# Self-Balancing Arduino Robot

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## Abstract

Building a self-balancing robot gives us practice integrating robotics and engineering. Powered through an Arduino platform, our self-balancing autonomous robot idea was inspired by a *MAKE Magazine* called "*How to build a self-balancing autonomous Arduino robot*." Our self-balancing, inverted pendulum robot will be capable of autonomous navigation both indoors or out. We chose this project because of its real world applications. This type of robotics is useful for dangerous missions that include going on grounds those humans otherwise couldn't.


## Introduction / Objectives

For our project we are going to attempt rebuilding the Self Balancing Autonomous Arduino bot which was found in a *Make Magazine* article, "How to build a self-balancing Autonomous Arduino Bot" by Jason Short. Some of our objectives for this project include:

- Putting what we have learned so far form school into practice
- Attempting to build a robot
- Working with coding
- Getting hands-on experience with circuits
- Testing our abilities to build an autonomous robot.

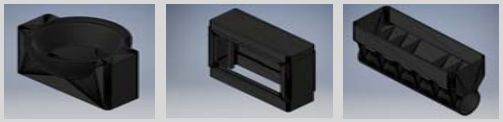
## Challenges

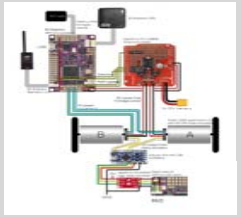
The project as a whole had many components and we quickly realized how difficult it was to build a robot from what seemed almost nothing. Through the building of the robot we came across many challenges:

- The amount of time it takes to receive online orders.
- The debugging the code we had originally assumed would easily compile.
- The lack of experience we had with circuit work including soldering.
- Problems with the telemetry and the controller originally purchased.

## Procedure

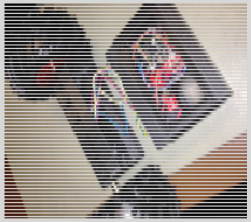
The 3-D printing:
The 3-D printing was the first part of the project. We were lucky enough to have the parts printed through the school. The dimensions were discussed and once the parts were printed, a lot of sanding was done to the parts so they would fit properly.





Circuits:
The circuit procedure required we pay attention to details; the circuiting process was done following the diagram shown to the left. On the right is an image of the same circuit work as the diagram. Another major part of the circuit work included soldering, building and connecting everything together, which required a lot of work.

Stage One:
The first stage where the robot really began coming together was when we were able to start trying to fit things inside, luckily, everything was able to fit inside as predicted.

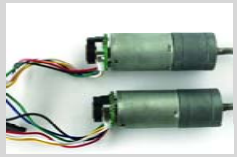


Stage Two:
The second stage consisted of gluing things together and this is where we started adding holes of the telemetry antenna and such

Stage Three:
The third stage of the robot mainly focused in getting the robot to turn on and working on making it function.

## Materials

- Ardupilot,3D Rbotics APM 2.5
- Telemetry radios, #DR Radio 915MHz
- GPS Module, 3DR uBlox GPS with compass
- Two Gearmotors 34:1 with 48 CPR rotary encoder
- Two Wheels
- Arduino pro Mini 328 minicontroller board, 5V/16MHz
- Ardumoto motor driver shield
- Level translator breakout Board
- R/C receiver
- R/C transmitter
- Battery, LiPo, 3s 11.1V
- Power leads, power switch, and battery connector
- Foam core board $\frac{1}{4}$" x 3" x 5"
- Acrylic sheet, clear, 1/8"thick, about 3"x5"
- Plastic tree ornament



## Conclusion

In conclusion, the project was a lot more work than expected, and the fact that the parts were obtained through online purchases time was a huge obstacle. If done again, time management would be the first thing to look out for. It was really an eye opening experience for all of us, and gave us a perspective into what it takes to be working on a project on our own…. but in the end the product was satisfying and it was a truly rewarding experience.

## Budget

According to the *Make Magazine* article, the budget for the project was estimated to be in the range of $400-$500. As a team, we discussed how we could lower the budget, if at all possible. As shown on the chart to the right, we were able to reduce the budget to $366.27, which was under the estimated budget according to the article, but still over our personal planned budget.

| Budget List | |
|---|---|
| Part | Price ($) |
| FrSky Receiver | 24.99 |
| Wheels (pair) | 14.95 |
| 34:1 Motor x2 | 69.9 |
| APM 2.6 | 79.6 |
| Motor Shield Kit | 29.95 |
| Translator - PCA9306 | 6.95 |
| Arduino Pro Mini | 9.95 |
| FrSky 6ch Transmitter | 47.6 |
| 18G Copper Wire | 5.98 |
| 11.1V Lipo Adapter | 12.99 |
| Bullet Connectors (6pc) | 6.99 |
| Jumper Wires (120pc) | 6.99 |
| 2700mAh Lipo Battery | 23.95 |
| Plastic Dome | 5.49 |
| USB to 5V Cable | 19.99 |
| **Total** | **366.27** |

## Acknowledgements

- Vince Bertsch for opening several resources for which otherwise we would not have been able to get as far as we did.
- Daniel Milspaugh for being so much help with the putting together of the robot itself, from help with soldering, to help with the coding and circuit work.
- Todd Amos for his patience and helping us out with the 3-D printing.
- Omar Fajardo for helping with coding.
- Article used to conduct project (Work Cited):

Short, Jason, and Nicole Smith. "How to Build a Self-Balancing Autonomous Arduino Bot | Make:." *Make: DIY Projects and Ideas for Makers*. Make: Projects, 03 June 2015. Web. 05 May 2017.

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- Darci Rosales – project coordinator.