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Autonomous Snow Shoveling Robot Design

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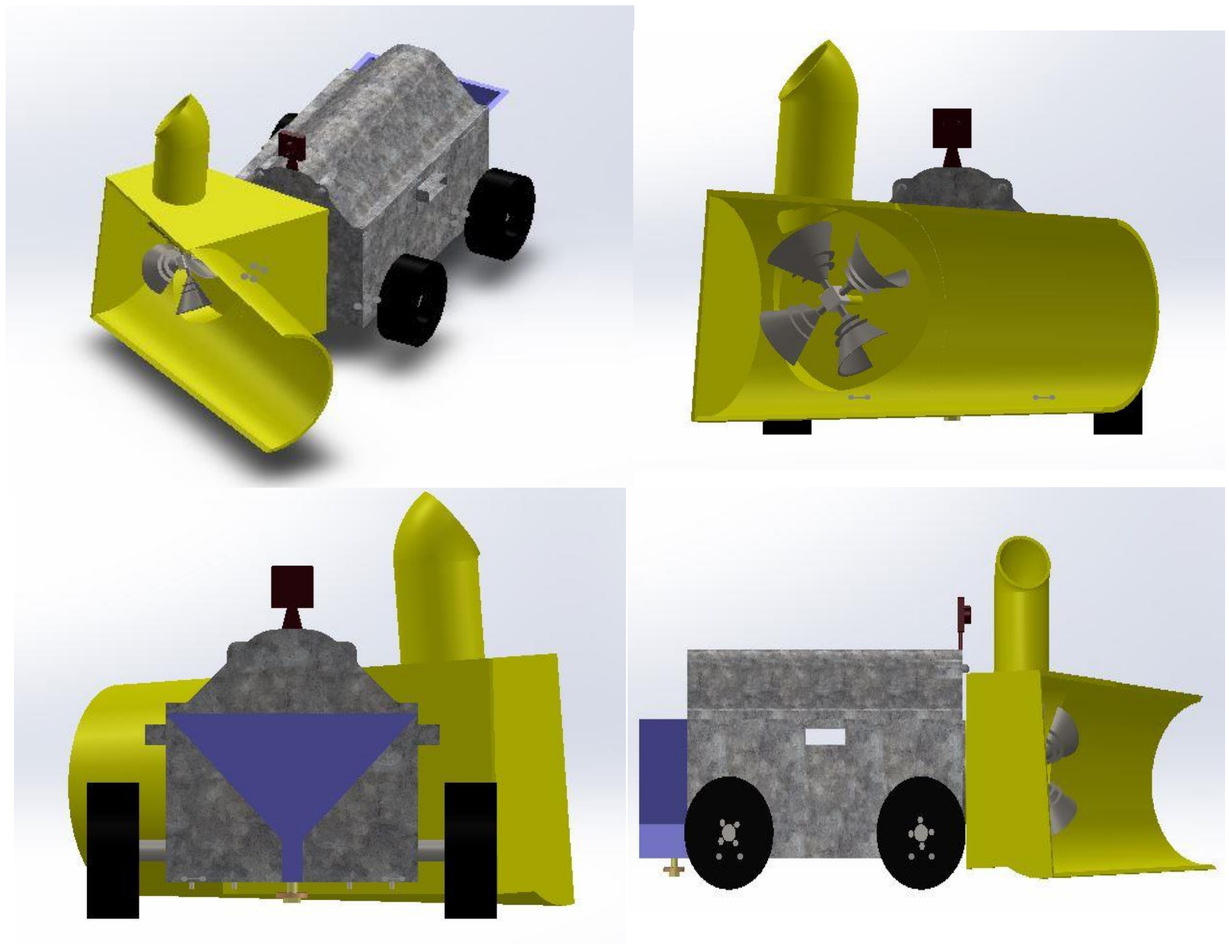
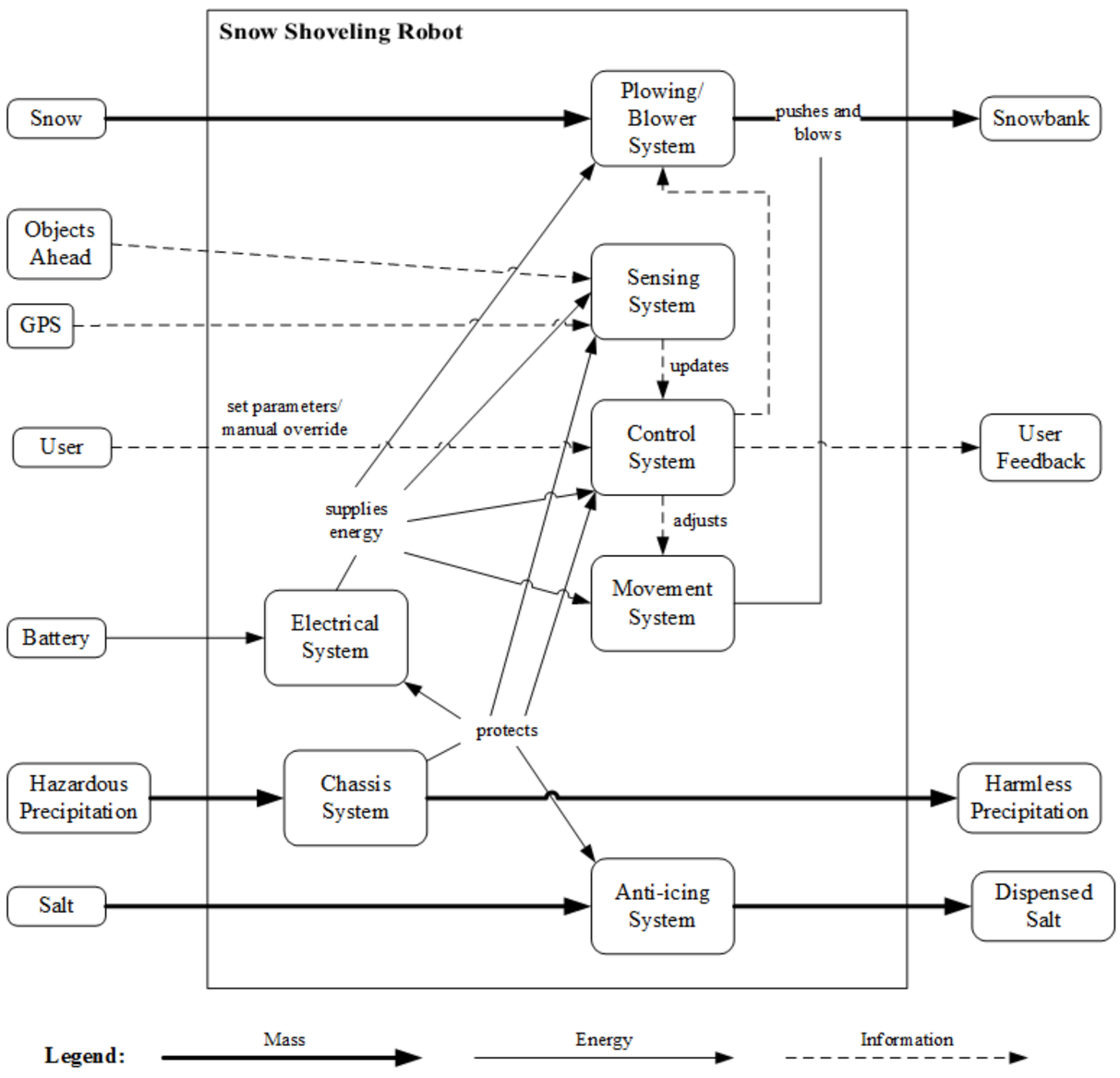
A snow shoveling robot with the ability to run autonomously was to be designed. This robot system must clear a residential property from snow with as minimal input from a user as possible. The snow should be placed at a safe location that does not interfere with the user's everyday life and activities. Several in-market benchmark products were initially identified that reasonably met most of the requirements. However, there was no real solid basis for a design of the desired caliber. Therefore, this truly was a design-based project in terms of scope and scale. Many calculations were performed to ensure that a feasible design was eventually met. The final design was modelled in SolidWorks. Computer programs were developed using the Arduino IDE for simple and fast prototyping. Ultimately, a functional design was created that met all the requirements of this project.

