SAE Mini Baja - Drivetrain

Concept Generation and Selection

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Overview

- Introduction
- Design Concepts
  - Manual Transmissions
  - Direct Drive and Automatic Transmission
  - Continuous Variable Transmissions
- Decision Matrix
- Gantt Chart Update
- Conclusion

Introduction

- SAE sponsored
- Customer requires reverse, lightweight, and safe
- Goal is to develop drivetrain that will place in top 10
- Acquired constraints and needs for design
- Establish testing/operating environment
- State-of-the-Art research on potential designs
- Planning, deliverable dates, and milestones established

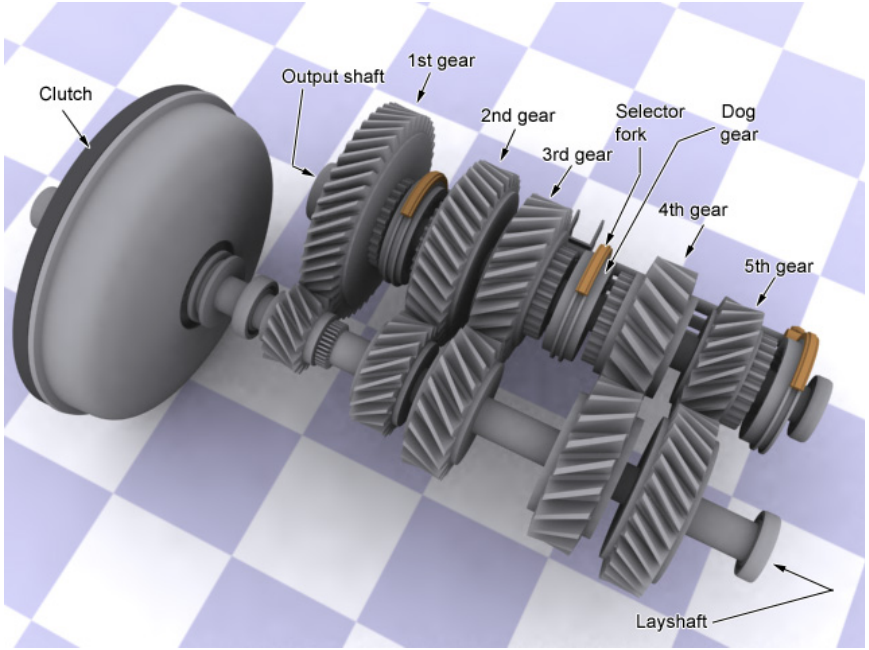
Manual Transmission

Pros:

- Reverse capable
- Reliable
- Cost effective

Cons:

- Extra weight from clutch
- Loss of power between shifts



(Representation of Manual Gearbox)

Janca

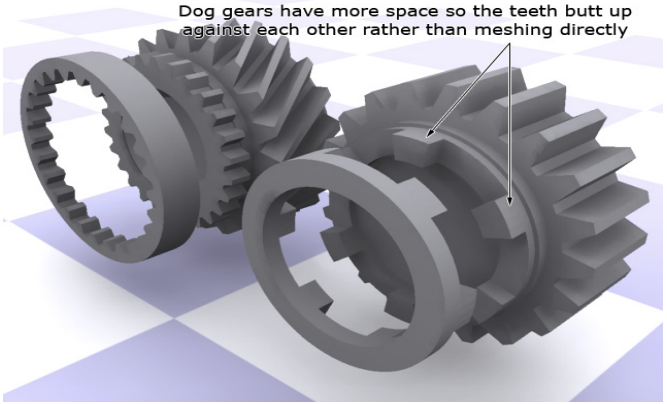
Sequential Transmission

Pros:

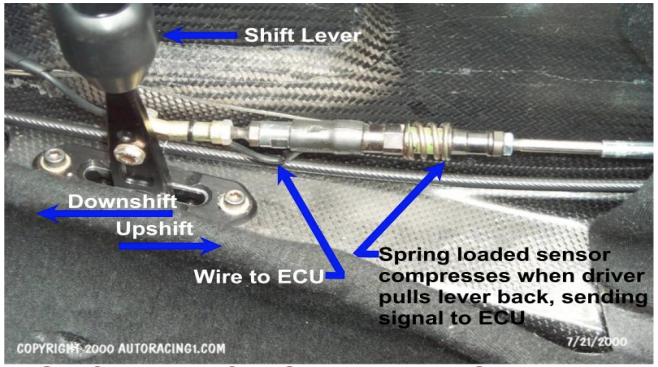
- Little loss of power
- Lightweight/Compact
- Simple to operate
- Stronger and more reliable

