

# Intake Alignment Device

## Final Presentation

Team 3:

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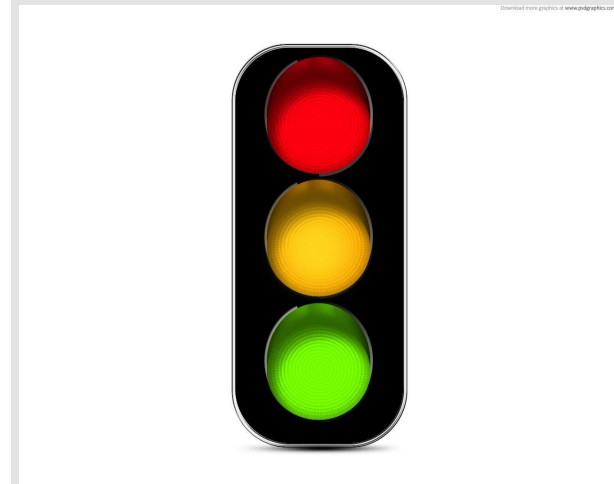
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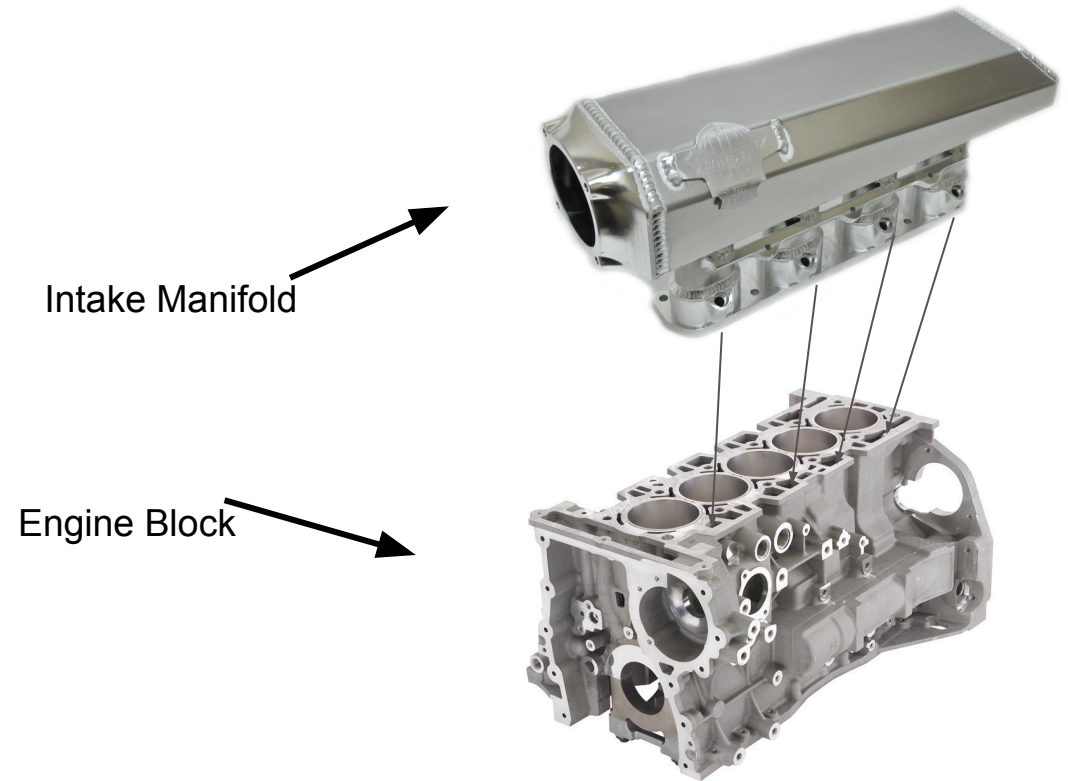


# The Problem

- Engine and intake manifold are torn down after each run
- 20 minutes to rebuild engine
- The engine block and intake manifold need to be flush together and parallel

# The Problem

- While installing the intake manifold it can distort and not be parallel to the engine block
- These distortions will cause the intake to not seal properly against the engine



2004 Vortec 3500 15  
Engine Block Assembly

# Safety



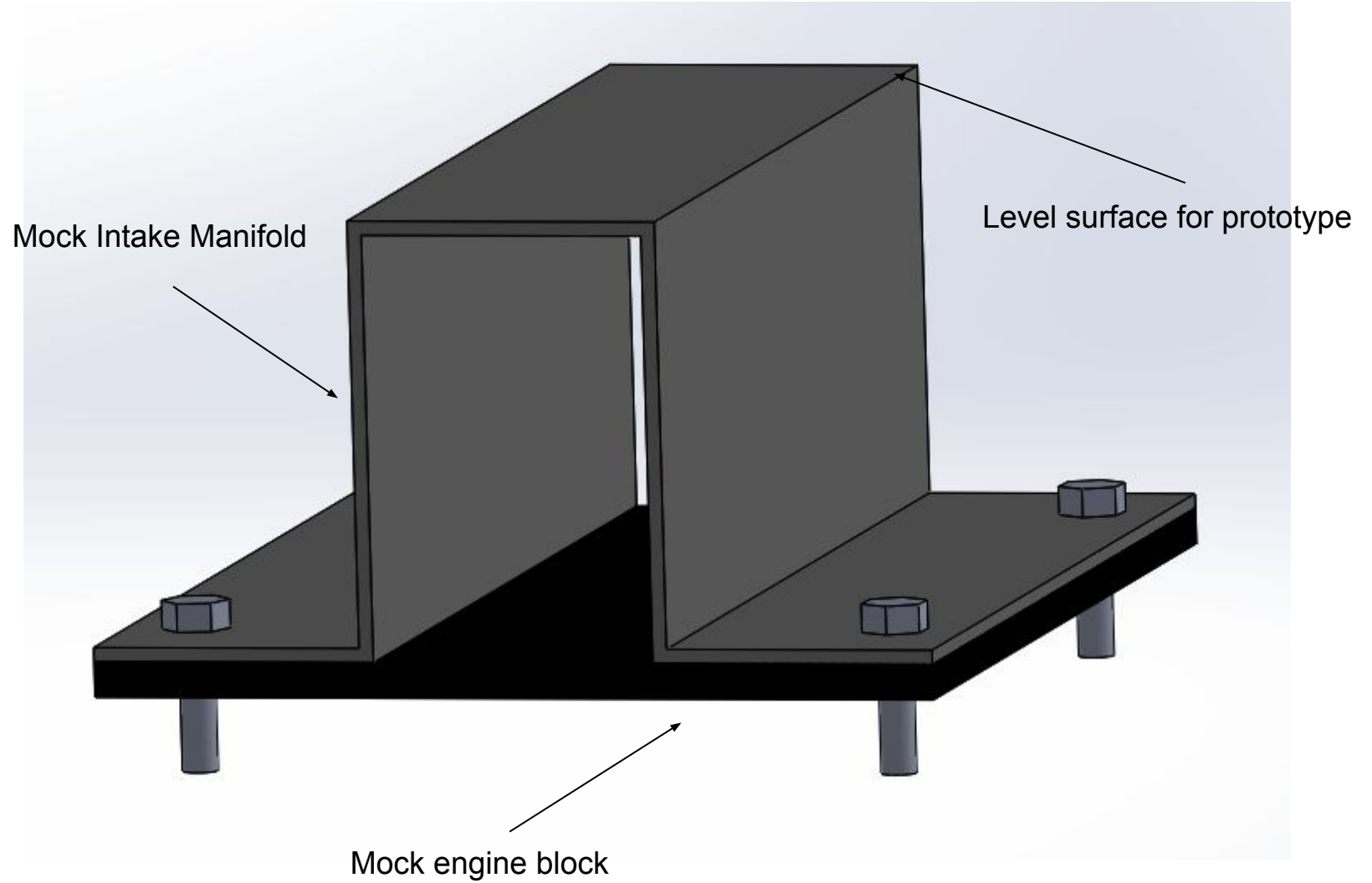
# Objective

- Design a device that is:
  - Fast
  - Accurate
  - Self contained
  - Simple to use

