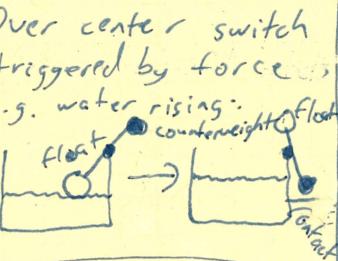
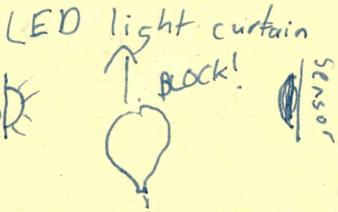
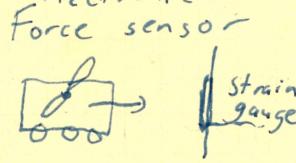
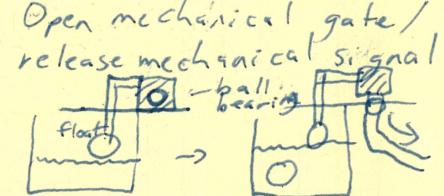
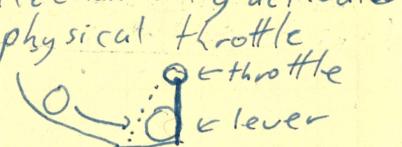
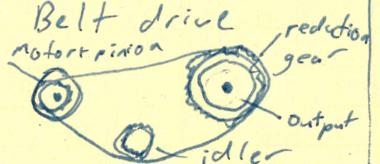
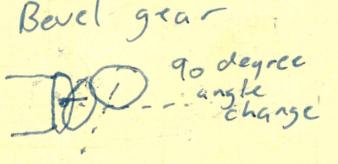
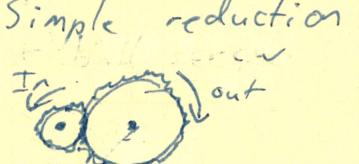
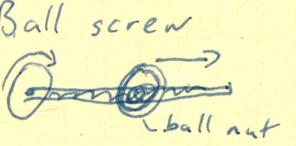
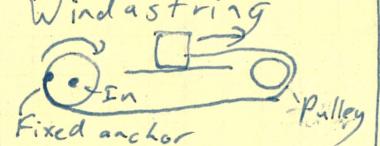
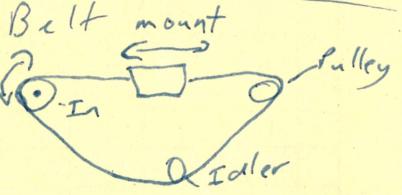


# Morphology

Subfunction	Idea 1	Idea 2	Idea 3	Idea 4
Sense motion	Over center switch triggered by force e.g. water rising: 	LED light curtain 	Electronic Force sensor 	Open mechanical gate/ release mechanical signal 
Convert input signal to motor signal	Voltage to PWM converter to ESC	Sensor signal to microcontroller to logical switch to motor commands	Voltage to relay switch to simple DC motor	Mechanically activated physical throttle 
Transform rotational energy to desired speed, torque, and axis	Planetary gearbox 	Belt drive motor pinion → reduction gear → output idler 	Bevel gear 90 degree angle change 	Simple reduction 
Convert rotational motion to linear motion	Rack + pinion 	Ball screw ball nut 	Wind a string Fixed anchor → Pulley 	Belt mount In → Pulley → Idler 

