HARDWARE II

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The kinetic sculpture is typically designed and constructed in two detach pieces namely the bird sculpture and the box containing at least three mechanical engineering principles along with secondary matters that the team concentrated on such as precision and balance which are deemed to be very important for effective construction of the kinetic sculpture. Thus, the precision ball bearings will be utilized to lessen friction as well as to accomplish long run durations for the sculptures. All metal pipes bought for the sculptures will be aluminum covered by an acrylic glass. Moreover, above layers of acrylic, a treat automotive-grade clear coat will be applied to the dense Styrofoam.

Figure 1: Styrofoam used to design the bird

Diverse materials like acrylic, plastic, steel and wood in the construction will be utilized in the project. Acrylic will be to construct the box; plastic to build the gears with a 3-D printer,

lumber to build the bird, steel to make the shaft, and PEX pipes was utilized to create the hinge for the wings.

3-D printed gears were being designed and printed from the library. Gears will be connected employing specific dimensions made in Solidworks in a bid to join the shaft through the borehole. For the spring motor, a ratchet gear was used to possess a constant linear or rotary motion in one direction as well as to prevent movement within the reverse direction.

Moreover, the ratchet gear was also 3-D printed. Acrylic was joined utilizing glue to keep the joints strong. Steel shafts were installed employing bolts that aided in keeping the shaft rotating avoiding fail. The v-belt was connected to a relatively smaller rod, and that moves the tail.

Figure 2: Ratchet gear and it's spring

The design consists of spring powered ratchet gear with the shaft attached to a big bevel gear to a relatively smaller bevel gear connected to the wing rods. Wing rods are typically moved by an acentric as well as centric movement. The v-belt is attached with a short shaft linking to an acentric wheel to move the tail. The interlocked gear system will aid in rotating the fins, when

the outside rod will be rotated by hand. Moving the shaft with the hand, it will automatically lead to movements of the gears in a 90 degree, which will makes gears interlocking system to make the second gear attached perpendicularly to move. Consequently, movement of the perpendicular rod will make the gears interlocking system to rotate the fins.

The crankshaft will be connected to the spring on one end. The rotation of the crankshaft was then used to compress the spring. Consequently, the shaft is connected to the gears to ensure that the gears move and rotate. All the gears and the crankshaft will be combined and held together and stabilized by the Acrylic board which is also used as the base. Rotation of the crankshaft will compress the spring. Conversely, the gears will start to rotate and in turn rotate the shaft and the wings until the spring relaxes when the shaft is released.

The v-belt is attached to the rod in the system as well as the main shaft which is in connection with the gears as well as the ratchet gear with the self-made spring. The power is supplied to the spring. The compression of the spring will permit the main shaft to start rotating. The rotation of the main shaft will subsequently allow the gears to start moving as they are connected to the main shaft.

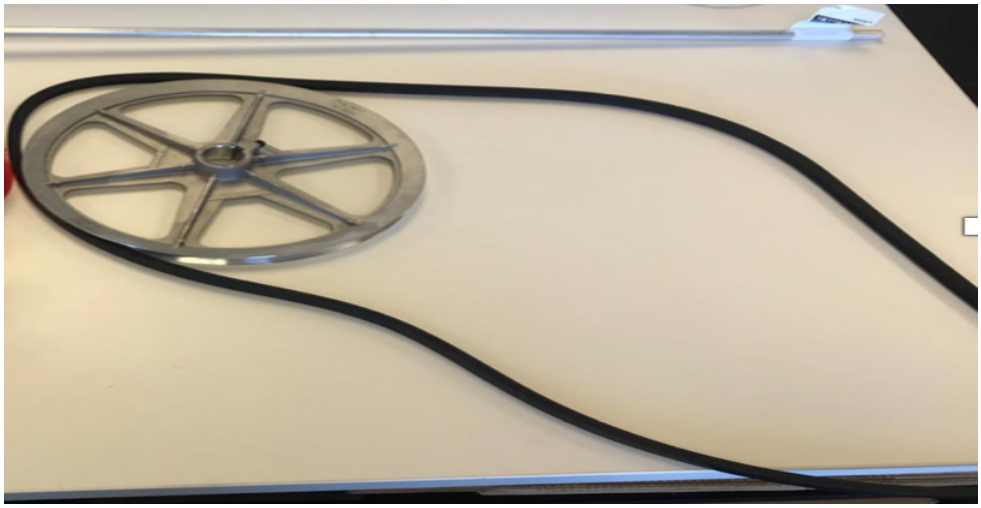

Figure 3: V-Belt and one of its timing pulley

The large driver gear will be connected to the small driven gear by a single idler gear. Moreover, the idler gear will comprise of a large idler gear that is typically interlocked with a small idler gear. A spring with relatively higher wire diameter, smaller inner diameter as well as a high constant k/rate require more energy but typically offer a better speed output compared to the spring with small wire diameter, a large inner diameter and a lower constant k/rate.

Furthermore, a strong spring will require more energy to compress but will allow the shaft to rotate at higher speeds as the spring relaxes. The spring will be placed inside the ratchet gear in the beginning of the device where the human force will be applied and shaft is connected. One end of the spring will be tied to the shaft while the other end will be linked to the base of the sculpture. When a human force is manually applied, then the force will compress the spring. The dimension of the spring will be less than 30% of the dynamic force applied by the human hand and sufficient to compress the spring. After releasing the rod, it will start rotating in the opposite direction of the power being placed until the spring relaxes. Generally, the spring selected for the sculpture ought not to exceed a force that would break it. Thus, the design will be based on

determining the size of the spring as well as the position where the spring ought to be placed for maximum performance.

The main shaft is attached with the gears system while the main shaft is linking with the self-made spring gear. Therefore, the power will be supplied to the spring. The spring will create the movement thus making the main shaft to rotate. When the main shaft rotates, it will rotate the bevel gears attached to the main shaft which consequently makes the small bevel gear interlocked with a bigger bevel gear in perpendicular form to start rotating. Moreover, this process will make a shaft attached to the next equipment to begin rotating. The other edge that is also connecting to two gears interlocked at 90 degrees with the shaft will also rotate those two gears and at the end where a PVC plastic pipe rod would cause the wings to move. This is the main functionality of the wings .The tail which moves through another shaft connected to the v-belt.

Figure 4: PVC and metal pipes used as rods and shaft

The spring that powers the device works by compressing itself which results in the energy storage that emanates due to the expansion and used to rotate the shaft. The interlocking of gears assists in turning each other since the teeth of both gears merge into each other as the teeth of

one gear come successively after the teeth of the second gear. This makes this interlocking position to rotate together and when the first gear rotates it pushes the second gear and the subsequent teeth to interlock with each other. Thus, this way interlocking of gear turns all the gears together. Where an achievement of 60% was completed in this project of the kinetic sculpture.