Digital Spring Tester

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ECET 491 Senior Design II
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Purpose

- The primary purpose of the digital spring tester is to accurately test spring rate for suspension springs in an efficient and organized manner, while still being an affordable piece of equipment for the typical racecar consumer.

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Background

- Dave has been racing for 10 years
- Expensive
- Checking Springs before and after every race
- Staying consistent keeps your car at top performance and helps it run smoother and more efficiently

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Incentive

- Maintain consistent chassis setup.
- Affordability
- Performing at peak capabilities on various tracks and at top performance levels

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Deliverables

- Prototype
- Presentation
- Report

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Product

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System

- 3000lb Hydraulic bottle jack
- 3000lb Analog load cell
- Analog to digital converter chip
- Digital LCD display screen.

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System

- Does not include Automatic operation.
- Not able to test springs over 3000 lbs.
- Not able to test non-coil springs (leaf springs).

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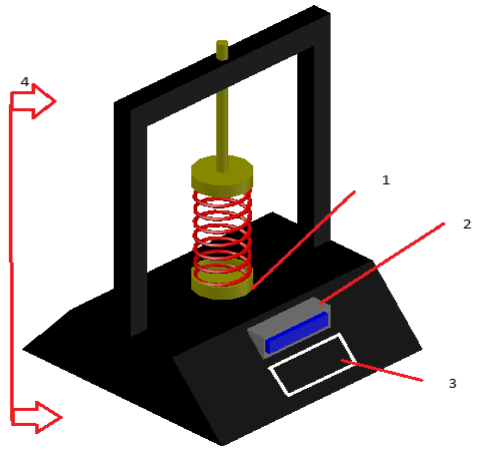
AutoCAD Sketch



1. Load Cell and Hydraulic bottle jack are enclosed in the outer housing which is attached by screws for easy replacement and stability

2. LCD Display screen Implemented Custom

3. Keypad complete with scrolling arrows, numbers, Start/Stop buttons.

4. Project Stands about 3 feet high in a reinforced steel frame

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Prototype

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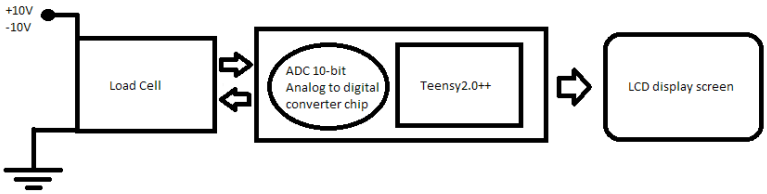
Flow Diagram



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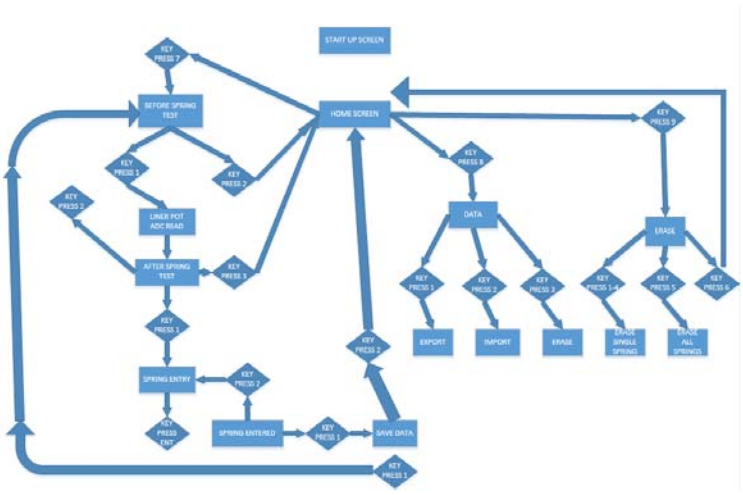
State Machine Flow Chart



