

CM Robotic Marking

Sponsor: Bruce Gehrig

PROBLEM STATEMENT

Our goal is to build a prototype for an autonomous robot that lays out traffic control markings on paved surfaces.

- Prototype/Test the autonomous robot that can successfully follow the layout of traffic patterns
- Build/ design chassis for propulsion system
- Design Control Interface
- Create a paint delivery system that can successfully apply common traffic control markings
- Implement an emergency stop button onto the robot as well as other safety features

REQUIREMENTS

#	Description
1	Spray nozzle should output 3 in wide lines with water-based spray
2	Hold a standard 5-gallon bucket
3	Wheel or tire propulsion system
4	Weigh up to 200 lbs in total without bucket
5	Support a static load of 600 lbs on the top surface of the robot
6	Balance or self-leveling system
7	Locate the clear side of a road within +/- 1 in
8	Battery is operational for 2 hours on full charge
9	Battery charging system based off 12Vdc or 120Vdc
10	Water damage resistant
11	Able to read X-Y coordinate datafiles through USB port
12	Navigation system uses GPS for position tracking and correction to +/- 10 cm
13	Must have a 6-to-10-inch touchscreen interface on a tether
14	
15	Total cost of robot between \$5k to \$7k
16	Mark 3 in straight lines between two points at least 10 ft apart in at most 2 minutes
17	Mark 3 in wide lines with 2 ft dashed at least 14 ft long in at most 3 minutes
18	Arched (circular) 3 in lines through three points in a radius between 3 ft and 10 ft in at most 2 minutes
19	Crosswalk patterns with diagonal lines that are 1 ft wide over a rectangular area of 3 ft by 6 ft in at most 10 minutes
20	Merge Arrows 6 ft in length with a body width of 1 ft and a pointed head that is 1.5 ft across in at most 5 minutes
21	The word 'STOP' in letters with 6 in wide strokes in an area of 6 ft wide and 3 ft high in at most 10 minutes

FINAL DESIGN, APPROACH, PLAN

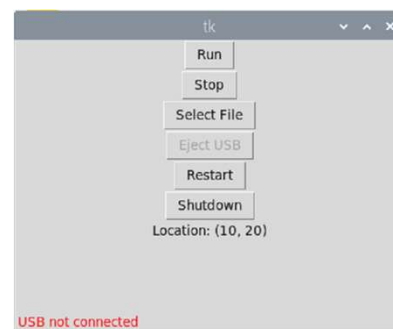
Mechanical:

- Have a frame 2' x 3' in size
- 2 drive wheels, 1 caster wheel
- Be water resistant by adding plastic on all sides
- Support the weight of up to 600lbs static load
- Paint sprayer be located between the motors

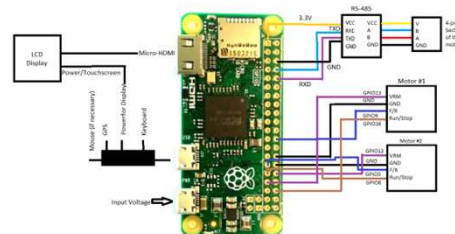
Electrical:

- Have a functional GPS able to read and print coordinates in Latitude and Longitude
- Working Iteration of the Touchscreen
- Have motors that can successfully receive commands from the Raspberry Pi
- Connect the paint sprayer to the chassis wire it to the Raspberry Pi
- Add an Emergency-Stop Button in between the battery and the Raspberry Pi

LCD Touchscreen Display



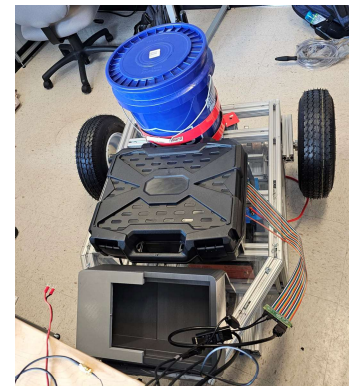
Electrical Schematic



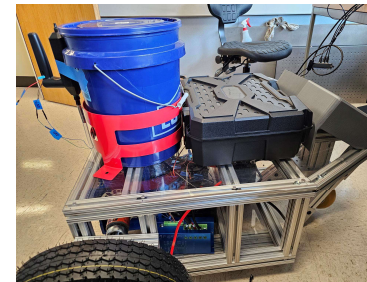
RESULTS

- Fully assembled Chassis with acceptable weight testing
- Functional first iteration of the LCD Display
- Functional GPS
- Functional motors

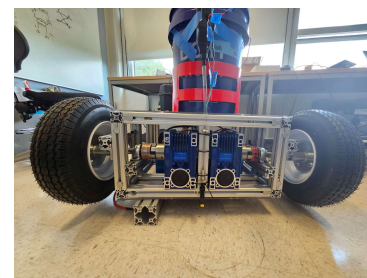
Chassis Assembly #1



Chassis Assembly #2



Chassis Assembly #3



SUMMARY AND CONCLUSIONS

The team set out to design, build, and test a robot that is capable of laying out different types of traffic control markings by following a Global Positioning System (GPS). It was designed so that different layouts can be uploaded through USB, and the user will be able to select the different files using an LCD Touchscreen. The prototype was designed to be used on pavement, and to be easily portable from various marking locations.

We were able to construct the chassis that successfully supports its own weight, as well as additional weight added to the robot. The motors, GPS, and Display all have working iterations of their respective code. The GPS can read and print its location in latitude and longitude, The motors are able to hard-coded directions, and the Display can be interacted with using either a mouse or touchscreen.

FUTURE WORK

- Weight reduction
- Rethink frame limitations
- Replace current "paint sprayer"
- Improve software: Motors and motor controllers, LCD Display, and GPS performance

TEAM & ACKNOWLEDGEMENTS

- Henry Atkins (ME)
- Benjamin Carpenter (EE)
- Cheyenne Hall (ET)
- Airelle Robinson (EE)
- Mentor: Dr. Hugh Jack
- Sponsor: Dr. Bruce Gehrig