

Project Summary

The intent of this project was to design a simple, yet logically sophisticated mini-sumo robot, capable of holding its own at a legitimate competition level with total automation. This means our design came with certain physical limitations on top of the intended electronic design, such as limiting our physical space to a 10cm width and a 10cm length.

Our design process was a slow trickle of adding and working on features from the start. We began with some broad basic ideas for the components: a microcontroller for the logic, motors for basic motion, a source of power, and some method of detecting an object.

We chose 9V batteries for the power source because they are small and provide significant battery life. The first sensor we chose to work with was an ultrasonic sensor, to allow for simple detection of an object from a distance. The control of this sensor was handled by an Uno R3 microcontroller board, and we continued to use this board as the lone “brain” for our robot for some time. We continued to add and refine some other sensors, such as a temperature sensor to keep track of ambient temperature within the enclosure, and limit switches as “whiskers” on the front of the bot, updating the code to compensate for our entire system as it was developed.

Around this time is when we began to face some difficulties in the design process. We lost a team member and it was on the two of us that remained to compensate for their responsibilities. This included the motors and how to control them, as well as a display for debugging purposes. The added weight onto each of our shoulders did slightly slow the development of the whole system, but we were able to mostly compensate and get each individual block functioning. We also added a series of IR phototransistors, intended for detection of the edge of the arena from each of the corners.

Lastly, a second microcontroller was added via a Nano v3. This allowed us to have one program function as a constantly polling loop of the sensors, and transmitting any detections or contact on the sensors to the main program via sending a byte of bitflags through a serial connection. The main program then responds to the sensor data as it needs to, prioritizing the IR sensors, then the whiskers, then finally the distance sensor.

At this point, we had each individual component functioning independently, then functioning as a full system. Unfortunately, this point may have come slightly too late, as we had little time left to design an enclosure. We improvised a design with some acrylic plates, just to have something in which we could contain all of our components in time.

We had very minimal time in which to test and prototype the fully constructed design, and unfortunately, we ran into some issues with the physical construction and how the motors were secured in the chassis, leading to functional issues with the motors, and the bot ultimately not functioning as designed.

While the entire electronic system of our robot is fully functional as designed, we now know that our hastily improvised physical configuration should have had more planning go into it. Given additional time to hone our design, we would absolutely 3D print a design that can neatly contain our components and allow us to secure the motors more effectively.

Ultimately, this project taught us a lot about designing under a suddenly increased workload and definitely emphasized the importance of planning at least something for each and every portion of the design ahead of time. Physical designs are neither of our strong suits, and we should have taken that into consideration sooner. However, we are also proud of the progress we did make considering our design was initially intended for three people.