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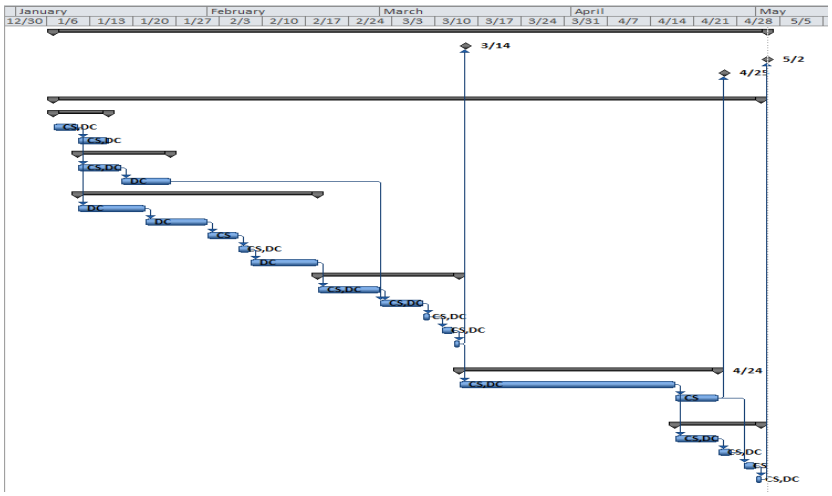
Schedule



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Responsibilities

Task (hours)	Chris	David
Framework, Diagrams, Measurements	24	24
Software Flow Diagrams	3	3
Complete Schematic Design	24	24
PCB Design	30	30
Complete Coding	30	70
Assemble Framework	2.5	2.5
Assemble Electronics	6	6
Program Electronics	1	1
Finalize Prototype	5	5
Testing Prototype	1.5	1.5
Report	20	10
Presentation	16	16
Demonstration	0.5	0.5
Total	163.5	193.5

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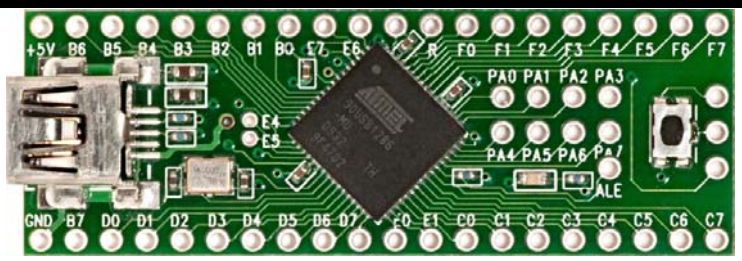
Teensy++2.0



- Actual Size 2.0 by 0.7 inch
- Microcontroller
- I/O – 46 (8 Analog In 10 bit ADC)
- Single Pushbutton Programming

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Load Cell Specs

- Load cell tested @ 3.0087 mV/V
- 0.012003 mV/lb
- Our particular load cell zero is plus or minus 0.29%
- Plus/minus 10 volts
- Pressure to both ends for accurate reading

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Keypad Specs

- 700 series, 16-key Gray colored IP67
- Custom keys
- Large and easy to see
- Stability
- Prevents dust and water

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Keypad

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Battery

- 7.2 Volt RC Rechargeable Battery
- Amperes restrictions of a 9 volt battery
- Looked into camera batteries

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Battery

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Why LCD Display?

- Battery-powered equipment
- Easy interface with Microprocessor
- LED back-light

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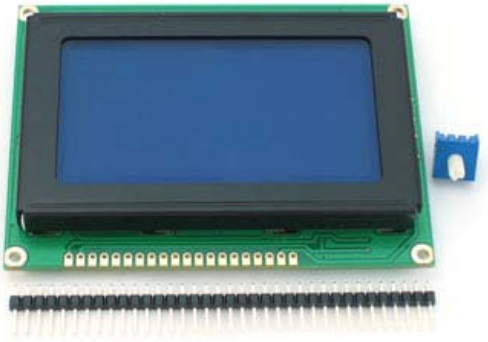
LCD Screen



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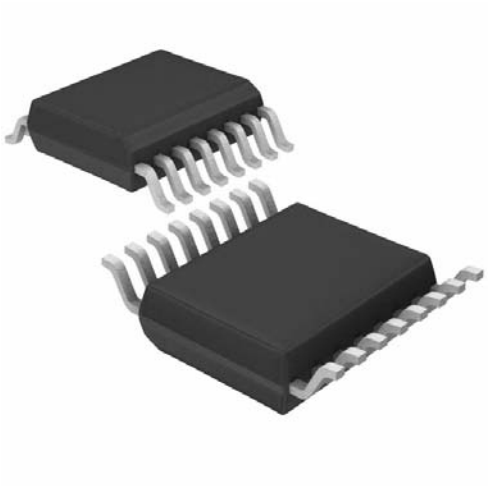
24 – BIT ADC