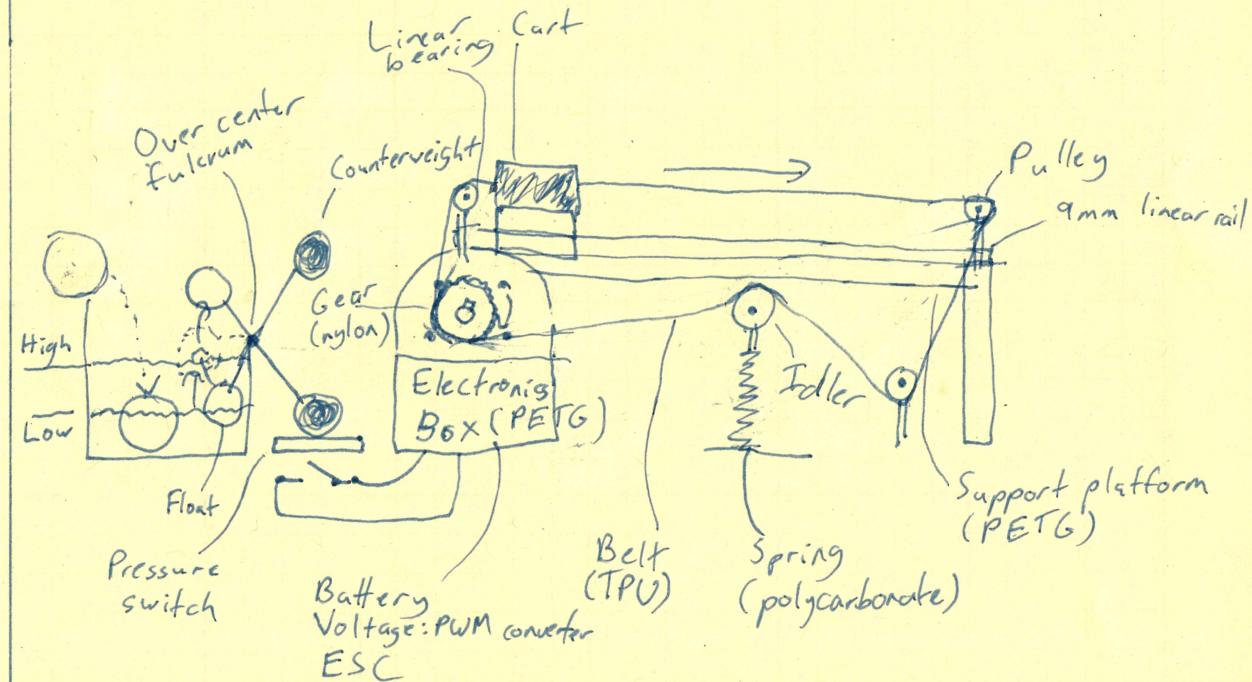
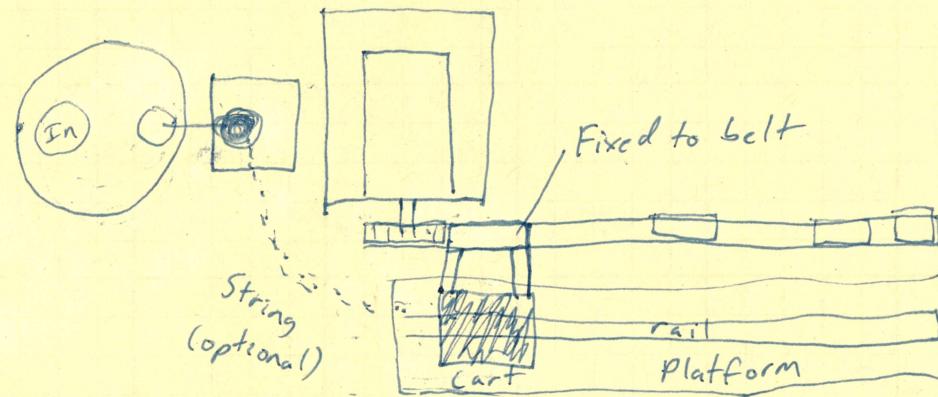
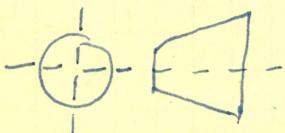
## Concept 1

Input: Water rising

Output: Cart traveling on rail

Flow:

1. Water rises.
2. Float rises above equilibrium.
3. Counterweight depresses switch.
4. Switch completes circuit and applies voltage to V: PWM conv.
5. V: PWM converter signals ESC
6. ESC signals motor
7. Motor turns gear
8. Gear moves belt
9. Belt moves cart
10. (Optional) Cart pulls string to lift counterweight and open circuit.

