Plasticity Modeling Team F6

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Project description

-Description of the project:

Demonstrate plasticity modeling.

- Who is sponsoring the project?

1. The Mechanical Engineering Department.

2. Dr. Feigenbaum

- Why is it important?

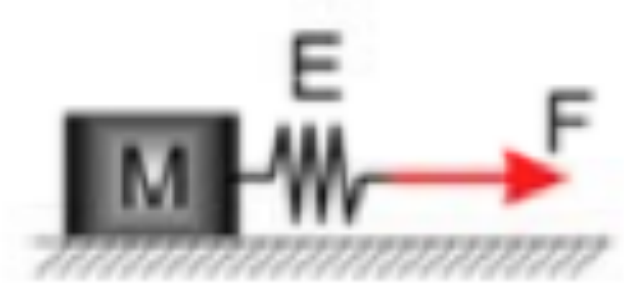
Graduate level design class.

Background

- Plastic limit.
- Desktop sized.
- Frictional force.
- Free springs considered.
- Graphs. Force vs. Displacement.

Benchmarking

- Elastic Spring.
- Block resist moving.
- Yield strength.
- Do not require a lot of strength.



Design Requirements

1. Easy to carry.
2. Easy to store.
3. Able to generate graphs.
4. Able to be seen by 20 students.
5. Works in an xy-plane.
6. System must be around 40 lbs.
7. Works in both tension and compression.
8. Have a friction coefficient to the surface.
9. Easy to add and remove springs on demand.
10. Durable.

Customer Requirements

1. Desktop sized system, small to store in an office.
2. Large to be seen in the classroom of 20 students.
3. System will control by user.
4. System must work in both tension and compression.
5. User can change the direction of force at any point during loading, within the xy-plane.
6. Surface must have a friction coefficient.
7. Generate Force vs Displacement graphs.
8. Module built.

Engineering Requirements

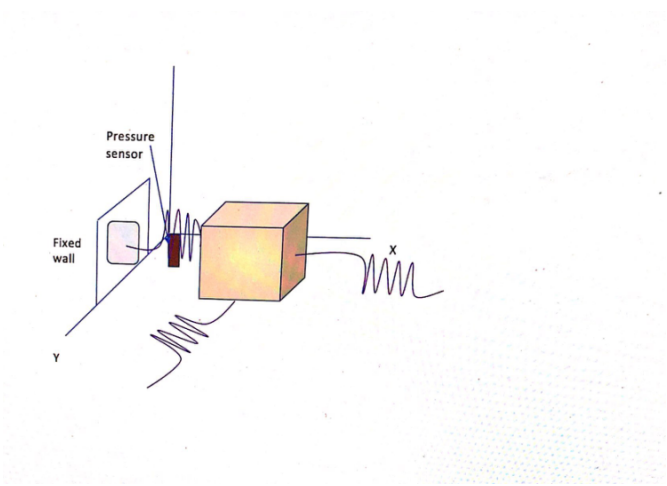
Engineering Requirements	Tolerance Values
Spring Expansions	1 feet
Elasticity	3 feet
Pushing/Pulling Force	10 N
Frictional Factors	1
Weight of system	18 Kg
Length of Sliding Area	1 m
Wireless Control distance	5 m
Weight of Sliding Box	2 Kg
X Y direction displacement	1 m
Durability	2 years
Reliability	Maximum to all the targeted values

House of Quality

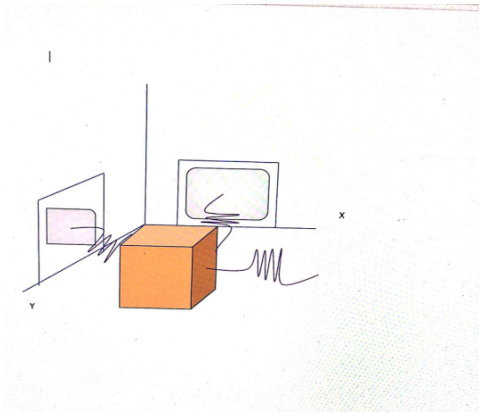
Customer Requirement	Weight	Engineering Requirement	Compat Design	Weight of system	Frictional Factor	Motion/Force sensor	Length of Sliding Area	Wireless Control distance	X & Y Displacement.	Elasticity	Pushing/Pulling Force	Build Box - material?	Spring Expansions	Durability	Reliability	Weight of Sliding Box
1. Easy to be stored in an office	10		9	3				1				9			3	9
2. Visable from a distance	4		1					1		3		9				9
3. Desktop sized	8		9	3								3		3	3	3
4. Various types of spring	1						3	3	3				9			
5. Portable	9		3	9								3			3	3
6. Easy to carry	6		3	9				1				3			1	3
7. Generate different types of graphs	7					9				9	9				9	
8. Module built	3				3		9	9	9	3		1	9	9		1
9. x&y displacment	5					9	9	9	9	3	3		3			
10. Friction surface	2				9									3		
Absolute Technical Importance (ATI)			211	189	27	108	75	95	75	99	78	198	51	93	150	198
Relative Technical Importance (RTI)			1	3	12	5	10	7	10	6	9	2	11	8	4	2
Target ER values			25"x25"	40 lbs	any -1	1	1m	5m	1m	3ft	10N	4"x4"	1 ft	2 yrs	max	8 lbs