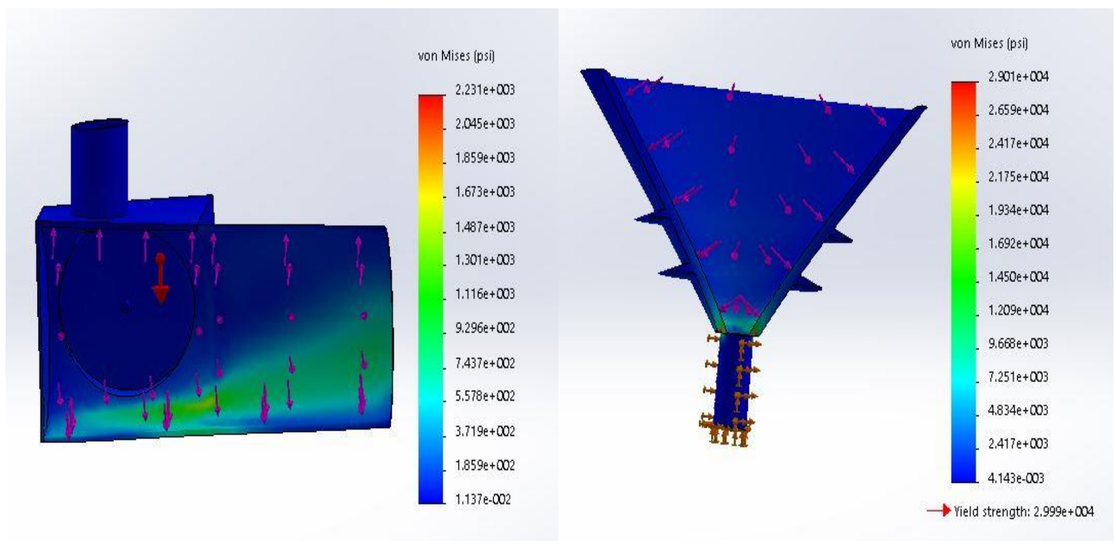
After carefully analyzing the problem and reviewing existing snow removal machines, the group began to brainstorm and sketch ideas to visualize a desired final product. After several design iterations, the final design was created (shown to the right).



- Unique combination of a snowplow and snow blower
- The shovel is at a 30° angle: snow gets shifted and forced toward the impellers as the robot moves forward
- Salt dispenser mounted at back to distribute salt along shoveled pathway as robot advances
- Proximity sensors on each side plus the front and rear end
- Image-sensing camera at the front to capture images up to 4 meters ahead and distinguish any obstacles approaching
- Four-wheel drive with no threaded tire belt
- Two LEDs at the front to light the path for the vision camera and two LEDs placed at the back for user safety
- Main chassis made of corrosion-resistant stainless steel



- Shovel composed of high density polyethylene (HDPE), allowing it to be lightweight, durable, and strong
- Impeller blades constructed of stainless steel, for breaking up ice and snow and throwing it through the chute
- Chute is mechanically controlled, and directed with respect to the movement of the robot and GPS-selected location
- Embedded GPS tracking system to get location information
- Powered by a Hi Power Polymer Li-ion battery, that would generate 58.8 volts at 20 amperes, allowing sufficient power for plowing an average suburban driveway
- Clears average two-car driveway in 2 minutes



Although the design generated has been sensibly analyzed, there is always ways of improvement in a design project. A great feature that could be added onto this device is having it operate based on the weather each day. The robot could be programmed to be updated with the weather forecast daily, and start operation when necessary and automatically along with a timing feature. Another great feature to consider is to make this robot a multi-seasonal machine by a replaceable unit, providing it the benefit of substituting to other modules such as a leaf shredder or lawn mower for other seasons. Also, although this design was intended for residential use, modifications can be made to implement this design for commercial and municipal use.