device	50%	\$9.98
Energizer Eveready 9V Battery	\$3.99	Batteries to power motor	200%	\$7.98
Pantene Pro-V 2 in 1 Shampoo and Conditioner	\$2.50	Chasis of device	100%	\$2.50
Unique Bargains 5pc Ivory White Multipurpose Hot Melt Glue Sticks 7x100mm	\$12.99	Glue parts	7.14%	\$0.93
Table Tennis Balls, 30-pack	\$14.99	Attached to front of device	1.66%	\$0.25
Southwire GPT Primary Wire 16-Gauge, 7.5 M, Red	\$6.99	Wire to connect motors to batteries	3.28%	\$0.23
General Purpose Vinyl Electrical Tape, 19-mm x 18-mm	\$0.99	Tape to bind and secure parts together	5.55%	\$0.05
			TOTAL	\$34.73

Final design

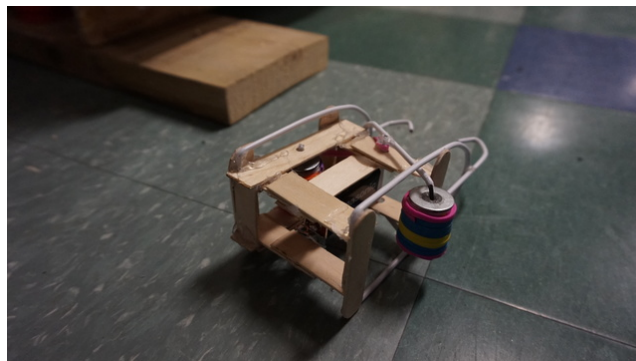
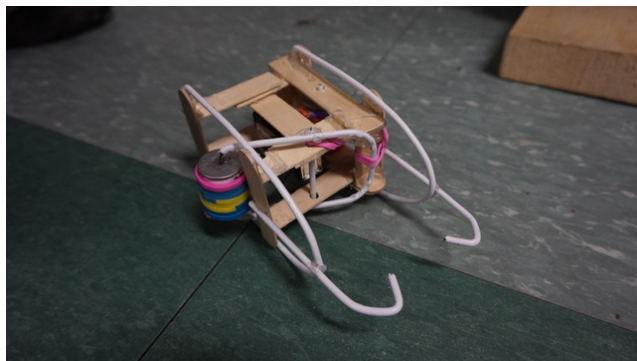


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=2m17s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
200:1 Plastic Gearmotor 90 Degree Shaft	\$6.25	Used two entire motors	200%	\$12.50
Supercycle Long Side-Pull Bike Break Calipers	\$13.99	Contains two calipers, one was used	50%	\$7.00
Papc 1/8x1 - 1/2x3 Flat Aluminum	\$15.72	Used 1 quarter of the sheet	25%	\$3.93
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Used 2 of 4 batteries	50%	\$2.98
Rigid Rubber Caster, 1-1/4-in	\$1.99	Used Entire wheel	100%	\$1.99
M6 Metric Hex Nut	\$0.21	Used 6 nuts	600%	\$1.26
1/4x1 GR2 Carriage Bolt Unc	\$0.20	Used 4 entire bolts	400%	\$0.80
Unique Bargains 50pcs 7mm x 270mm Yellow Hot Melt Glue Stick for Electric Tool Heating Gun	\$37.99	Used 1 glue stick of 50	2%	\$0.76
3/4 Safety Cap	\$0.30	Used 2 full safety caps	200%	\$0.60
Southwire GPT Primary Wire 16-Gauge, 7.5 M, Red	\$6.99	Half a meter out of 7.5 meters	6.67%	\$0.47
1/4x1-1/2 GR2 Carriage Bolt HDG	\$0.28	Used Entire Bolt	100%	\$0.28
General Purpose Vinyl Electrical Tape, 19-mm x 18-m	\$0.99	Used 2 meters out of 18 meters	11.11%	\$0.11
Small 16-inch x 12-inch x 12-inch Moving Box	\$0.98	Used one 20th of box	5%	\$0.05
			TOTAL	\$32.72

Group 1-10

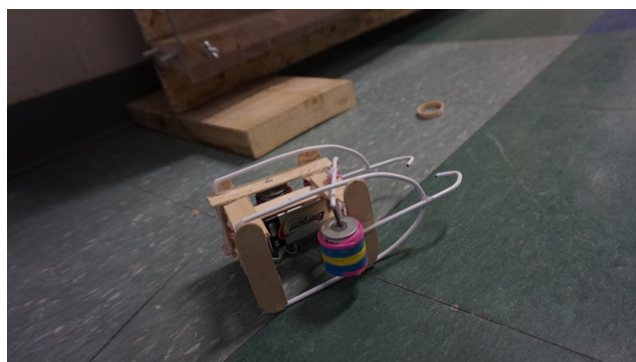
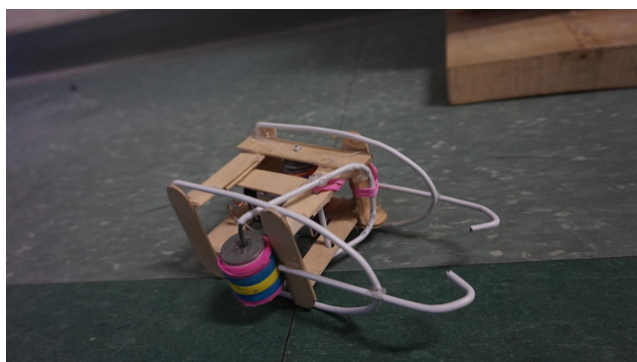
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=57s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
298:1 Micro Metal Gearmotor	\$12.18		100%	\$12.18
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Used 1 battery	25%	\$1.49
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Used 1 of 8	12.5%	\$0.37
AdTech Mini Glue Sticks - 100 pack	\$11.47	Used 3 glue sticks	3%	\$0.34
Hillman Flat Washer, Zinc, 1/4-in, 50-pk	\$5.49	Used 3 of 50	6%	\$0.33
3/4" x 1' PVC Pipe	\$13.99	Used 6cm of 300cm	2%	\$0.28
Staples Economy Rubber Bands, Assorted Size and Colour - 1/4lb bag	\$1.56	Used approximately 5% (conservative estimate)	5%	\$0.08
Horizon Group USA Wood Craft Sticks	\$6.97	used 6 full sticks	1%	\$0.07
25' #22 Gauge Black Hook-Up Wire	\$2.88	Used 6" of 25'	2%	\$0.06
			TOTAL	\$15.20

Final design

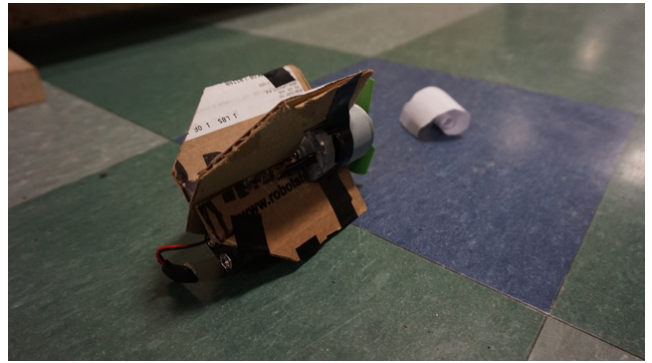
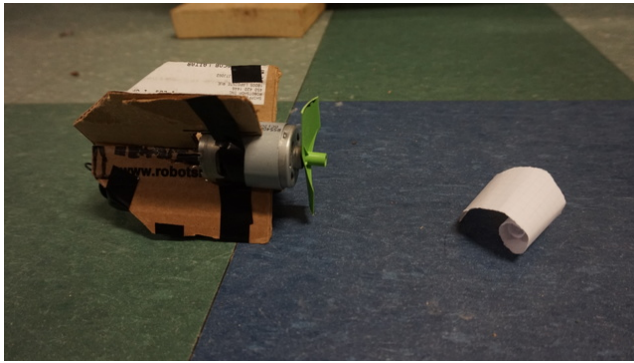


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=2m35s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
298:1 Micro Metal Gearmotor	\$12.18			\$12.18
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Used 1 battery	25%	\$1.49
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Used 1 of 8	12.5%	\$0.37
AdTech Mini Glue Sticks - 100 pack	\$11.47	Used 3 glue sticks	3%	\$0.34
Hillman Flat Washer, Zinc, 1/4-in, 50-pk	\$5.49	Used 3 of 50	6%	\$0.33
3/4" x 1' PVC Pipe	\$13.99	Used 6cm of 300cm	2%	\$0.28
Staples Economy Rubber Bands, Assorted Size and Colour - 1/4lb bag	\$1.56	Used approximately 5% (conservative estimate)	5%	\$0.08
Horizon Group USA Wood Craft Sticks	\$6.97	used 6 full sticks	1%	\$0.07
25' #22 Gauge Black Hook-Up Wire	\$2.88	Used 6" of 25'	2%	\$0.06
			TOTAL	\$15.20