- Very accurate Analog to Digital Conversion even at low voltage

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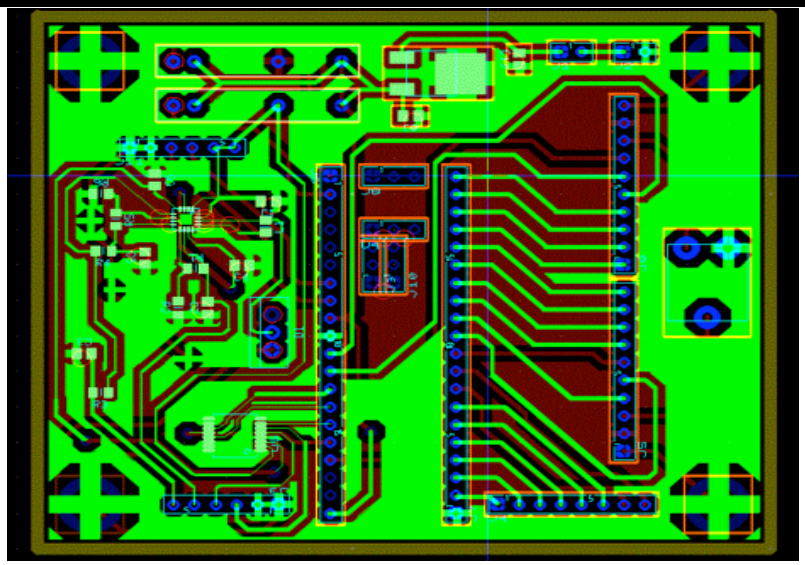
Ultiboard Design



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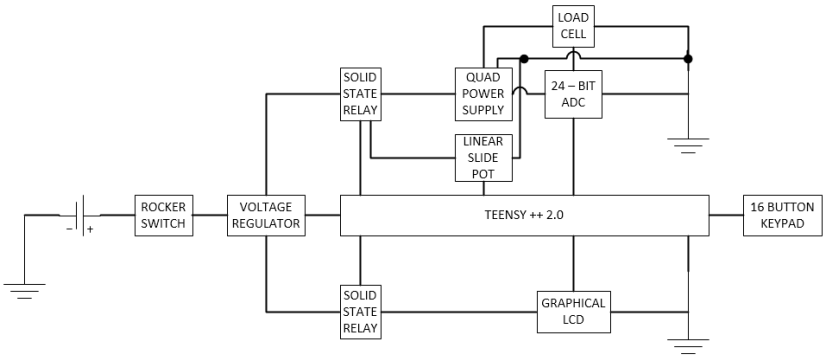
System Function Modeling



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System operation

- Turn Power button
- Insert Spring
- Compress Spring
- Measurement taken
- Information is either stored or exported

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Cost

Materials	$
Linear Pot	4.00
LCD Display 4.5 Digit	25.00
Keypad	45.00
Voltage Regulator	1.00
Chip	24.00
Resistors	5.00
Caps	5.00
Frame	10.00
Hydraulic	20.00
Finish Skinning	15.00
Load Cell	50.00
Misc. Bolts	25.00
Spring holder plates and bolts	20.00
Connectors	20.00
Power Adapter	2.00
Total Cost	300.00

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Primary Technical Risk

- Coding errors that still make the device work, but make it inaccurate.
- Solution: Avoid

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Primary Schedule Risk

- Conflicting Schedules
- Work
- Illness
- Injury
- Solution: Avoid

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Primary Cost Risk

- If parts are ruined during assembly or during shipment.
- Solution: Avoid

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Lessons Learned

- Microsoft Project
- Plan projects
- Pre-determine risks
- Technical writing techniques
- Organization
- Record Data and events
- One step at a time
- Expect the unexpected

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Questions?

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