# Mock Engine Design

- To mimic a engine a mock engine was created
- Basic scenario to show proof of concept
- Has elevated intake manifold and flat engine block
- Simple 4 bolt design was implemented

# Mock Test Engine Block and Intake Manifold

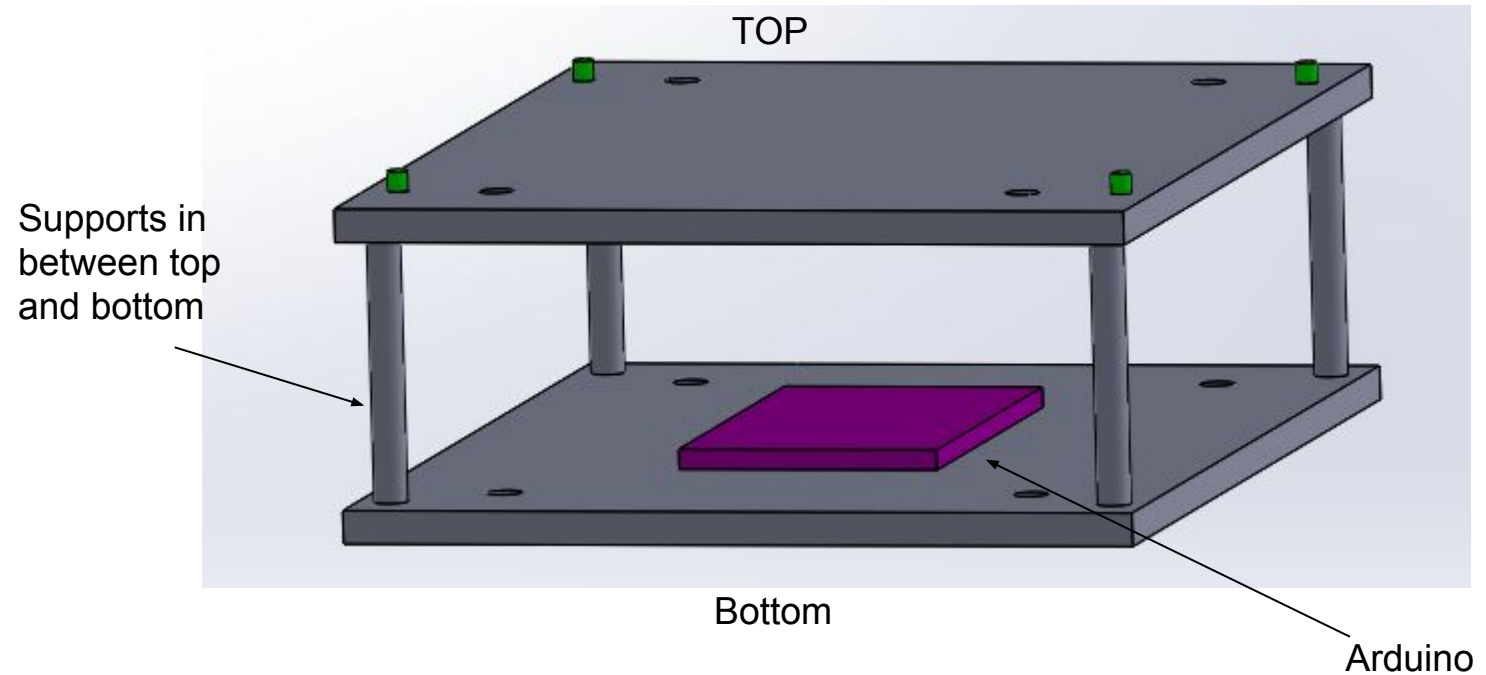


# Prototype Leveling Device

- Must be a durable housing for the arduino and wires to be protected
- Has to be non pliable so the indicator shafts stay straight
- Must show operator easily which bolt needs to be tightened