Group 1-11

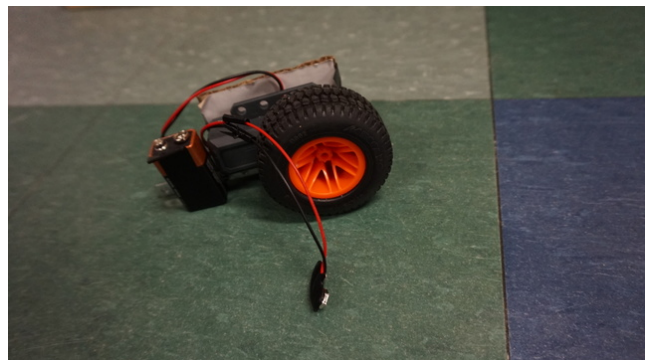
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=1m33s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Duracell 9V Alkaline Batteries, 2-Pack	\$14.23	Used 1 of 2	50%	\$7.12
RS-550 Motor 19300rpm 12V 62.49oz-in	\$6.40		100%	\$6.40
9V to 2.1mm Barrel Jack	\$1.92		100%	\$1.92
5" x 3" Black Multi-Rotor CCW Propeller Pair	\$2.13	Used 1 of 2	50%	\$1.06
Corrugated Boxes, 4" x 4" x 4", 50/Bundle	\$13.91	use 1/2 box of 50	1%	\$0.14
Scotch Vinyl Electrical Tape	\$3.56	used 50 cm of 20 m	2.5%	\$0.09
Louis Garneau Small Metric Quad Notebook	\$0.88	used 1 sheet of 32	3.12%	\$0.03
			TOTAL	\$16.76

Final design

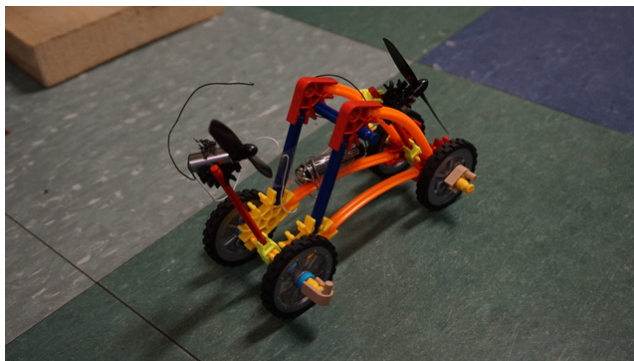


Watch video of the device in action: https://youtu.be/niUaM_l9Xos?t=3m8s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Meccano Erector 4x4 Off-Road Truck 25 Model Building Kit	\$59.99	used 1 of 4 wheels and less than 25% of all other parts	25%	\$15.00
1-Card 9 Volt Duracell Alkaline Battery	\$9.49		100%	\$9.49
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	Cost for 6V 90 deg. Gear motor motor used is 4.5 V 90 deg. Gear motor from kit.	100%	\$7.45
9V to 2.1mm Barrel Jack	\$1.92		100%	\$1.92
Scotch Vinyl Electrical Tape	\$3.56	used 50 cm of 20 m	2.5%	\$0.09
Corrugated Boxes, 4" x 4" x 4", 50/Bundle	\$13.91	use 1/6 box of 50	0.33%	\$0.05
			TOTAL	\$33.99

Group 1-12

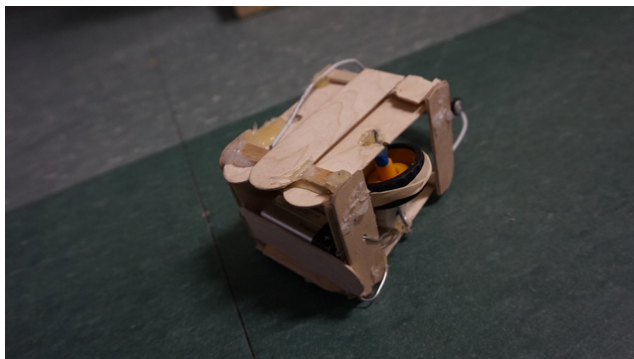
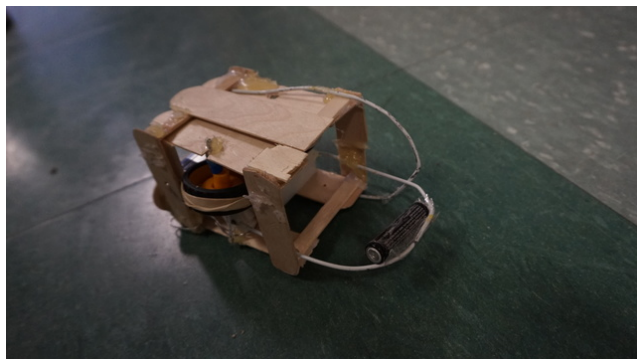
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m01s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
50 000RPM Coreless Motor for Quadcopter (Pair)	\$11.49	used all	100%	\$11.49
Walmart, K'nex 521 piece value tub	\$19.96	33/521	6.33%	\$1.26
Energizer Max AAA Batteries, 20-pk	\$19.99	1	5%	\$1.00
Seal-It Transparent Tape	\$1.47	10/203cm	4.93%	\$0.07
			TOTAL	\$13.83

Final design

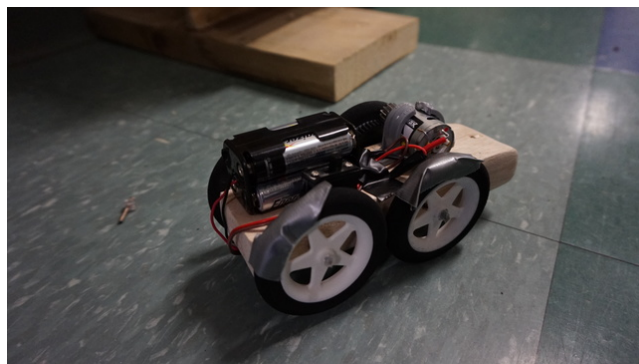
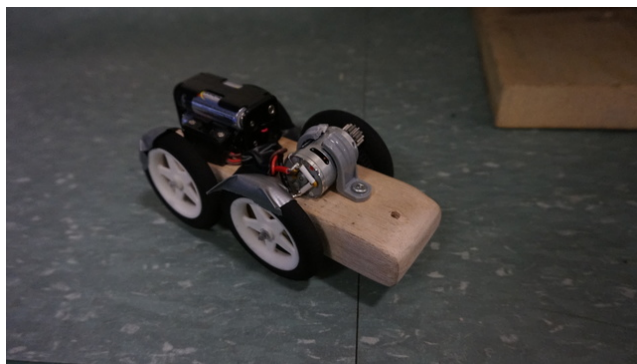


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=3m16s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	1	100%	\$7.45
Energizer MAX 9-Volt	\$12.97	1/4	25%	\$3.24
AAA Alkaline Battery 30 Pack	\$11.68	1/30	3.33%	\$0.39
Home Collection Wire Hanger, Black, 8-pk	\$2.99	1/8	12.5%	\$0.37
Horizon Group USA PDQ Jumbo Wood Craft Sticks	\$2.00	11/75	14.67%	\$0.29
AdTech Mini Glue Sticks	\$11.47	2/100	2%	\$0.23
Walmart, K'nex 521 piece value tub	\$19.96	4/521	0.77%	\$0.15
25' #22 Gauge White Hook-Up Wire	\$2.88	10"/25'	3.33%	\$0.10
Energizer MAX 9-Volt, Cardboard box	\$0.00	Cost is 0 since it came with the batteries	0%	\$0.00
			TOTAL	\$12.23

Group 1-13

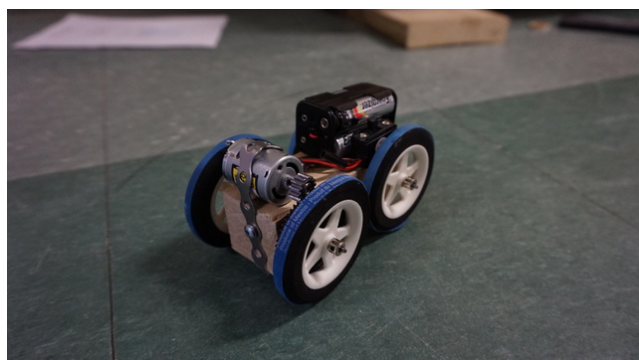
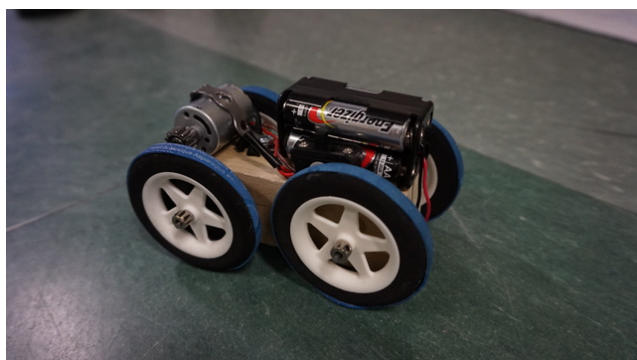
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m12s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Traxxas LaTrax 370 Motor w/Bullet Connectors	\$13.99		100%	\$13.99
Micro Sport Wheels 2.50" (2)	\$5.99	four wheels total	200%	\$11.98
Pinion Gear	\$5.99		100%	\$5.99
Dura Collars - 1/8" (4)	\$2.99	we only used 6 out of 8	150%	\$4.49
Spur gear 0.8p	\$3.99		100%	\$3.99
Switch Harness FUT J Conn No Charge Lead	\$3.49		100%	\$3.49
2x2x8 Framing Lumber	\$2.82		100%	\$2.82
Unique Bargains 10 Pcs 3V Battery Holder Case Storage Box 2 x 1.5V AA Battery Wire Leads	\$10.99	we only used two by stacking them together	20%	\$2.20
Energizer MAX AA-38	\$19.97	Only 4 batteries were used	10.5%	\$2.10
Aluminum Tube 12" 1/8" (3)	\$2.59	We only needed 10% for the wheel and Axels	10%	\$0.26
Music Wire 36" .078"	\$1.19	it just required a little percentage for the Axels	5%	\$0.06
Utility Duct Tape	\$2.79	used just a fraction to ease grip of tiresGrip	1%	\$0.03
3M electrical tape	\$3.39	used just a fraction for Tapping things down	0.5%	\$0.02
			TOTAL	\$51.40