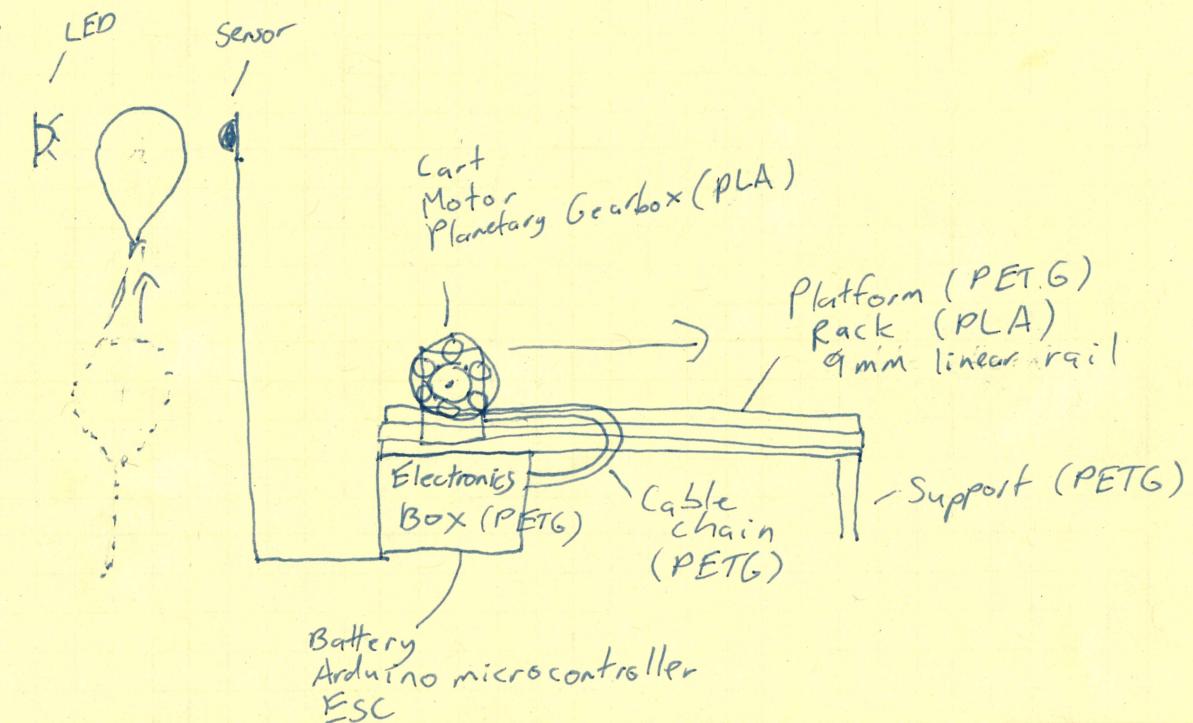
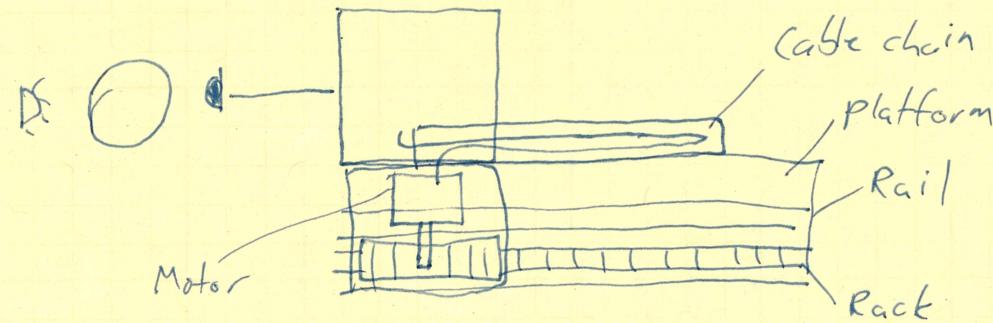


## Concept 2

Input: Helium balloon rising  
Output: Cart traveling on rail

### Flow:

1. Balloon rises.
2. Balloon breaks light curtain and triggers sensor.
3. Sensor signals Arduino.
4. Arduino signals motor to run for n seconds.
5. Motor rotates planetary gearbox.
6. Outer gear rotation pulls cart along rack + rail.
7. Motor shuts off after n seconds.



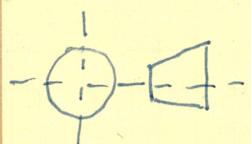
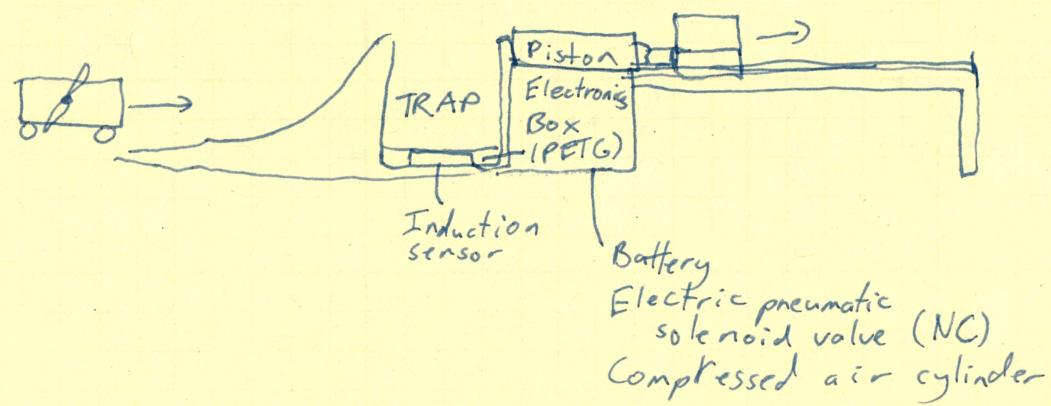
### Concept 3

Input: Tiny wind-up vehicle

Output: Cart traveling on linear rail

Flow:

1. Toy car drives up ramp.
2. Toy car falls in trap.
3. Inductive sensor detects car.
4. Inductive sensor signals pneumatic solenoid to open.
5. Pneumatic solenoid allows air to pass from compressed air cylinder to piston.
6. Piston rapidly extends.
7. Piston extension pushes cart forward.
8. Cart coasts to end of rail.