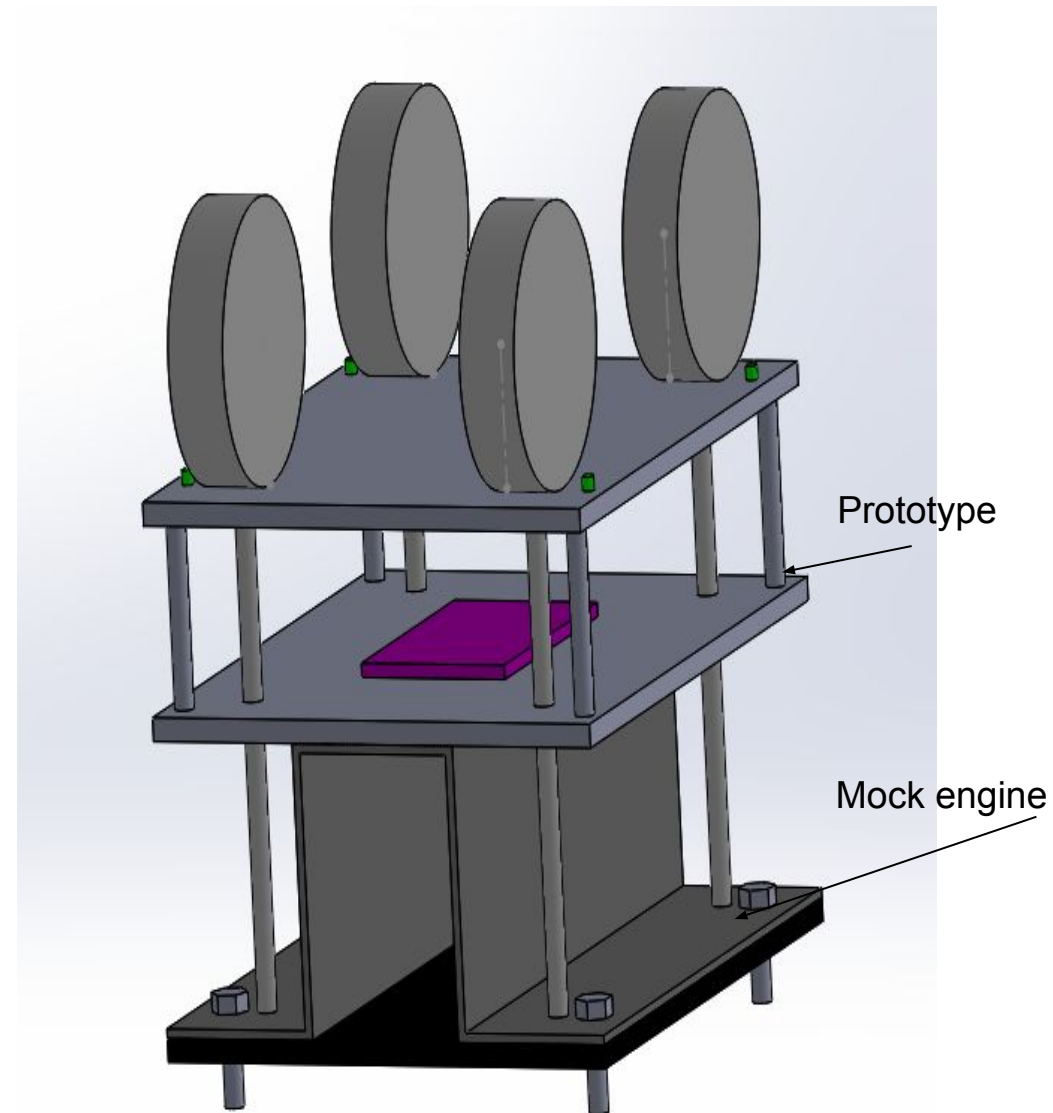


# Prototype Platform and Housing



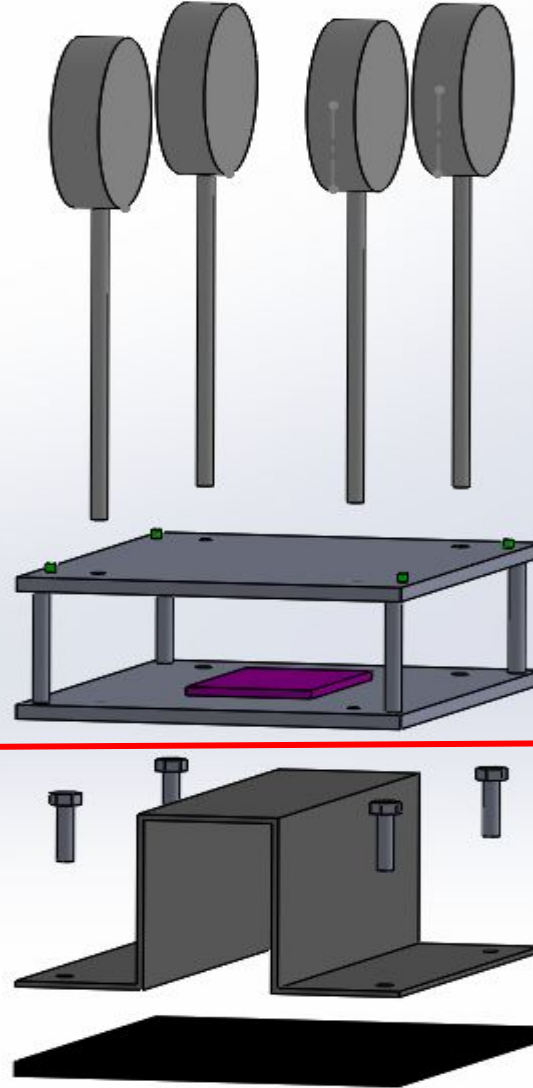
- Housing consists of top and bottom with supports to insure durable build with no warping of both plates

# 3D Model of Both Prototype and



- Prototype sitting on top of Mock engine.
- Indicator shafts rest next to each bolt

# Exploded View



- Exploded view of mock engine and prototype

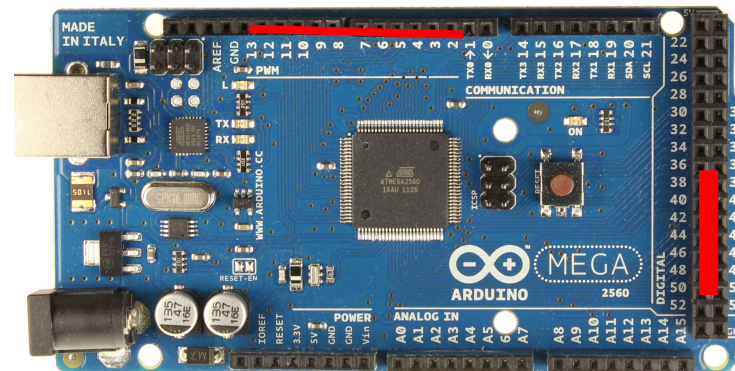
# Logic System of The Prototype

- There are three main components that consist of the logic portion of the prototype that are in charge of the processing and thinking of the prototype



Digital Indicator (input)

2 - 13



Arduino (Processing)

48, 50  
44, 46  
40, 42  
46, 47  
36, 38



RGB LED (Output)

# First Indicators Used



Digital Indicator (input)

- Igaging indicator
- Didn't output voltage to Arduino Board

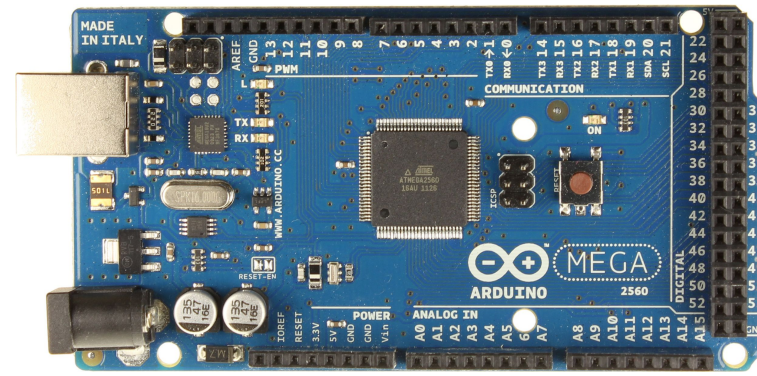
# Final Indicators Used



Digital Indicator (input)

- Pittsburgh
- Accurate to 0.0005". 10x more accurate than 0.005" constraint
- Allows the power, ground, data, and clock pins to be accessed

# Arduino Board



Arduino (Processing)

- The Arduino is the processing mechanism for the prototype
- Arduino Mega is used because it has more digital pins than other models but is still small enough.
- Reads input from the indicators and outputs to the LEDs

# RGB LEDs



RGB LED (Output)

- Prototype uses 4 RGB LEDs
- LEDs are the output of for the prototype that gets its signal from the Arduino



# Switches



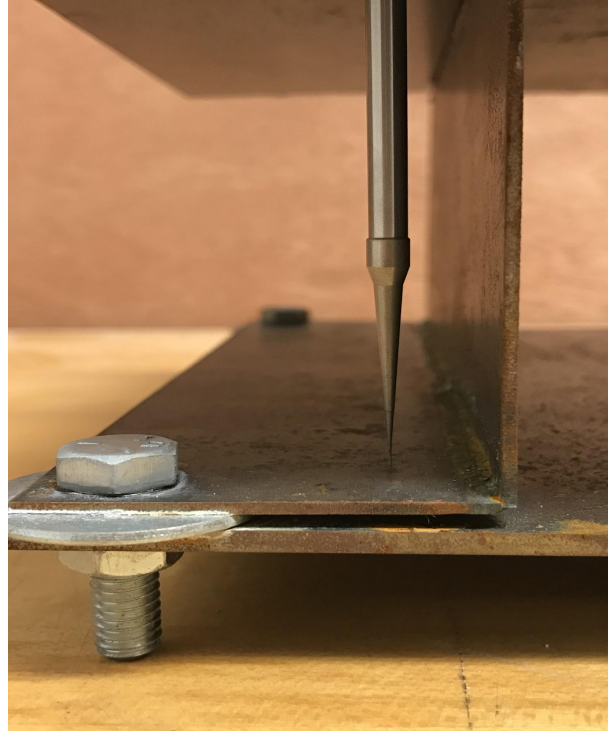
- Momentary zero switch for all indicators to zero at once.



