Design 1

Design 1, detailed in Figure 1, features aluminum beams configured to send as much force from the back drive wheels to the rubber bumper which will push the payload. From a front view, a vertical rectangular frame of metal bars connects the two front wheels and gives a spot for the rubber bumper to rest and push against the payload, 3 inches above the ground. Two diagonal bars connect from the back drive wheels to the top of the rectangular frame, attempting to transfer as much force from the back wheels to the bumper. Two L-bars extend from the diagonal bars, on which sits a metal table to mount the battery, microcontroller, emergency stop button, tether, and other required components. The back two wheels are the drive wheels, with the motor and gear box between the two wheels, while the two front wheels are thinner wheels of the same radius to reduce unwanted friction.

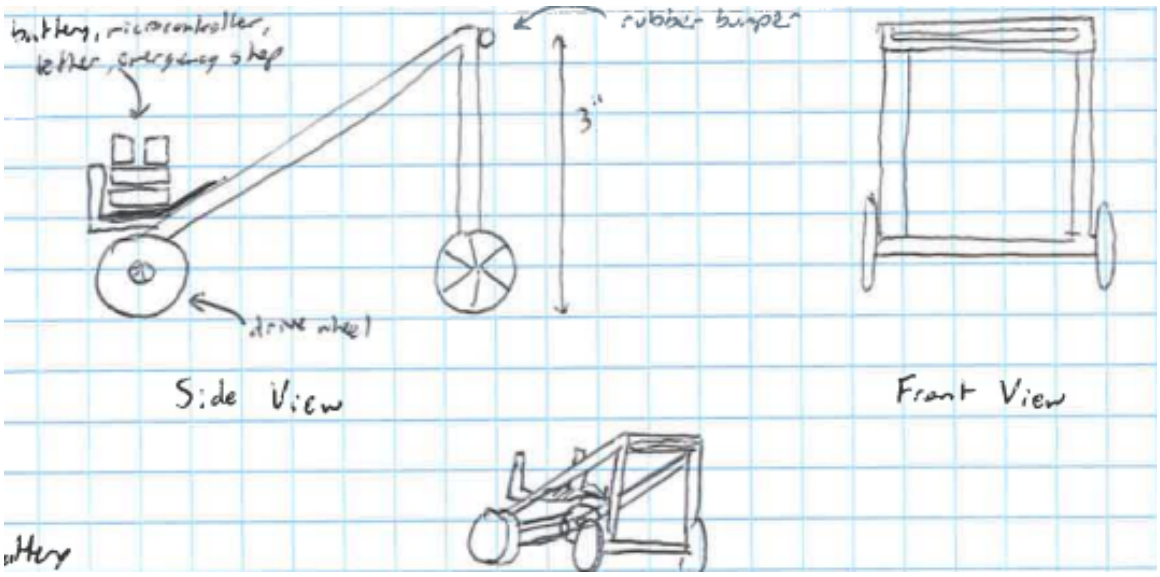

Figure 1: Design 1.

Advantages:

1. Concentrates all weight on the back wheels to provide greater friction force to the drive wheels.

2. Uses a minimum amount of material on the chassis to reduce weight and reduce unwanted friction that will slow down the acceleration and top speed of the vehicle.

3.

Disadvantages:

1. There could be unnecessary stress at the top of the front bar, but this could be fixed with bars connecting the two axles.

2. Additional metal might need to be added towards the back to allow for enough space to mount all of the electronics.

3. The force might cause the front wheels to come off of the ground, violating one of the design specifications by causing an imbalance that could cause the entire robot to fall over.

Design 2

Design 2, detailed in Figure 2, features aluminum beams configured into what would look like a table on wheels. On top of the beams is a large sheet of metal, serving as an actual tabletop for the battery, microcontroller, emergency stop button, tether, and other required components. As in Design 1, the front view features a rectangular beam structure, reaching a height of 3 inches from the ground. The back of the robot symmetrically matches the front, with two diagonal beams extending from the front and back wheels on both sides to form truss structures. The back two wheels are the drive wheels, with the motor and gear box between the two wheels, while the two front wheels are thinner wheels of the same radius to reduce unwanted friction.