Final design

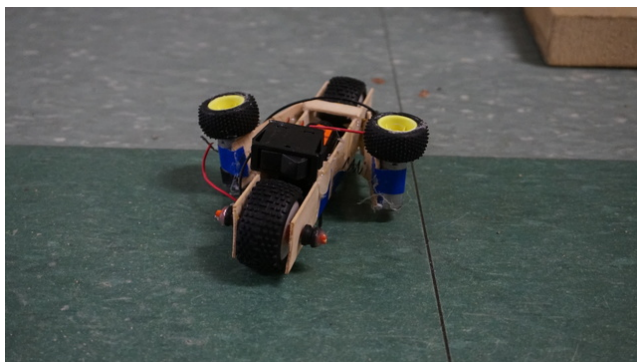
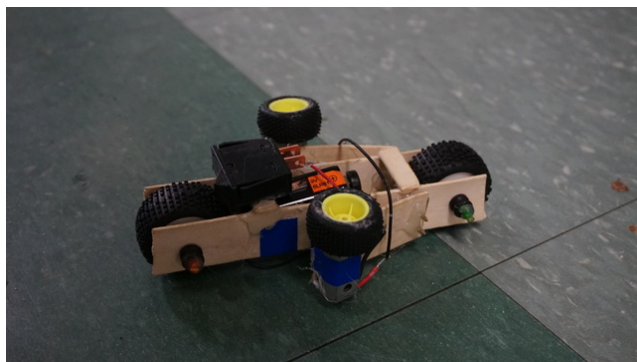


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=3m52s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Traxxas LaTrax 370 Motor w/Bullet Connectors	\$13.99		100%	\$13.99
Pinion Gear	\$5.99		100%	\$5.99
Micro Sport Wheels 2.50" (4)	\$11.98		200%	\$5.99
Dura Collars - 1/8" (4)	\$2.99	we used 6 total	150%	\$4.49
Spur gear 0.8p	\$3.99		100%	\$3.99
Switch Harness FUT J Conn No Charge Lead	\$3.49		100%	\$3.49
Unique Bargains 10 Pcs 3V Battery Holder Case Storage Box 2 x 1.5V AA Battery Wire Leads	\$10.99	we only used two by stacking them together	20%	\$2.20
Energizer Max AA Batteries, 38 Pack	\$19.97	Only 4 batteries were used	10%	\$2.00
Poplar Hobby Board 2 x 2 x 2 Feet	\$6.51		25%	\$1.63
VLB Marketing Rubber Bands, LatexFree, Antimicr, 3-1/2" x 1/4", 1/4lb/Box, 40/Pack	\$4.99	used just a fraction to ease grip of tiresGrip	10%	\$0.50
Aluminum Tube 12" 1/8" (3)	\$2.59	We only needed 10% for the wheel and Axels	10%	\$0.26
All Round Strapping, Steel, 22Ga 1/2-inch x 25'	\$5.98	Fraction	1%	\$0.06
Music Wire 36" .078"	\$1.19	it just required a little percentage for the Axels	2%	\$0.02
General Purpose Vinyl Electrical Tape, Black	\$3.39	used just a fraction for Tapping things down	0.5%	\$0.02
			TOTAL	\$44.62

Group 2-01

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m16s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Tamiya Off-Road Tires	\$4.74	4/2	200%	\$9.48
Nexxtech Rigid Battery Snap for a 9V Battery	\$5.99	1/1	100%	\$5.99
Brushed DC Motor 2 (RM2)	\$2.85	2/2	200%	\$5.70
1-1/2 Inch Brass Narrow Hinge Loose Pin 2pk	\$3.48	2/2	100%	\$3.48
Energizer Max Alkaline 9V Batteries	\$17.99	1/6	16.67%	\$3.00
Rocker Switch	\$1.22	1/1	100%	\$1.22
5/8X2-1/2 Compression Spring	\$2.08	1/2	50%	\$1.04
Horizon Group USA Assorted Sizes Wood Dowels	\$1.00	1/8	12.5%	\$0.12
Horizon Group USA Jumbo Wood Craft Sticks	\$4.97	3/300	1%	\$0.05
Horizon Group USA Wood Craft Sticks	\$6.97	1/1000 used	0.1%	\$0.01
			TOTAL	\$30.09

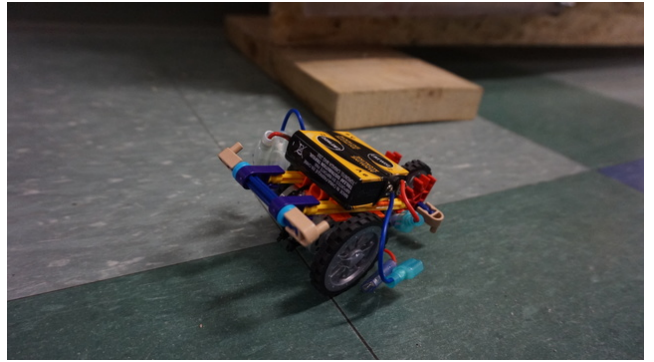
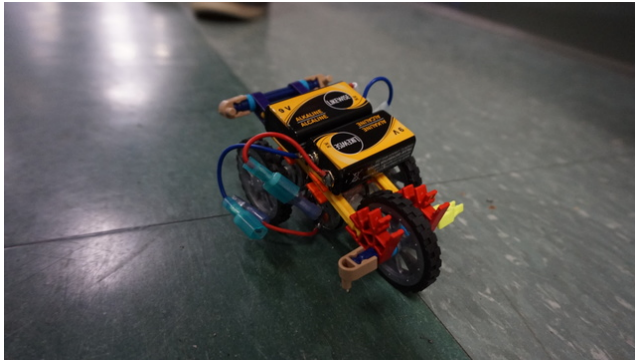
Final design



Watch video of the device in action: https://youtu.be/niUaM_l9Xos?t=4m0s

Group 2-02

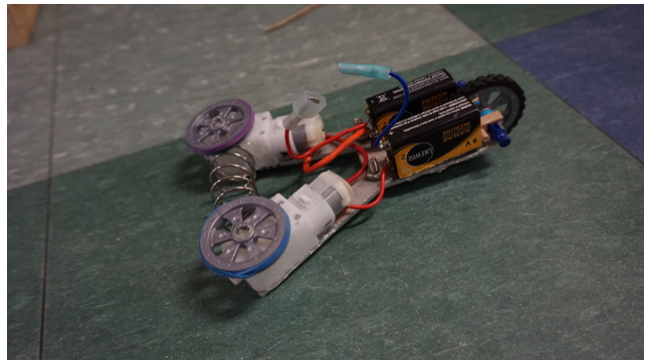
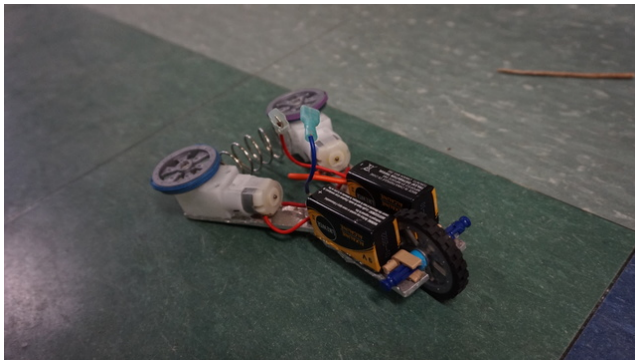
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m20s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
DIDC1133 Speed Secret Motor 22T w/Conn BX MT SC 4.18	\$13.99		2%	\$27.98
K'NEX 521 Piece Value Tub	\$19.96	Used 50 out of 521 pieces	9.6%	\$1.92
Panasonic - BSG S-006PNPA/B	\$174.01	Used 2 out of 210 batteries	0.95%	\$1.65
TE Connectivity AMP Connectors 3-350819-2	\$317.53	Used 8 out of 2200	0.36%	\$1.15
Chenille Kraft Glue Sticks, Bonus Bag, 200/Pack	\$45.58	Used 1 out of 200	0.5%	\$0.23
RCA 18-Gauge Speaker Wire	\$24.99	Used half of foot out of the total 100 feet	0.5%	\$0.12
Chip Quik Inc. SMDSW.031 1OZ	\$6.74	Used 1/100th of the roll	1%	\$0.07
			TOTAL	\$33.12