- On/OFF switch for the power for the Arduino Board. Board receives 9V outputs 3.3V and 5V

# Mimicking Different Distances

Lower



Higher



- Prototype reads different distances that the indicators are measuring and outputs to LEDs

# Unparalleled Simulation






- Flush between engine block and intake manifold



- Washers added to simulate engine block and intake manifold are not parallel

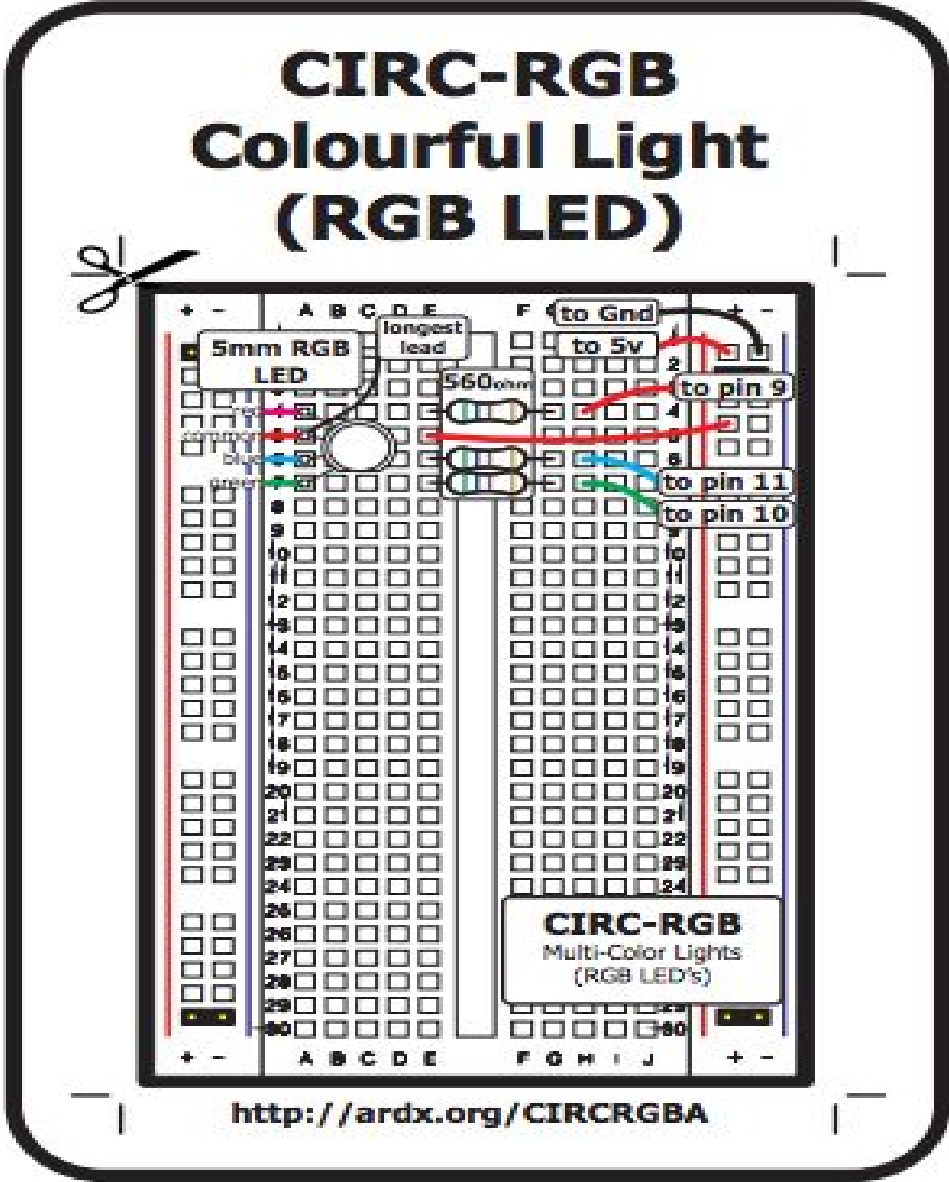
# LED indicator

Insert image of led legend

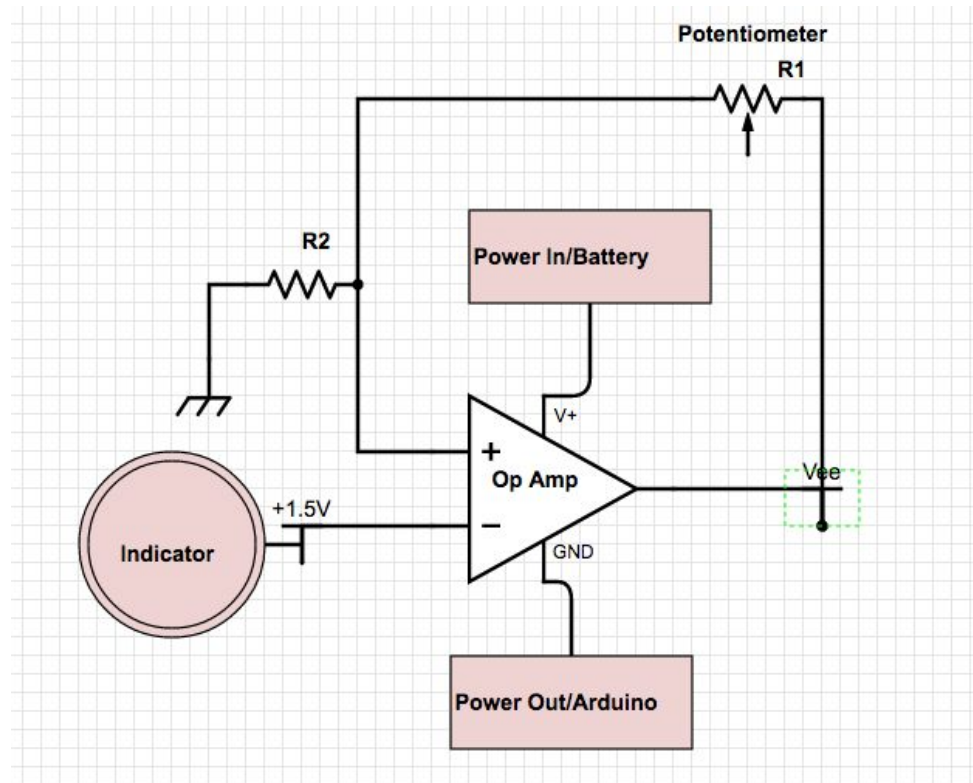
- Green light – Tighten 
- Blue light – Continue to tighten with caution 
- Red light – Stop 

