

The Self-Leveling Table (SLT)

Center for Outdoor Recreation and Adventure (CORA)

Project funded by



In collaboration with:
WCU Corp. for Entrepreneurship and Innovation



PROBLEM STATEMENT

Capstone Team 15 has been tasked by CORA with designing, developing, and prototyping a portable table that can level independently (with no external leveling device). The self-leveling table should allow the consumer to create a level surface out of an uneven surface.

The sponsor produced the idea while looking for a level stump to set camping items on. Having a self-leveling table would make outdoor activities (like camping) easier to keep items on without them sliding away.



Figure 1. Table transitioning from unlevel to level

REQUIREMENTS

#	Description
1	Product weight < 20 lbs.
2	Thickness < 1.5"
3	≈ 18" diameter
4	0° ± 1°
5	Up to 20° level correction
6	< 6 minutes to become level
7	30 to 40 uses (single charge)
8	Stay level for > 72 hours
9	Load weight > 20 lbs.

Memsic-2125 Dual-Axis Accelerometer

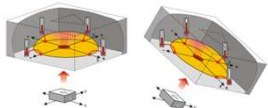


Figure 2. Memsic-2125 Diagram

- The Memsic Accelerometer is a dual axis IC package
- It uses a micro heat source and micro heat sensors to find "level."
- It sends a mV signal to the Arduino which converts it to mg.'s.
- It also contains a temperature sensor as it is affected by temperature changes
- These temperature changes are read by the Arduino in mV to adjust mg readings

FINAL DESIGN

- RV LEG Components
 - 3D Printed Parts
 - Greatisan 12-V 20-rpm Gear Motor High Torque
 - Threaded Rods and Nuts
 - Limiter Switches
- Electrical Design Components
 - Memsic Accelerometer
 - Voltage Regulator LM317
 - Arduino Uno R3
 - QUNQI L298N Motor Drive Controller
 - Tattu R-Line 1300-mAh 14.8V Battery Pack

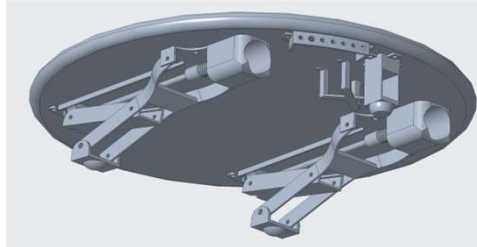


Figure 3. The SLT Assembly

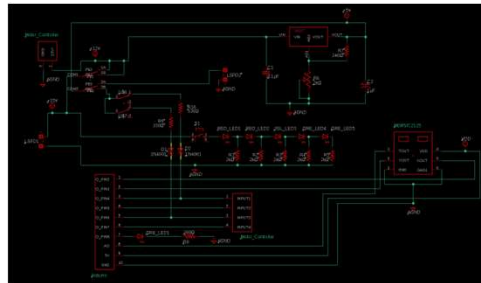


Figure 4. SLT Eagle Schematic

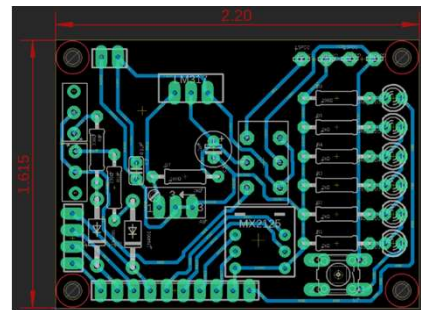


Figure 5. SLT Board

RESULTS

- The SLT is fully assembled
- The SLT can level an unlevel surface
- The SLT is operational at a small range of temperature around 70 °F

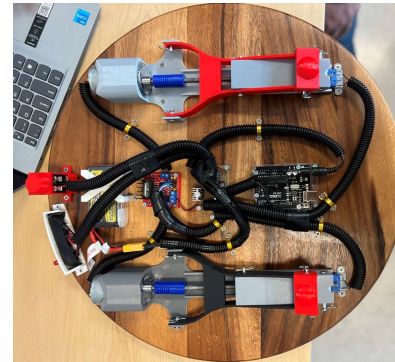


Figure 6. The Underside of the SLT



Figure 7. The SLT at Level



Figure 8. Battery Indicator

SUMMARY AND CONCLUSIONS

The SLT can level within a small range of temperatures. It meets all requirements. The prototype needs some exterior improvements and code modifications to be ready for mass production of the product.

FUTURE WORK

- Rework wiring between components to make it more organized.
- Improve connection between motor shaft and adapter.
- Model a housing for all the electrical components.
- Testing the SLT at different temperatures to update the code so that the Memsic Accelerometer can work at a wider range of temperatures.

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References

- <https://www.coraoutdoors.com/>
- <https://www.mouser.com/datasheet/2/321/28017-Memsic2Axis-v2.0-221244.pdf>