Final design

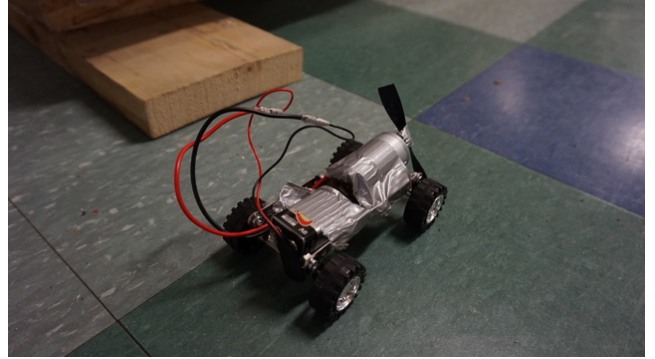
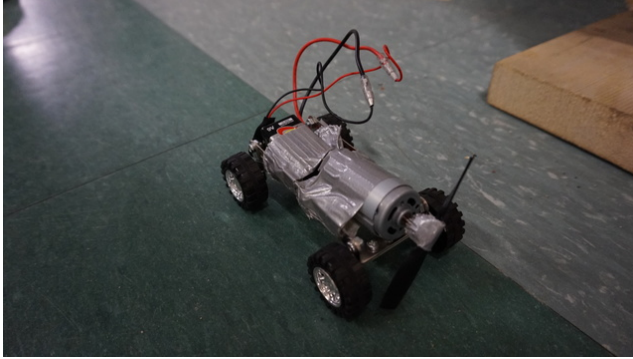


Watch video of the device in action: https://youtu.be/niUaM_l9Xos?t=4m5s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$6.24	Used two motors	2%	\$12.48
Unique Bargains M6 x 12mm 304 Stainless Steel Phillips Hex Head Bolts Nuts w Washers 8 Sets	\$12.99	Used 2 out of 8 sets	25%	\$3.25
DTXC9235	\$3.99	Used 1 out of 2	50%	\$2.00
Panasonic - BSG S-006PNPA/B	\$179.14	Used 2 out of 210 batteries	0.95%	\$1.71
K'NEX 521 Piece Value Tub	\$19.96	Used 8 out of the 521 pieces	1.54%	\$0.31
TE Connectivity AMP Connectors 3-350819-2	\$6070.39	Used 2 out of 55,000	0%	\$0.22
RCA 18-Gauge Speaker Wire (100')	\$24.99	Used half a foot of the 100 feet	0.5%	\$0.12
Chenille Kraft Glue Sticks, Bonus Bag, 200/Pack (CK-3358)	\$45.58	Used half a glue stick out of the 200	0.25%	\$0.11
Chip Quik Inc. SMDSW.031 1OZ	\$6.74	Used 1/100th of the roll	1%	\$0.07
Staples Economy Rubber Bands, Size #24	\$1.56	Approx 205 bands per bag, used 2	0.98%	\$0.02
			TOTAL	\$20.28

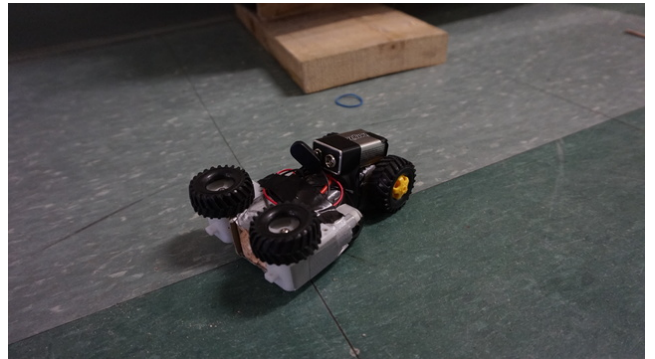
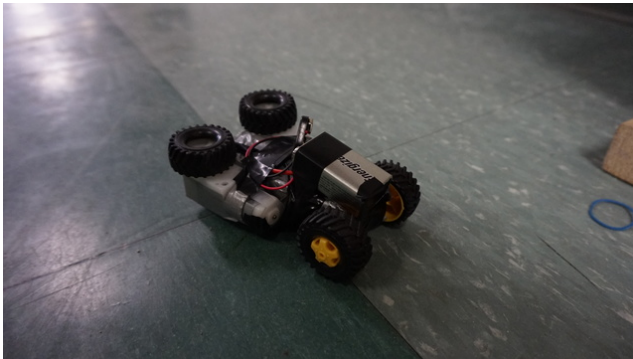
Group 2-03

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m24s>

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=4m13s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	Used two motors	200%	\$14.90
Tamiya Truck Tire Set	\$5.10	Used all four tires, 1 axel and cardboard box	100%	\$5.10
Max 9-Volt Battery - 6 Pack	\$19.98	Used 1 Battery of 6	16.7%	\$3.34
GMW - Plastic wheel	\$1.35	Used two of these wheels	200%	\$2.70
20Pcs 12-Wire Soft Faux Leather I Type 9V 9 Volt Battery Clip Connector	\$15.99	Used 1 Connector of 20	5%	\$0.80
Balsa Wood Block 12"-2" X3"	\$15.27	Used a 3"-1" X1" piece	4.2%	\$0.64
Southwire GPT Primary Wire 16-Gauge, 7.5 M, Red	\$6.99	Used 15cm of 750cm	2%	\$0.15
Seal-It Premium Duct Tape (1.88 inch X 60 yd)	\$5.97	Used 12" of 180'	0.56%	\$0.03
			TOTAL	\$27.66

Group 2-04

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m27s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Wheel and DC Motor Kit	\$5.13	4 wheels needed	300%	\$15.39
Duracell Procell Alkaline 9V Batteries 12 Pack	\$12.97	2 out of the 3 used	66.67%	\$8.65
Nexxtech Rigid Battery Snap for a 9V Battery	\$5.99	2 out of 5 used	40%	\$2.40
Rocker Switch	\$1.22	1 used total	100%	\$1.22
Metal U-Channel Satin Clear 1/2-inch x 1/2-inch x 8 Ft.	\$14.11	only 5" used in the car (5"/96"=0.052)	5.2%	\$0.73
Southwire Primary Wire, 18-Gauge Bulk Spool, 100-Feet, Red	\$42.65	only 20 cm used (20cm/3048cm=0.0065)	0.65%	\$0.28
Dmiotech 1mm 50G 60/40 Rosin Core Tin Lead Roll Soldering Solder Wire	\$10.53	0.5g used (0.5g/50g=0.014)	1%	\$0.11
General Purpose Vinyl Electrical Tape, 19-mm x 18-m	\$0.99	only 20cm used (20cm/1800cm=0.011)	1.1%	\$0.01
			TOTAL	\$28.78

Final design

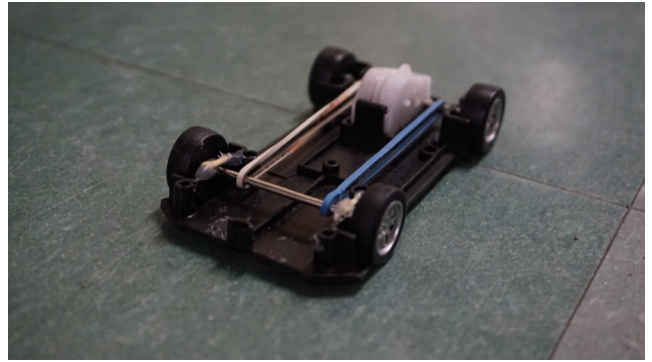
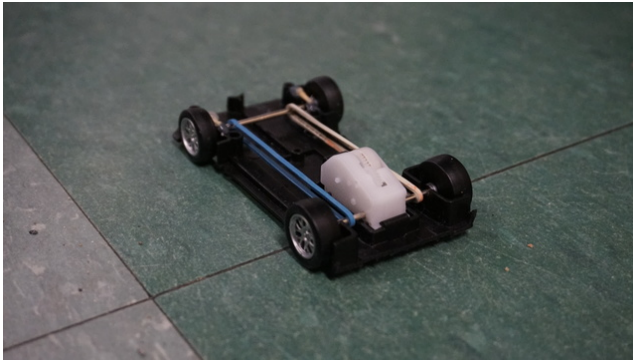