# LED Circuit

- Circuit setup for RGB LEDs
- 5k resistors to decrease voltage
- 4 LEDs

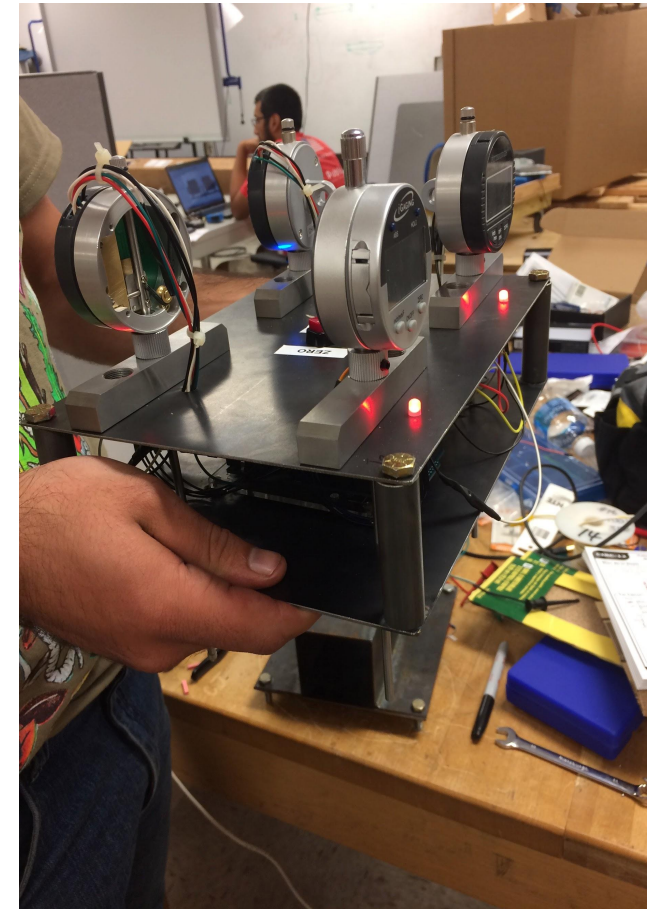
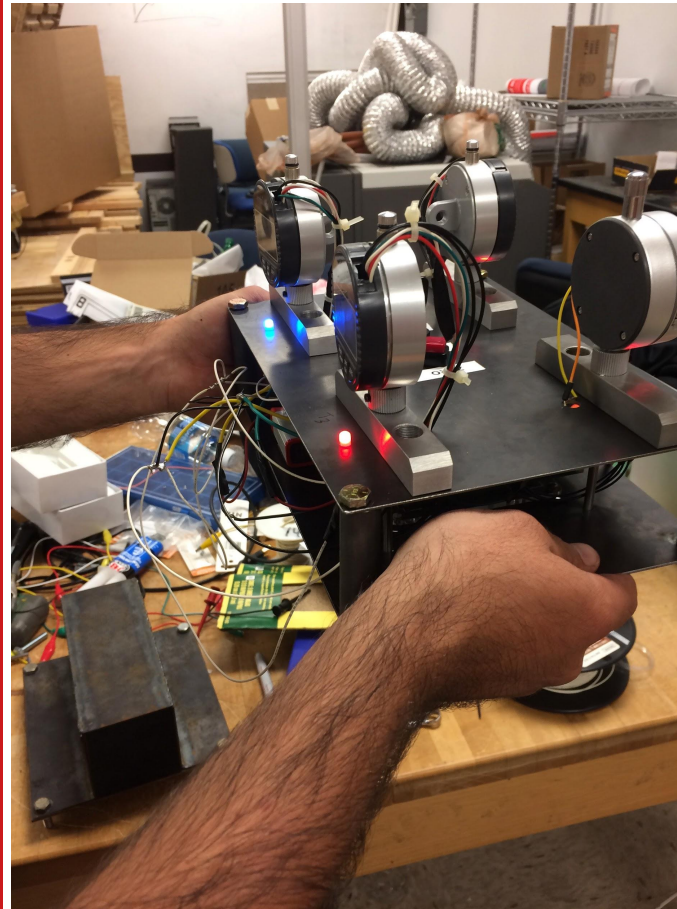


# Electrical Circuit



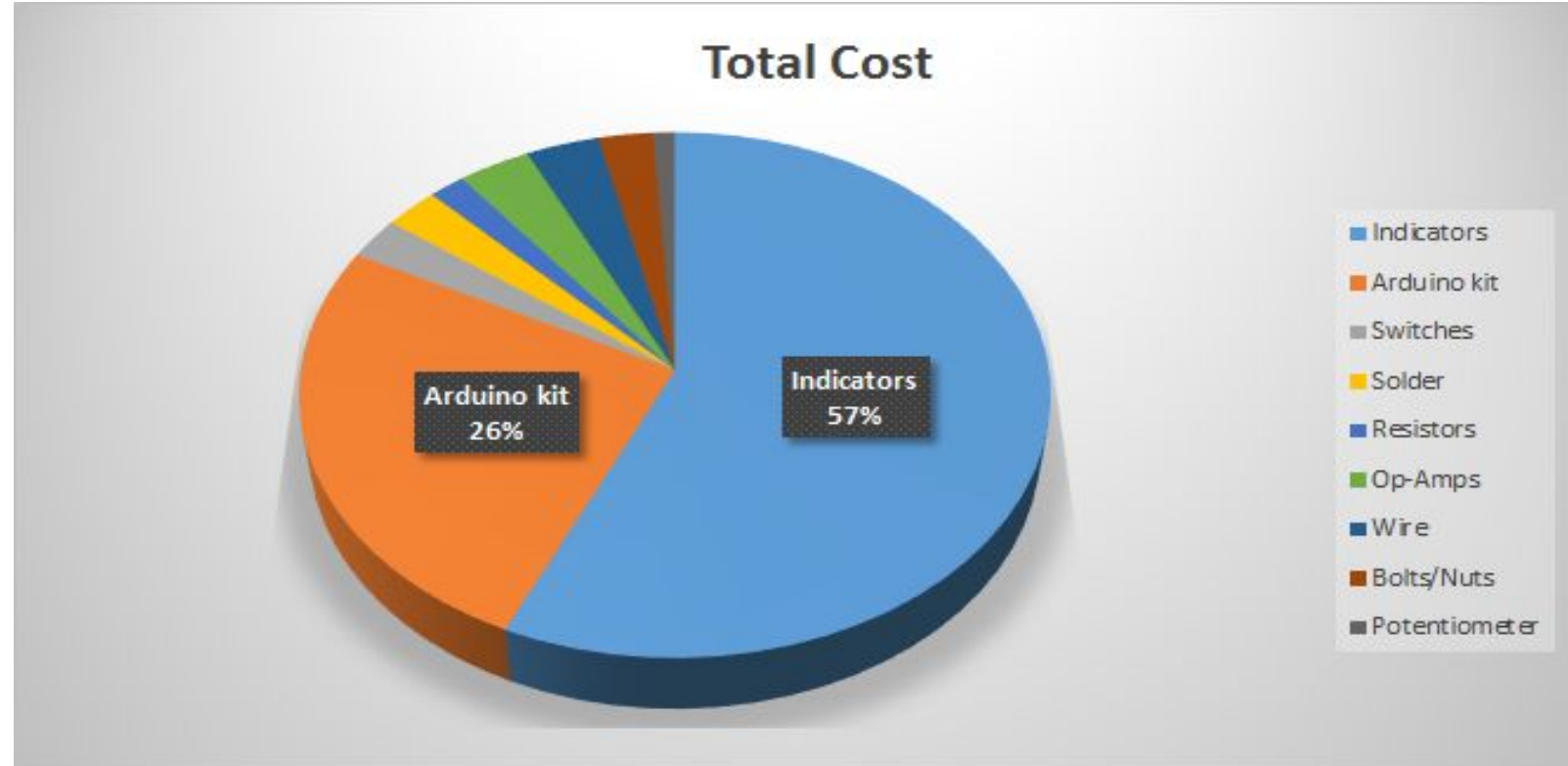
- Circuit used to so the indicators are not overclocked and so the arduino can read the data and clock pins from the indicators