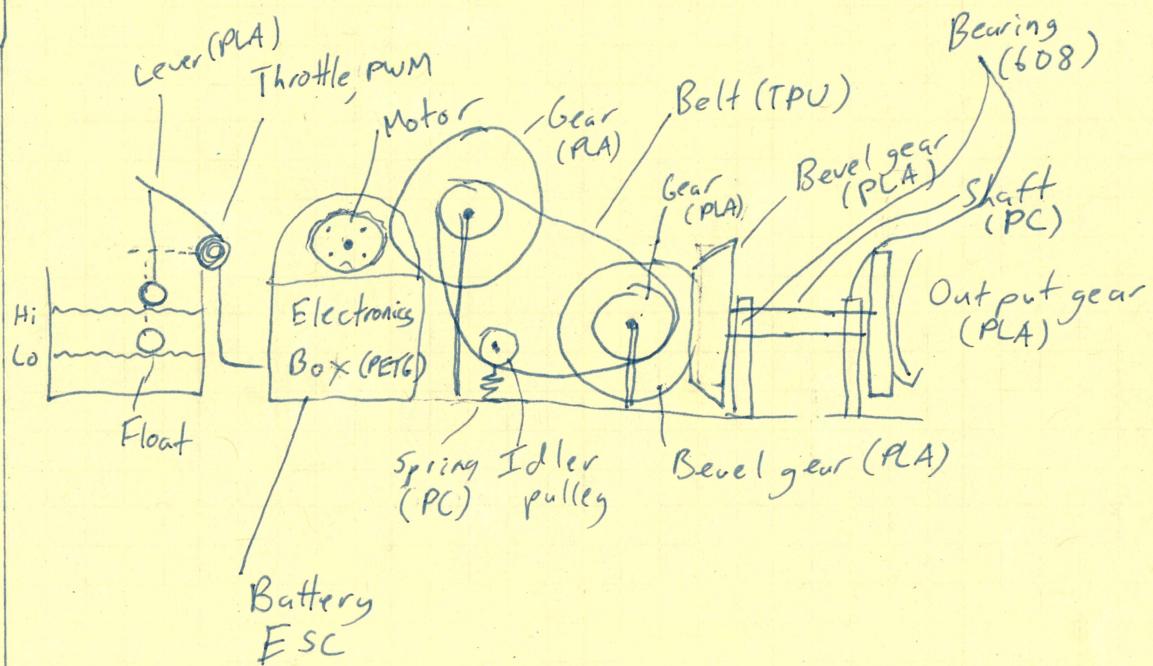
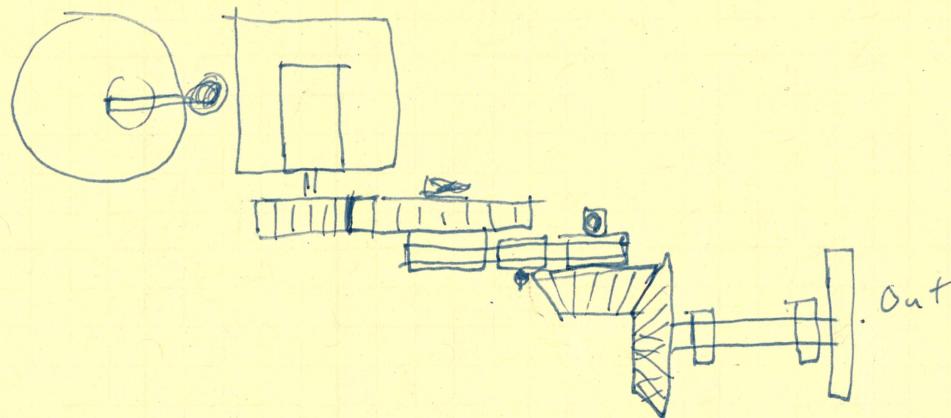


## Concept 4

Input: Water surface rising  
Output: Spur gear rotating

### Flow:

1. Water rises and lifts float.
2. Float pushes throttle lever up.
3. Throttle signals ESC
4. ESC signals motor
5. Motor turns pinion
6. Pinion turns spur gear
7. Spur gear turns belt
8. Belt turns bevel gear
9. Bevel gear 1 turns bevel gear 2
10. Bevel gear 2 turns output gear.



## Concept 5

Input: Helium balloon

Output: Moving bar with 12V contacts

Flow:

1. Balloon lifts fake ceiling + attached gate
2. Ball bearing rolls down ramp
3. Ball bearing activates switch
4. Switch activates DC motor
5. Motor drives ball screw
6. Ball nut pulls bar forward
7. At end of line bar contacts are energized and motor circuit is broken/deenergized