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=4m31s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Wheel and DC Motor Kit	\$5.13	2 wheels and 1 motor	100%	\$5.13
Duracell Procell Alkaline 9V Batteries 12 Pack	\$40.41	1 out of the 12 used	8.33%	\$3.37
Nexxtech Rigid Battery Snap for a 9V Battery	\$5.99	1 out of 5 used	20%	\$1.20
Gorilla Tape To-Go, 1in X 30ft	\$3.58	1ft used (1ft/30ft=0.033)	3.33%	\$0.12
Staples Economy Rubber Bands, Size #64	\$1.56	10 used	0.5%	\$0.01
Horizon Group USA Wood Craft Sticks	\$6.97	1 out of 1000 used	0.1%	\$0.01
			TOTAL	\$9.83

Group 2-05

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m30s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Adventure Force Pull Back Action Die-Cast Toy Vehicles	\$4.97	whole car used	100%	\$4.97
Chenille Kraft Glue Sticks, Bonus Bag, 200/Pack (CK-3358)	\$45.58	1 out of 200 glue sticks used	0.5%	\$0.23
100% Rubber Rubber Band	\$1.97	2 out of 50 rubber bands used	4%	\$0.08
Chenille Craft Natural Wooden Craft Stick,, 3000/Pack (CK-377401)	\$42.12	1 out of 3000 popsicle sticks used	0.03%	\$0.01
			TOTAL	\$5.29

Final design

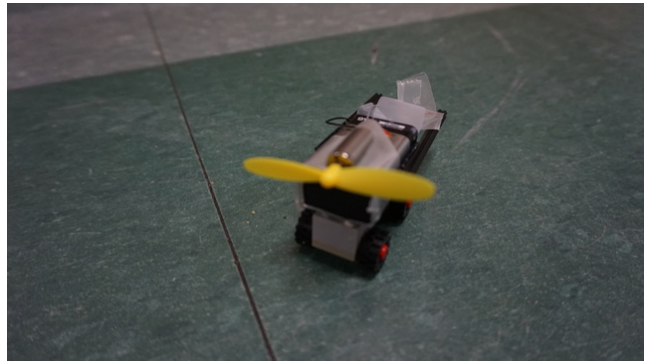
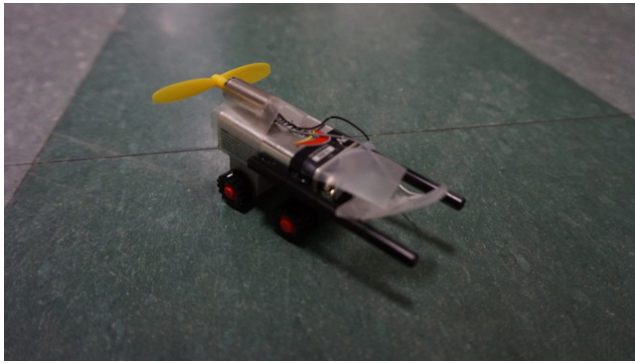


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=4m37s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
New Bright 1:43 Bigfoot, Blue	\$5.47	All of car used	100%	\$5.47
AA Alkaline Battery 48 Pack	\$11.68	1 battery used	2.08%	\$0.24
Multi-Temp Mini Glue Sticks-.27" X4" 30/Pkg 16837	\$11.15	1/2 of one glue stick	1.67%	\$0.19
			TOTAL	\$5.90

Group 2-06

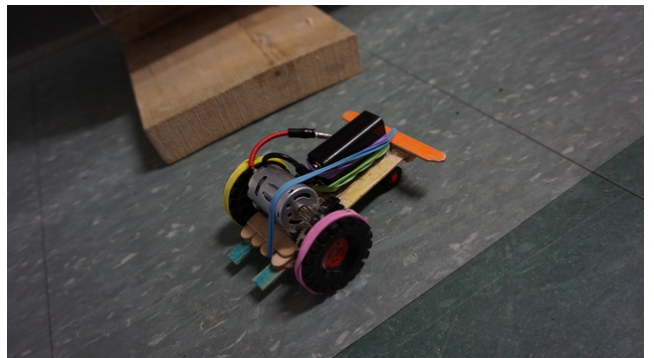
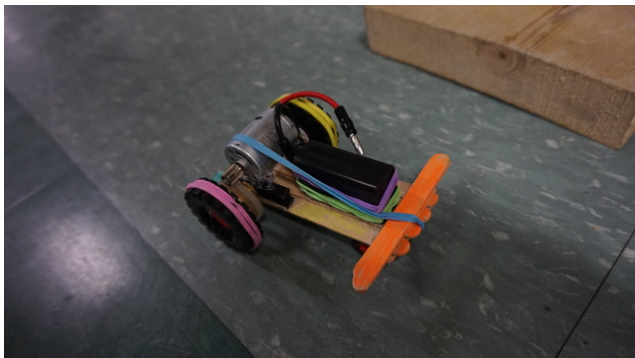
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m33s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Crazyflie Nano Quadcopter DC Motor	\$3.85		100%	\$3.85
6 x Energizer 9V Battery	\$17.99	Only 1 of 6 Batteries Used	16.67%	\$3.00
LEGO Creative Bricks, 221-pcs Unique Bargains 30pcs	\$34.99	Only used 3 pieces of 221 pieces.	1.36%	\$0.47
100mmx7mm Milky White Hot Melt Glue Adhesive Stick for Heating Gun	\$17.99	1/4 of glue stick used of 30	0.83%	\$0.15
K'Nex Value Tub, 521-pc	\$24.99	2 pieces used	0.38%	\$0.10
Scotch Magic Tape, 6-pk	\$16.99	Only 15cm used	0.12%	\$0.02
			TOTAL	\$7.59

Final design

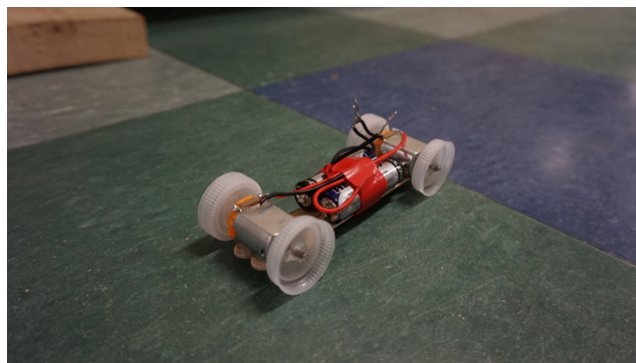


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=4m45s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Banebots Brushed DC Motor	\$6.73		100%	\$6.73
Align Motor Pinion Gear 13t	\$8.99	1 of 2 used	50%	\$4.50
6 x Energizer 9V Battery	\$17.99	Only 1 of 6 Batteries Used	16.67%	\$3.00
10Pcs 34 Teeth 0.5 Modulus Plastic Single Reduction Motor Gear for RC Airplane	\$9.38	1 of ten used	10%	\$0.94
LEGO Creative Bricks, 221-pcs	\$34.99	Used 4 pieces of 221 pieces. 1 is cut in half	1.81%	\$0.63
Rainbow Loom Pastel Rubber Bands with 24 C-Clips (600 Count)	\$31.43	5 elastics used	0.83%	\$0.26
AdTech Mini Glue Sticks 100 count	\$11.47	1 glue stick used	1%	\$0.11
Horizon Group USA Wood Craft Sticks	\$2.00	6 of 150 sticks used	4%	\$0.08
Bernzomatic Rosin Core Solder	\$7.99	1/100th of weight used	1%	\$0.08
25' #22 Gauge Black Hook-Up Wire	\$2.88	6" of 25' red/black same price	2%	\$0.06
Bamboo Skewers, 100-pc	\$1.99	1/2 stick used for rear axel	0.5%	\$0.01
			TOTAL	\$16.40

Group 2-07

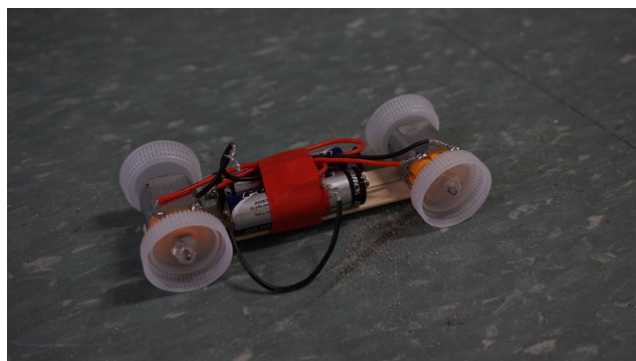
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m39s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Brushed DC Motor 6V, 11500rpm	\$2.29	2	200%	\$4.58
Nestl Pure Life Water, 500ml Bottles, 35-Pack	\$9.99	4 of 35	11.43%	\$1.14
AA Alkaline Battery 48 Pack	\$11.68	2	4.17%	\$0.49
Bernzomatic Solid Wire Solder	\$7.99	estamate 5g/226g	2.21%	\$0.18
12 pk of 4 in Glue Sticks	\$2.99	0.5	4.17%	\$0.12
Red Silicon Wire AWG18 (3m)	\$2.54	estamate 50mm	1.67%	\$0.04
Chenille Craft Natural Wooden Craft Stick,, 3000/Pack (CK-377401)	\$42.12	used 2	0.07%	\$0.03
General Purpose Vinyl Electrical Tape, Black	\$3.39	20mm/20000mm	0.1%	\$0.00
			TOTAL	\$6.58