Advantages:

1. Easy to add additional electronics or components to the top because there is such a large top surface area.

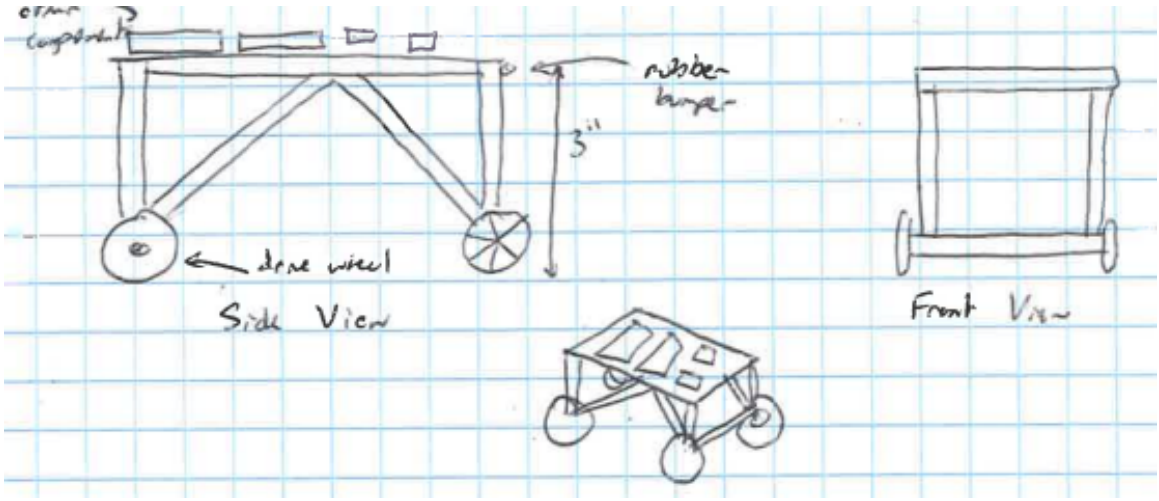

Figure 2: Design 2.

2. The force of the rubber bumper against the payload will travel along the long tabletop structure supported by trusses, distributing it through the entire robot. The robot is balanced and will not topple over.

Disadvantages:

1. The weight is evenly distributed rather than focused on the drive wheels, decreasing the normal force over the drive wheels, decreasing the friction, and thereby increasing the slip.

2. There is a large amount of potentially unnecessary material which adds unwanted weight that will make acceleration more difficult. If components do not cover the entire top, there will be unused tabletop space that adds to weight. The symmetric truss structures and rectangular structures assure stability but add significant weight from the first design.

Design 3

Design 3, detailed in Figure 3, combines the efficient use of materials of design 1 with the stability of design 2, additionally including a new element. From the side view, it looks like design 1 except it has an extra bar on the bottom on both sides for greater stability. In contrast to both previous designs, it only has three wheels instead of four. Above the front wheels, a sheet of metal will act as a tabletop on which to place the battery, microcontroller, emergency stop button, tether, and other

required components. As in Design 1 and 2, the front view features a rectangular beam structure, reaching a height of 3 inches from the ground. The front two wheels are the drive wheels, with the motor and gear box between the two wheels, while the back wheel is a thinner wheel of a larger radius to reduce unwanted friction.

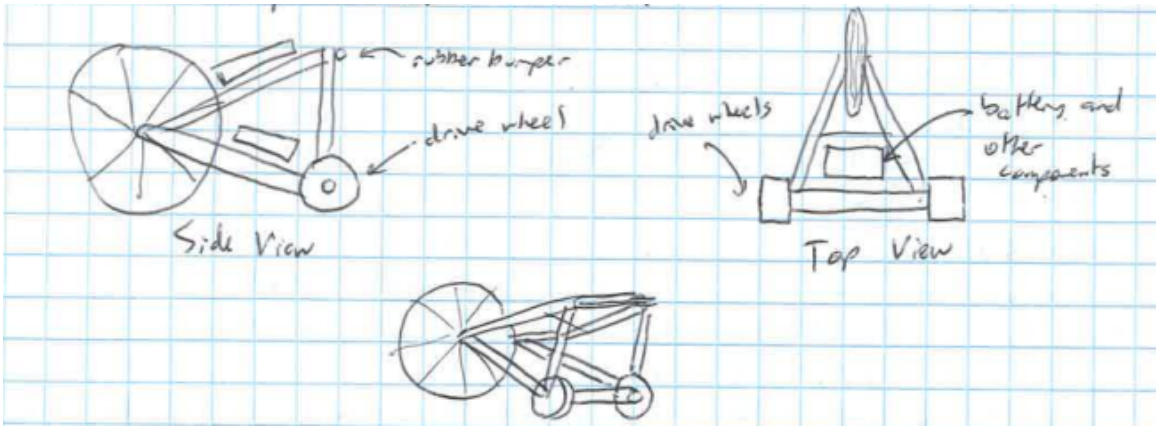

Figure 3: Design 3.

Advantages:

1. Easy to add additional electronics or components to the top because there is such a large surface area. If more is needed, a metal sheet could be placed across the bottom beams in addition to the top beams as drawn.
2. Minimizes kinetic friction in non-drive wheel by only having one instead of two.
3. Only allows controllers and batteries and other components to be up front above the drive wheels to provide for greater traction and prevent slip.

Disadvantages:

1. It might weigh less to use two smaller wheels rather than one big wheel, creating the possibility that two small wheels might have less friction.
2. Might not be as stable as a four-wheeled option.