# Final prototype



- Built prototype with RGB LEDs lit

# Picture of Final Prototype

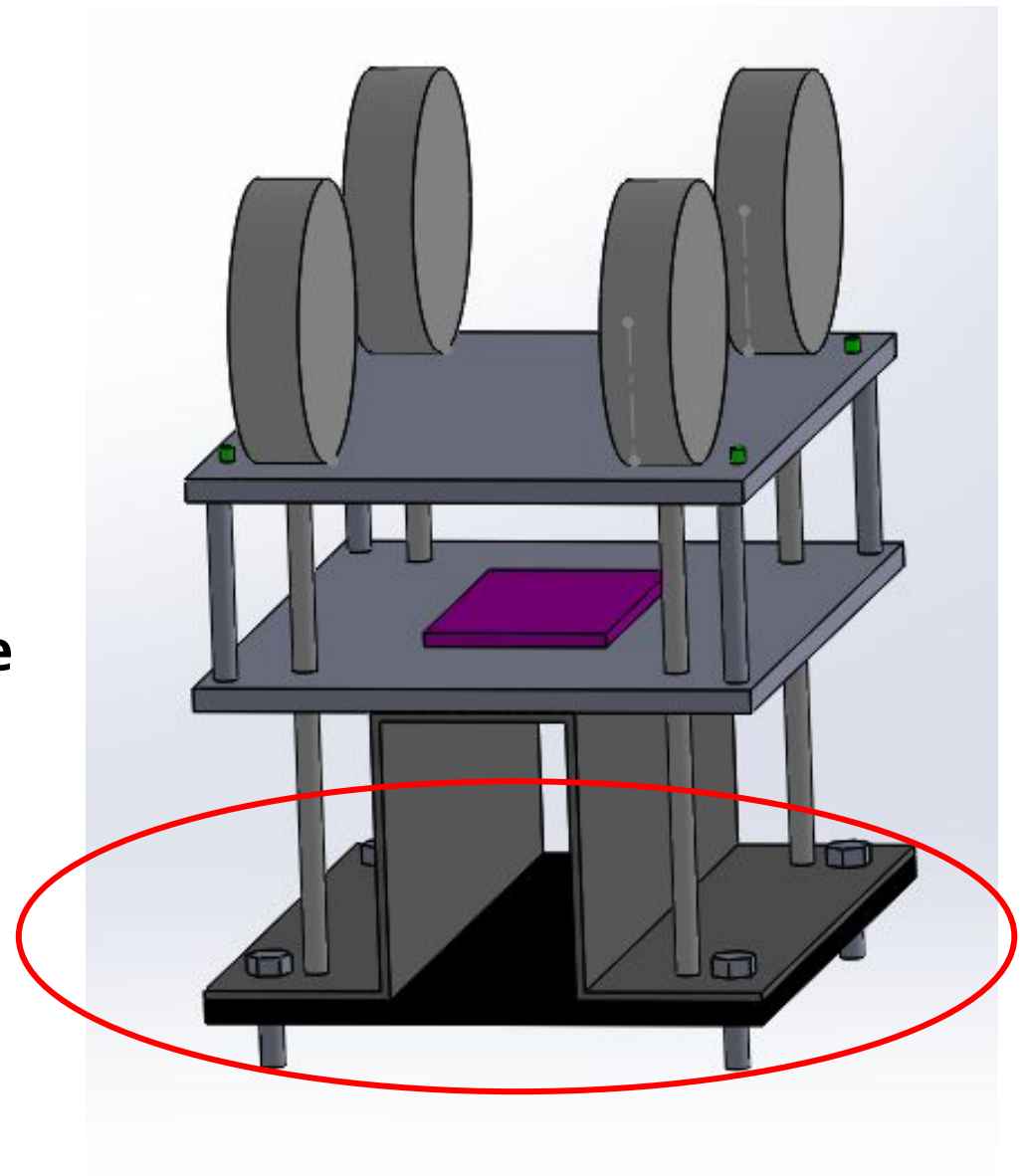


- Pie chart shows that the Indicators and the Arduino account for the majority of the cost. These are the main components that ensure that the intake manifold and the engine block are parallel and flush



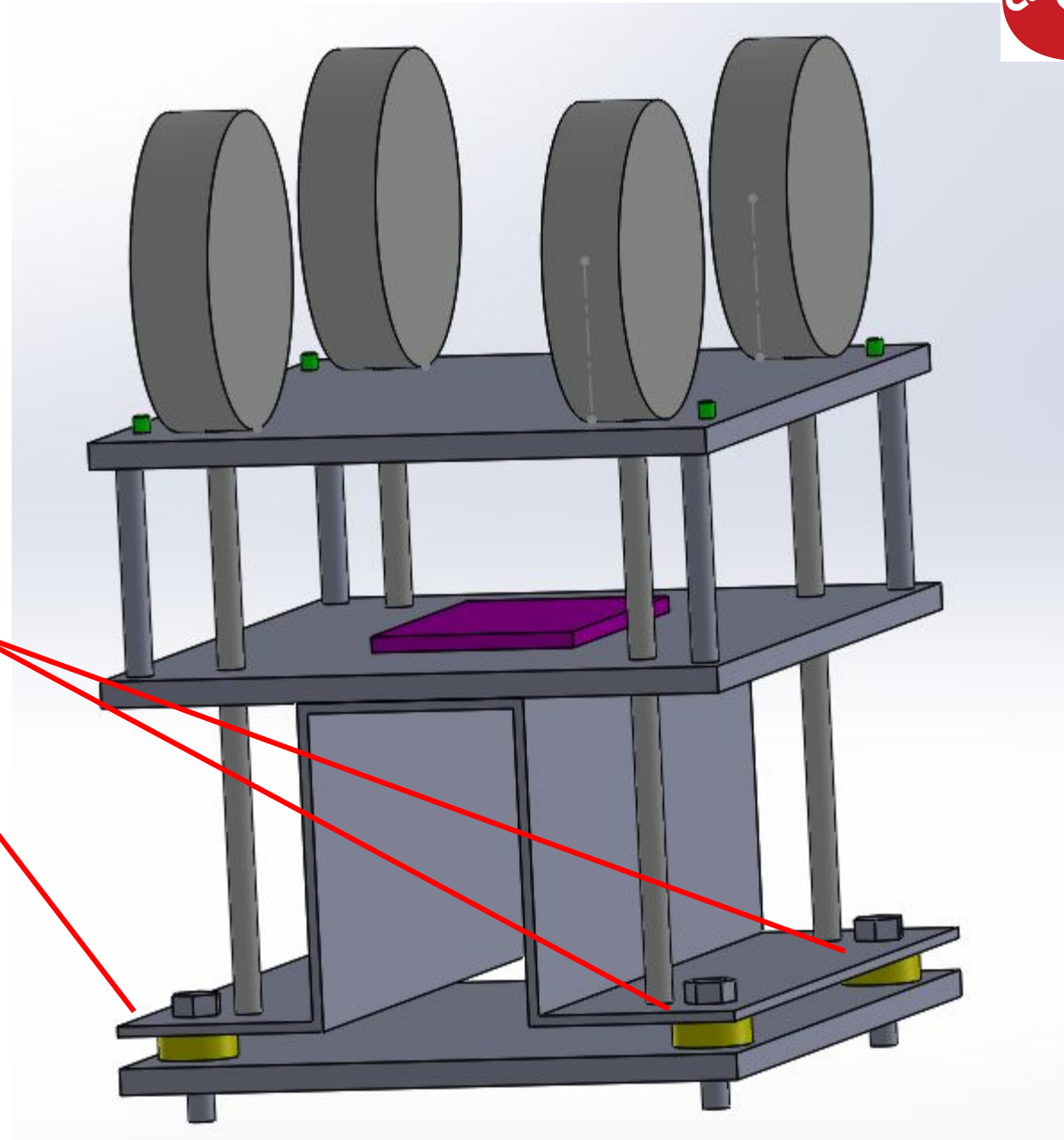
Procedure to  
Use  
prototype:  
Step 1