Final design

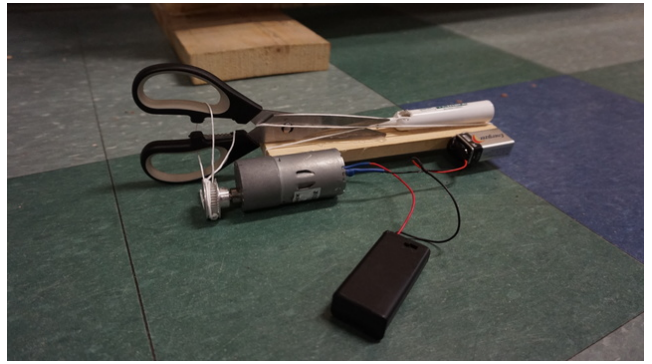


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=4m56s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Brushed DC Motor 6V, 11500rpm	\$2.29	2	200%	\$4.58
Nestl Pure Life Natural Spring Water (24 x 500 mL)	\$4.47	4	16.67%	\$0.74
AA Alkaline Battery 48 Pack	\$11.68	2	4.16%	\$0.49
Red Silicon Wire AWG18 (3m)	\$2.54	estamate 50mm	16.66%	\$0.42
Bernzomatic Solid Wire Solder (3oz)	\$7.99	estamate 5g/226g	2.21%	\$0.18
12 pk of 4 in Glue Sticks	\$2.99	0.5	4.17%	\$0.12
Chenille Craft Natural Wooden Craft Stick,, 3000/Pack (CK-377401)	\$42.12	used 2	0.07%	\$0.03
General Purpose Vinyl Electrical Tape, Black	\$3.39	20mm/20000mm	0.1%	\$0.00
			TOTAL	\$6.57

Group 2-08

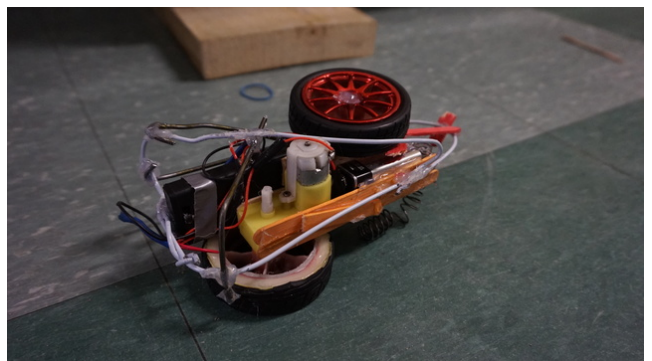
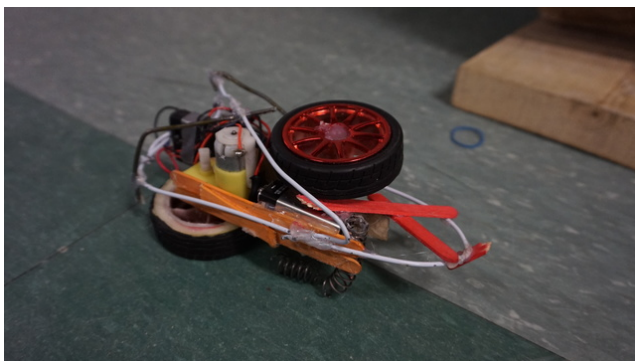
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m42s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Cryton 12V 100RPM spur Gearmotor	\$22.60		100%	\$22.60
Energizer Eveready 9V Battery	\$4.99		100%	\$3.99
Sparco 8" Bent Multipurpose Scissors	\$3.97		100%	\$3.97
Duracell Quantum Alkaline AAA batteries, 10-pk	\$16.99	Only 2 Battaries used.	20%	\$3.40
Dry erase marker	\$1.99		50%	\$0.99
Bag Of marbles- 30 pieces	\$24.21	1 used	3.3%	\$0.80
Multi purpose string 29 feet	\$6.40	2 feet used	6%	\$0.38
7.5 Meter 20 Gauge copper tie wire	\$4.49	only 0.3 meters used	4.1%	\$0.18
101 pc Spring Assortment Kit	\$6.99	1 spring used	1%	\$0.07
7/16 4x8 Oriented Strand Board	\$16.98		0.2%	\$0.03
			TOTAL	\$36.42

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m0s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Wheel and DC Motor Kit	\$5.13	used 2	200%	\$10.26
Duracell AA Alkaline Batteries, 4-Pack	\$8.11	used 2 or 4	50%	\$4.05
2 AA Battery Holder w/ Switch	\$1.92		100%	\$1.92
9V Alkaline Battery	\$1.91		100%	\$1.91
Home Collection Wire Hanger, Black, 8-pk	\$2.99	used only 2	25%	\$0.75
Southwire 12 AWG Stranded Black Copper THHN Wire (Per Metre)	\$1.99	1ft only used	33.33%	\$0.66
Multi-Temp mini glue sticks-27x4 pck 30	\$9.09	1 glue stick used	3.33%	\$0.30
Elmer's Craft Sticks, 150/Pack (EC61080)	\$3.46	used only 4	2.67%	\$0.09
			TOTAL	\$19.95

Group 2-09

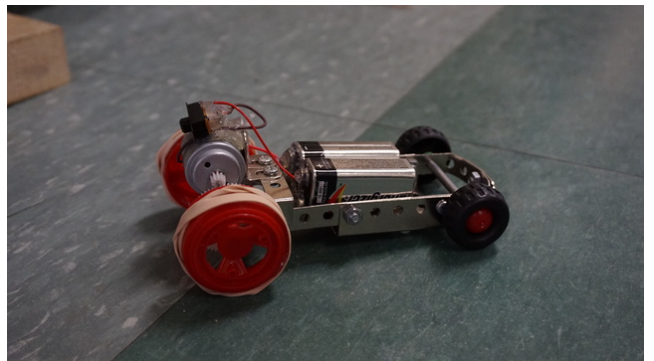
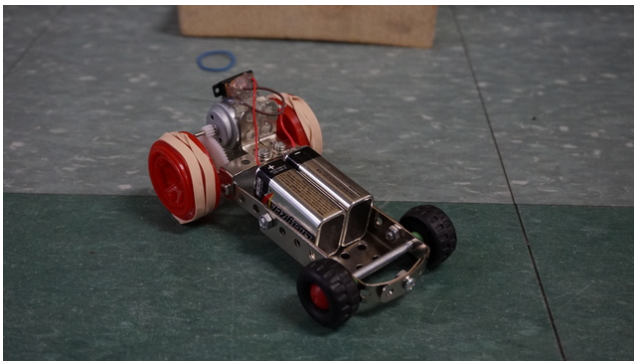
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m48s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
New Bright Mustang GT RC Chargers Sprots Car	\$21.00		100%	\$21.00
11x200mm Clear Hot Melt Glue Adhesive Stick for for Craft Heating Glue Gun	\$9.99	used 2of 11 sticks	0.18%	\$1.82
Matchbox Car Collection - Styles May Vary	\$1.00	2 wheels need for front and back of device	100%	\$1.00
Eveready Gold Alkaline AA Batteries, 24-pk	\$14.99	used 2 of 24 batteries	0.04%	\$0.62
Block Tech 3 Shades Pink Building Blocks	\$9.97	7 of 250 used	0.03%	\$0.28
Renfrew Clear Shin Pad Tape	\$1.00	3 pieces of tape used	0.03%	\$0.03
			TOTAL	\$24.75

Final design

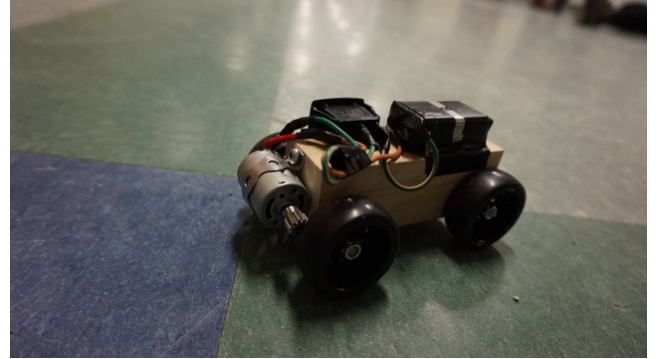
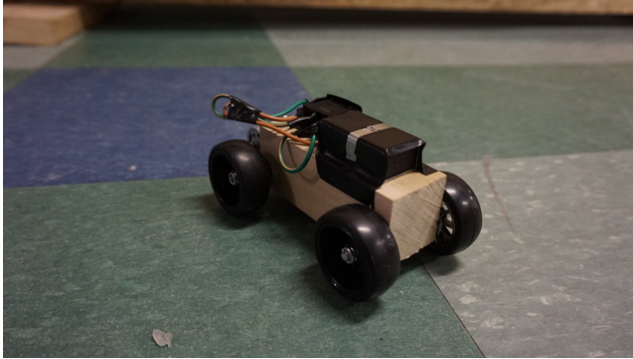