Designs considered

Here are the options of two designs that our client expected to see from us in ME486C



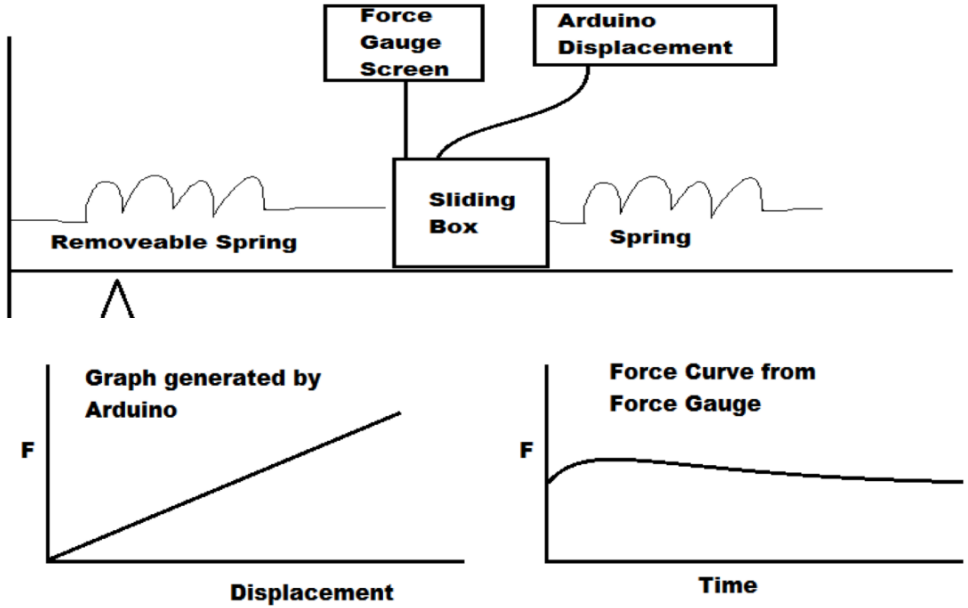
Design 1



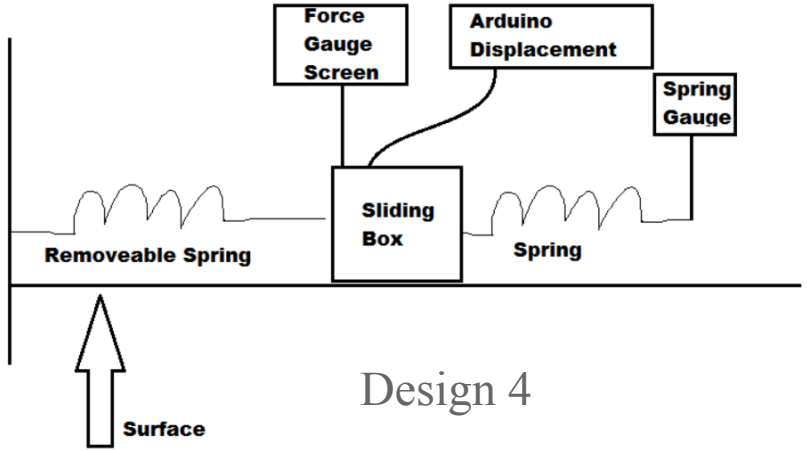
Design 2

Cont. designs considered

Those are the ideas that we came up with as a team:



Design 3



Design 4

Continue design considered

List of the advantages and disadvantages for the 3 & 4 designs system.