**Zero on flat surface**



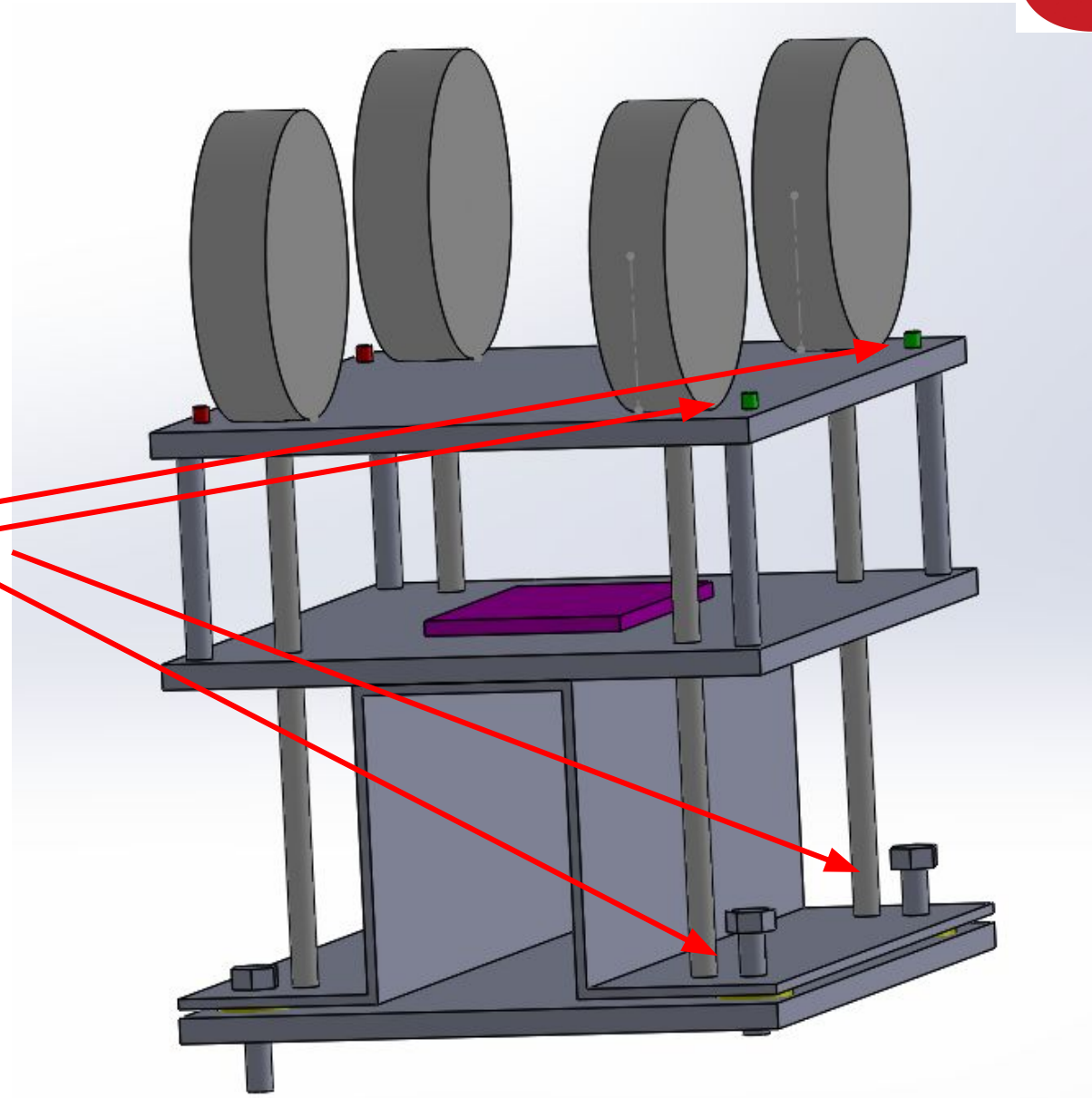
Procedure to  
Use  
prototype:  
Step 2