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m12s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Kustom Metal Kit	\$11.95	There is enough material in the kit to build 2	50%	\$5.97
3V Hobby Motor 6600 RPM w/ Gear	\$226.00	Used 1 out of 100 motors	1%	\$2.26
9V Great Value Alkaline Batteries - 4 Pack	\$5.97	Used 1 out of 4 Batteries	25%	\$1.49
10PCS Double Deck 42102B Model White Plastic Gear for RC DIY Toys	\$10.19	Used 1 out of 10 gears	10%	\$1.02
Nidec Copal Electronics MFS201N-9-Z	\$4294.91	Used 1 out of 5000 switches	0.02%	\$0.86
CHENILLE KRAFT COMPANY CK-3358 GLUE STICKS BONUS BAG 100 PC	\$76.37	Used 1 of 100 glue sticks	1%	\$0.76
0.7mm Tin Lead 170cm length High purity Disposable Tin Wire Soldering Wire Electrolytic Tin SN 63/37 10g	\$2.19	Used about 10 cm out of 170 cm of tin	6%	\$0.13
40PCS Dupont Wire 10CM 2.54MM Female to Female 1P-1P Jumper Cable For Arduino	\$1.56	Used 1 of 40 wires	2.5%	\$0.04
			TOTAL	\$12.54

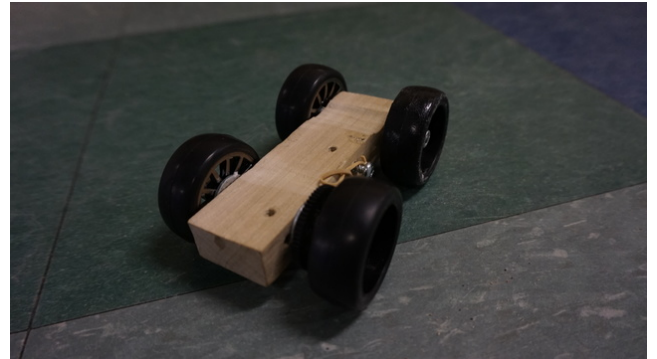
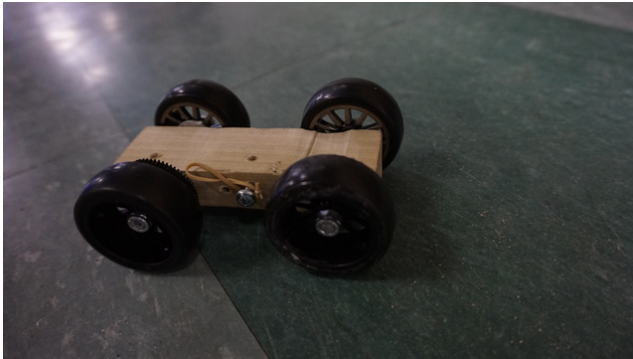
Group 2-10

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m53s>

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m16s

Group 2-11

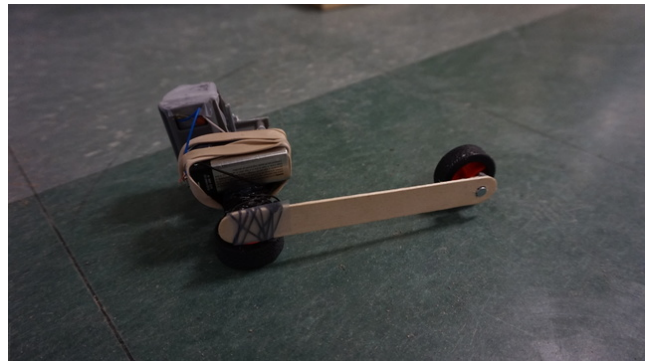
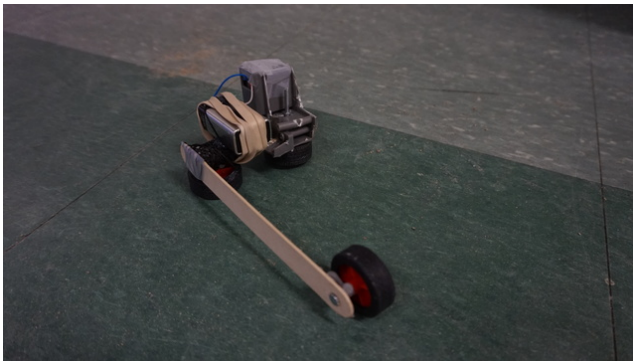
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=2m55s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
102 Piece Amigo Marbles, with Mesh Bag	\$3.79	Only used 1	0.98%	\$0.04
			TOTAL	\$0.04

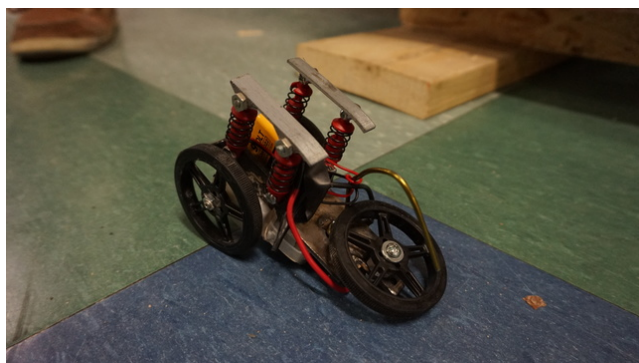
Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m20s

Group 2-12

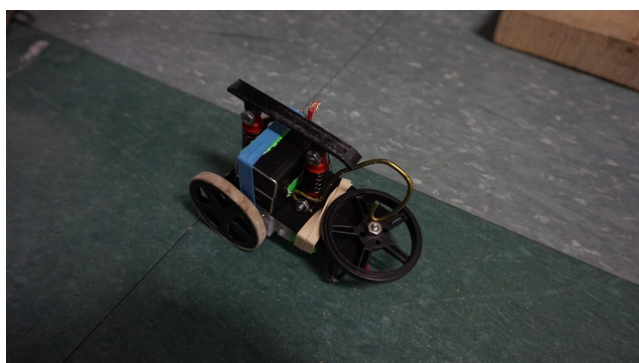
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=3m00s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	Two motors required	200%	\$14.90
Oil-Less Shocks w/ Springs (4pk)	\$8.36	One package of four shocks required	100%	\$8.36
2.4" Wheel for Micro Continuous Rotation FS90R Servo	\$1.78	Three wheels required	300%	\$5.34
Duracell Copper Top Alkaline 9V Batteries, 4-pk	\$13.49	One of four batteries required	25%	\$3.37
6-32 Hex Machine Sc Nut Ss	\$2.97	One package of ten nuts required	100%	\$2.97
9V to 2.1mm Barrel Jack Adapter V2	\$2.29	One adapter required	100%	\$2.29
Papc (1/8x1.50) Flat Stock	\$18.74	Five inches of seventy-two required	6.94%	\$1.30
Paco 6-32x5/8Rd Soc Mach 27Pcs Screw	\$2.97	Twelve bolts used of twenty-seven	37.04%	\$1.10
6x2 Flat Soc Wd 16Pc Screw Pltd	\$2.97	Two screws used of sixteen	12.5%	\$0.37
2 lbs. Large Cool Gray PLA Filament	\$69.95	Fifty centimeters used (0.00525lbs)	0.26%	\$0.18
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Five inches used out of one four foot hanger	1.3%	\$0.04
SRC300 - 3 oz. Electrical Solder	\$7.49	Roughly fifty centimeters used	0.5%	\$0.04
100 % Rubber Rubber Band #64	\$1.97	One elastic of 64 used	1.56%	\$0.03
Scotch Super 33+ Vinyl Electrical Tape - 03744NA	\$3.48	Two inches of three hundred used	0.67%	\$0.02
			TOTAL	\$40.32

Final design

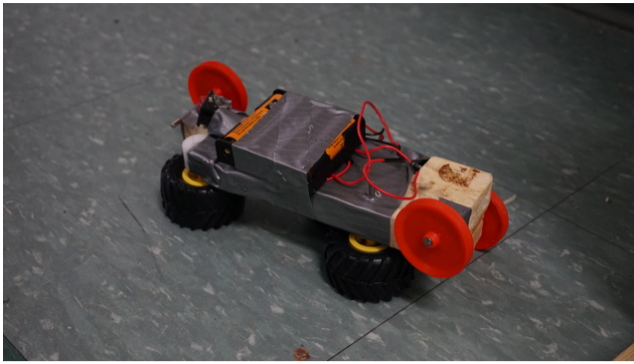


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m25s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM9 - Gear Motor 9 - 90 Degree Shaft	\$7.45	Two motors required	200%	\$14.90
Defiant 9V Alkaline Battery PDQ (8-Pack)	\$16.98	Ability to build four devices with this item	25%	\$4.25
Oil-Less Shocks w/ Springs (4pk)	\$8.36	Two of four shocks required	50%	\$4.18
6-32 Hex Machine Sc Nut Ss	\$2.97	Ability to build two devices with this item	50%	\$1.49
Nexxtech Rigid Battery Snap for a 9V Battery	\$5.99	Ability to build five devices with this item	20%	\$1.20
3D Filament - PLA Black	\$41.37	Three meters used (0.0315lbs)	1.79%	\$0.74
Paco 6-32x5/8Rd Soc Mach 27Pcs Screw	\$2.97	Five bolts used of twenty-seven	18.52%	\$0.55
6x2 Flat Soc Wd 16Pc Screw Pltd	\$2.97	Ability to build eight devices with this item	12.5%	\$0.37
100 % Rubber Rubber Band #64	\$1.97	Ability to build thirty-two devices with this item	3.12%	\$0.06
SRC300 - 3 oz. Electrical Solder	\$7.49	Roughly fifty centimeters used	0.5%	\$0.04
Home Collection Wire Hanger, Black, 8-pk	\$2.99	Ability to make ninety-six devices with this item	1.04%	\$0.03
Scotch Super 33+ Vinyl Electrical Tape - 03744NA	\$3.48	Two inches of three hundred used	0.67%	\$0.02
			TOTAL	\$27.82