Design 3:

Advantages

1. Force curve is available so force will monitor continually and it can vary eventually
2. Removable spring can make it easy to adjust and slide over the surface.
3. Spring elasticity will not affect the elasticity of material

Disadvantages

1. Force .vs. displacement curve will form by the system which makes the system slower
2. Will not be portable

Design 4:

Advantages

1. Displacement and force curves will monitor through the gauges.
2. Easy to understand the material behavior from the live gauge results.
3. Portable system

Disadvantages

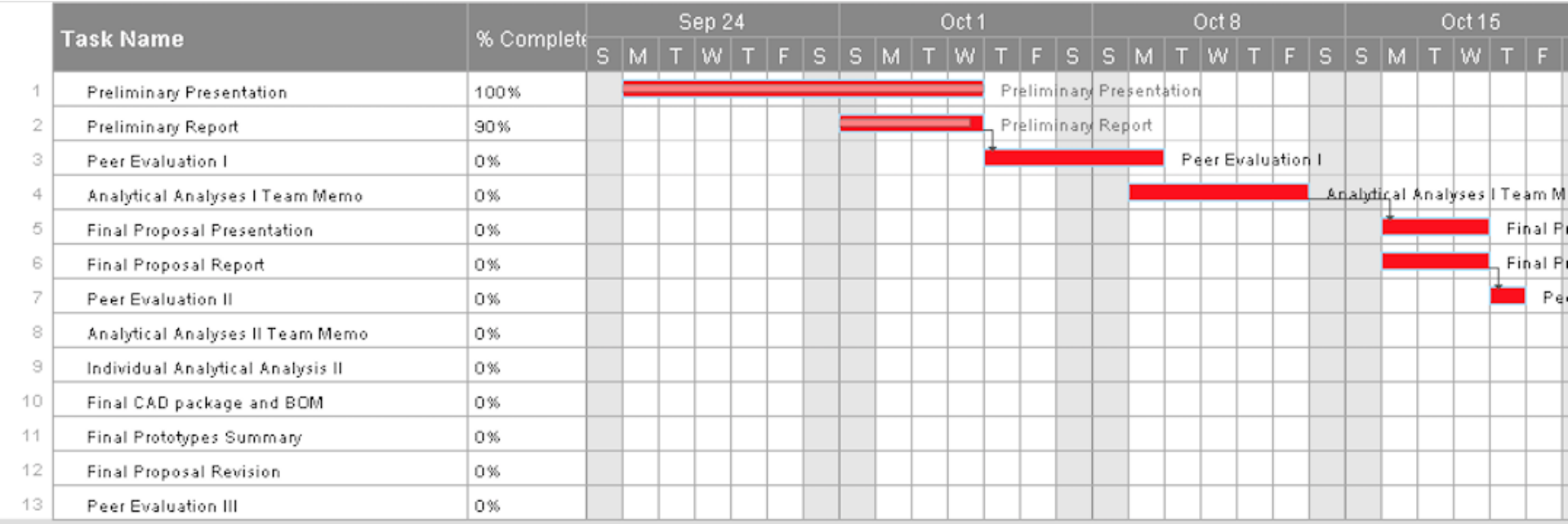
1. Interlink of force gauge and spring gauge to form the force vs. displacement is difficult.

Schedule

4th of October – 5th of November

- Finish up Preliminary Report.
- Verify design selected.
- Analytic Analysis – Team Memo
- Final Presentation and Report.

Schedule



	Task Name	% Complete
1	Preliminary Presentation	100%
2	Preliminary Report	90%
3	Peer Evaluation I	0%
4	Analytical Analyses I Team Memo	0%
5	Final Proposal Presentation	0%
6	Final Proposal Report	0%
7	Peer Evaluation II	0%
8	Analytical Analyses II Team Memo	0%
9	Individual Analytical Analysis II	0%
10	Final CAD package and BOM	0%
11	Final Prototypes Summary	0%
12	Final Proposal Revision	0%
13	Peer Evaluation III	0%

Budgeting

- Team proposed budget.
- Based on the final design chosen by the client.
- Range between $500 - $2000.

Materials used in the design	Approximation costs
Plastic box	50-150
Arduino	27.95-350
Sensors (BMP180) &(LM393)	6.99-35.99 & 5.34-22.90
Springs	3.60-12.07

References

https://nau.edu/cefns/engineering/mechanical/faculty-staff/directory/heidi-feigenbaum/ [Accessed 4 Oct. 2017].

Anon, (2017). [online] Available at: http://R. Hill, Mathematical Theory of Plasticity, Oxford University Press, 1950. [Accessed 4 Oct. 2017].

Questions

Thanks for listening