Insert washers,  
uneven surface



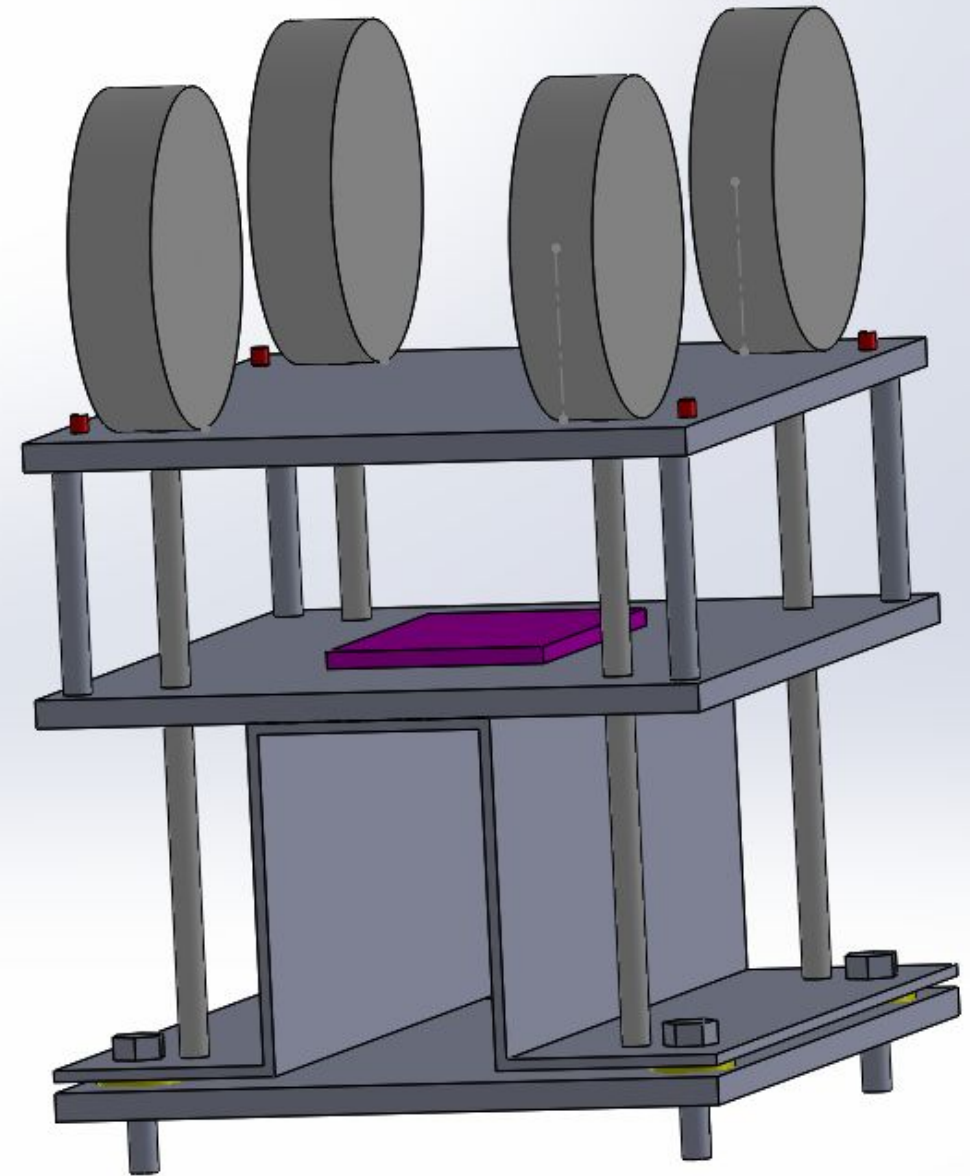
Procedure to  
Use  
prototype:  
Step 3

Tighten  
screws, LED  
lights change



Procedure to  
Use  
prototype:  
Step 4


**All screws tight  
and even with  
each other,  
finished**



# Current Issues With Prototype

- Proof of concept for the design works for one indicator.
- When more than one indicator is running on the code an input voltage occurs that inhibits the program from running
- All LEDs run, but are based off of one indicator

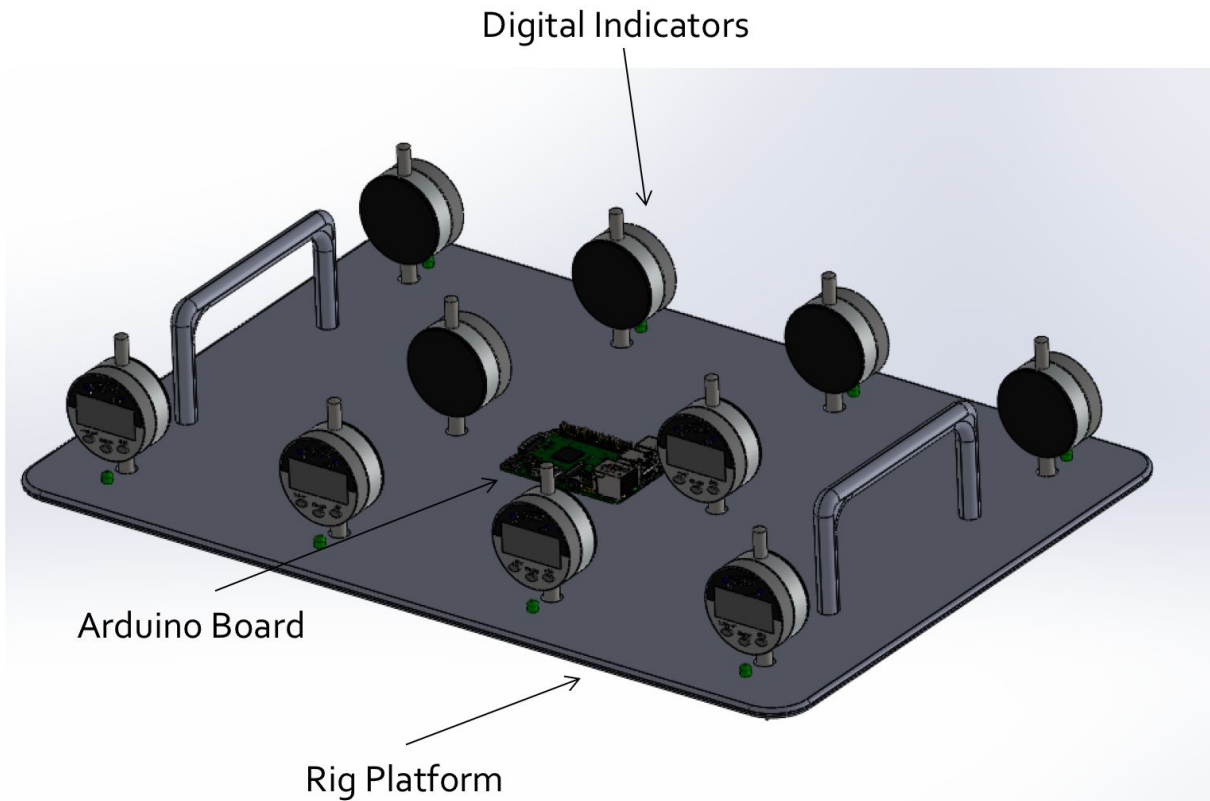
# Program

- Set all indicators as input to board, LED lights to output
  - One indicator to one LED
  - Arduino uses continuous loop
    - (indicator 1 to LED 1)
    - (indicator 2 to LED 2)
    - (indicator 3 to LED 3)
    - (indicator 4 to LED 4)
- 

# Future: Improvement

- How to adapt the prototype to accommodate the actual engine
  - Get actual engine
  - Increase number of indicators
  - Modify current code to accommodate more indicators

# Design for Actual NHRA Engine



- Actual NHRA engine has 10 bolts
- Created prototype can be converted to match NHRA engine



# Summary

- Design a device to make intake manifold and engine block parallel and flush to each other
- Built mock engine and prototype to accommodate
- Mock engine has four bolts and indicators to show proof of concept
- 6 step procedure to use it

# References

- <https://cdn.instructables.com/F6g/6HVE/GAPURZIR/F6g6HVEGAPURZIR.MEDIUM.jpg>
- <https://motorsportsnewswire.files.wordpress.com/2016/02/top-fuel-antron-brown-2015.jpg>
- <http://st.hotrod.com/uploads/sites/21/2016/05/22-rad-hemi-head-install.JPG.jpg>
- <http://roa.h-cdn.co/assets/16/18/640x320/gallery-1462225567-drag-race-explosion.gif>
- [http://www.makingstuff.info/Projects/Digital\\_Calipers](http://www.makingstuff.info/Projects/Digital_Calipers)
- <http://www.instructables.com/id/Reading-Digital-Callipers-with-a-n-Arduino-USB/>

Questions?