Group 2-13

Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=3m26s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM7 - Gear Motor 7 - Baby GM3	\$7.45	we used 2 motors	200%	\$14.90
Rubber Wheel for A4WD and A2WD (Pair)	\$6.99	We used 3 wheels	150%	\$10.48
1x4x2 Pine Hobby Boards	\$2.67	We used 1/3 of the pine boards as the body	33.33%	\$0.89
Battery Holder - 4xAA Flat	\$0.74		100%	\$0.74
SIMPull T90 Copper Electrical Wire - 14 Solid Red 300m	\$0.50	We only used 1/2 meters (\$0.50/m)	50%	\$0.25
Kubinec CL-3424 0.75 in. Orange Woven Polyester Strap, 1650 ft. Coil - 2550 lbs System Strength - 2 Rolls per Case	\$243.30	We used 3D ink and used 3D printer to print of the pulleys, about approximately 10g	0.1%	\$0.24
Hillman 17-Gauge Stainless Steel Round Wire Nail (28.35g-Pack)	\$3.79	We used 1.5g of 28.35g	5.29%	\$0.20
Gorilla Glue Epoxy Adhesive	\$9.99	We used approximately 5ml to connect the wheels into the motors	2%	\$0.20
Cantech All Purpose Duct Tape, 1.9 in x 55 m	\$6.89	We used approximately 1m for just taping the motors into body	1.82%	\$0.13
Lepage Express Quick Dry Wood Glue	\$5.77	We used approximately 2mL to connect the the cube wood into the body	1.3%	\$0.08
			TOTAL	\$28.11

Final design

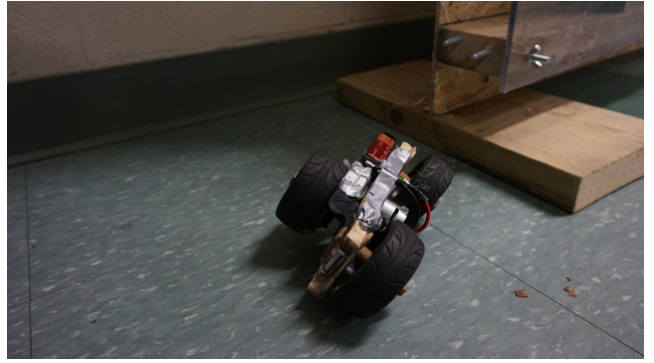


Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m38s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
GM7 - Gear Motor 7 - Baby GM3	\$624.00	We bought 100 motors to save up money and we only used 2 motors	2%	\$12.48
Rubber Wheel for A4WD and A2WD (Pair)	\$631.00	We bought 100 wheels in pair and we only used 3 wheels	1.5%	\$9.46
Alkaline AA Battery (48-pack)	\$11.68	We used 4 out of 48 batteries to run our device	8.33%	\$0.97
Rocker Switch	\$97.00	We bought 100 switches to save up some money but we only used one switch.	1%	\$0.97
Battery Holder - 4xAA Flat	\$63.00	we bought 100 battery holder and we only used 1	1%	\$0.63
AdTech Mini Glue Sticks	\$11.47	We used 4 pcs of Glue sticks out of 100 pcs of glue sticks that we bought.	4%	\$0.46
SIMPull T90 Copper Electrical Wire - 14 Solid Red 300m	\$0.50	We only used 1/2 meters to connect the two motors into the battery and switch	50%	\$0.25
Kubinec CL-3424 0.75 in. Orange Woven Polyester Strap, 1650 ft. Coil - 2550 lbs System Strength - 2 Rolls per Case	\$237.77	We used 3D ink and used 3D printer to print of the pulleys, about approximately 10g	0.1%	\$0.24
Hillman 17-Gauge Stainless Steel Round Wire Nail (28.35g-Pack)	\$3.79	We used 1.5g of 28.35g	5.29%	\$0.20
1x4x2 Pine Hobby Boards	\$2.67	We used 1/20 of the pine boards to connects the pulleys	5%	\$0.13
100 % Rubber Rubber Band #64	\$1.97	We used 1 out 475 rubber bands	0.2%	\$0.00
			TOTAL	\$25.80

Group 2-14

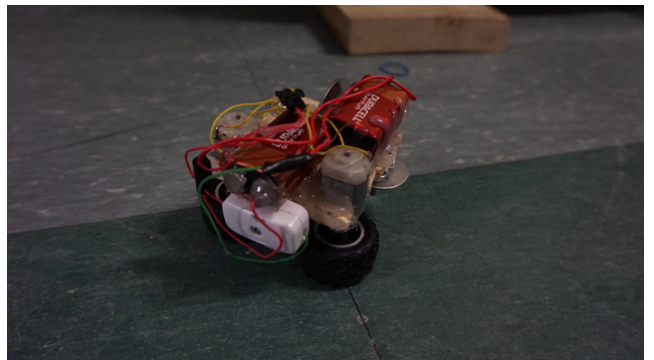
Prototype



Watch video of the device in action: <https://youtu.be/fe0ct275gRM?t=3m31s>

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Hillman Hex Flange Nuts	\$1.49	Used 7, 2 per wheel plus 1 extra	700%	\$10.43
RW2 - Large Rubber Wheel	\$4.99	packs of two, used 3 total	150%	\$7.49
Standard Motor 12850 RPM 12VDC	\$6.82	One powered wheel	100%	\$6.82
Duracell Quantum Alkaline 9v Batteries, 3 pk	\$13.49	Used 1 of 3 batteries	33.33%	\$4.50
Mastercraft Hot Melt Glue Stick	\$8.79	Used 2 of 6	33.33%	\$2.93
The Hillman Group #10-32 Zinc-Plated Round-Head Square Standard (SAE) Coarse-Thread Machine Screws	\$2.79	Used 2 of 3	66.67%	\$1.86
Hillman Flat Washer, Zinc, 1/4-in, 16-pk	\$3.49	Used 6 of 16	37.5%	\$1.31
Hillman #10-32 Zinc Plated Standard (SAE) Hex Nuts (18-Pack)	\$2.79	Used 8 of 18	44.44%	\$1.24
Rocker Switch	\$1.22	One switch	100%	\$1.22
Poplar Dowel (3/16 x 48")	\$1.19	One needed for axel	100%	\$1.19
Advanced Design 9v Battery Cap	\$0.89	One battery	100%	\$0.89
Alpha Wire 22 gauge electric wire	\$33.72	Price is for 100', used 1'	1%	\$0.34
Horizon Group USA Wood Craft Stick	\$1.00	Used 18 of 100	18%	\$0.18
All Purpose Duck Tape, 2in x 18m	\$5.99	Needed one small strip	1%	\$0.06
			TOTAL	\$40.45

Final design



Watch video of the device in action: https://youtu.be/niUaM_19Xos?t=5m45s

Product Description	Full Cost	Parts Used	Proportion of Total	Proportional Cost
Standard Motor 12850 RPM 12VDC	\$6.82	Each wheel powered by one motor	200%	\$13.64
RW2 - Large Rubber Wheel	\$4.99	2 wheels used	200%	\$9.98
Duracell Quantum Alkaline 9v Batteries, 3 pk	\$13.49	Used 2 of 3 batteries	66.67%	\$8.99
Mastercraft Hot Melt Glue Stick	\$8.79	Used 2 of 6	33.33%	\$2.93
The Hillman Group #10-32 Zinc-Plated Round-Head Square Standard (SAE) Coarse-Thread Machine Screws	\$2.79	Used 2 of 3	66.67%	\$1.86
Rocker Switch	\$1.22	One switch	100%	\$1.22
Hillman Finish Hex Nut, Zinc, 5/16-in-18	\$0.19	Used 4	400%	\$0.76
Hillman Flat Washer, Zinc, 1/4-in, 16-pk	\$3.49	Used 3 of 16	18.75%	\$0.65
Alpha Wire 22 gauge electric wire	\$33.72	Price is per 100', used 30cm	1%	\$0.34
7/16 Bs Plain Steel Washer	\$0.28	1 used	100%	\$0.28
Poplar Dowel (3/16 x 48")	\$1.19	Needed 1.5 of 48 inches for axel	0.42%	\$0.01
			TOTAL	\$40.67