Cons:

- Difficult to integrate reverse
- Possible increased cost



(Sequential Dog ring compared to Manual Dog ring)



(Shift Lever for Sequential Gearbox)

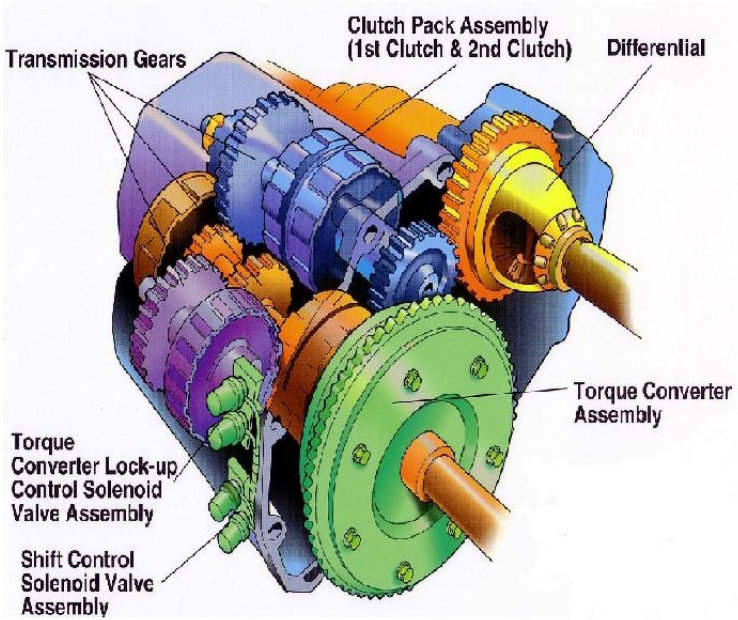
Automatic Transmission

Pros:

- High gear ratio range
- Reliable
- Reverse gear capable

Cons:

- Cost
- Medium efficiency
- Size



(Automatic Transmission)

Direct Drive Transmission

Pros:

- Cost
- Simplicity of design
- Size
- Weight
- Highly efficient

Cons:

- Static gear ratio
- Not reverse gear capable

(Direct Drive)

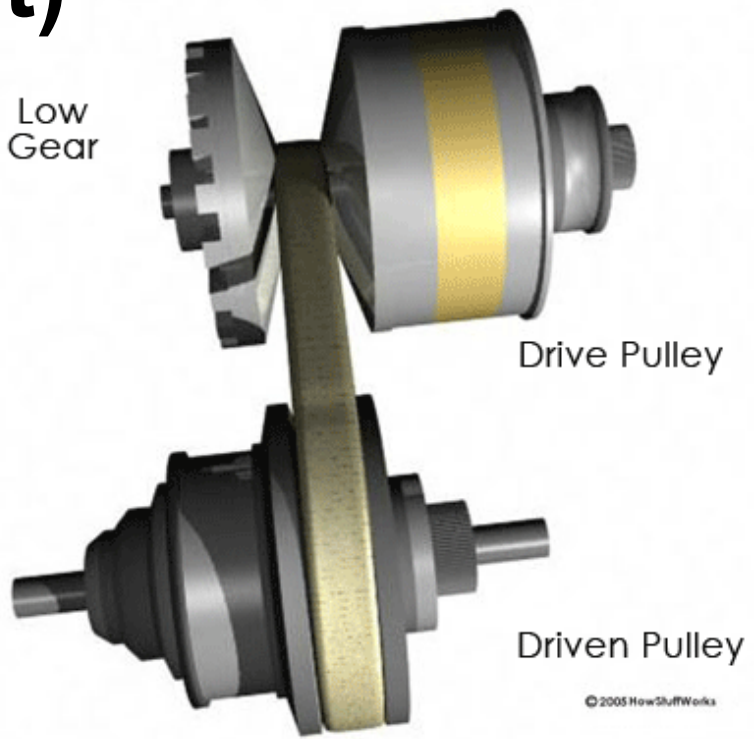
Continuous Variable Transmission (Belt)

Pros:

- Ease of use
- Size
- Weight

Cons:

- Cost
- Efficiency
- Reliability
- Reverse Gear



(CVT Picture)

Inzunza

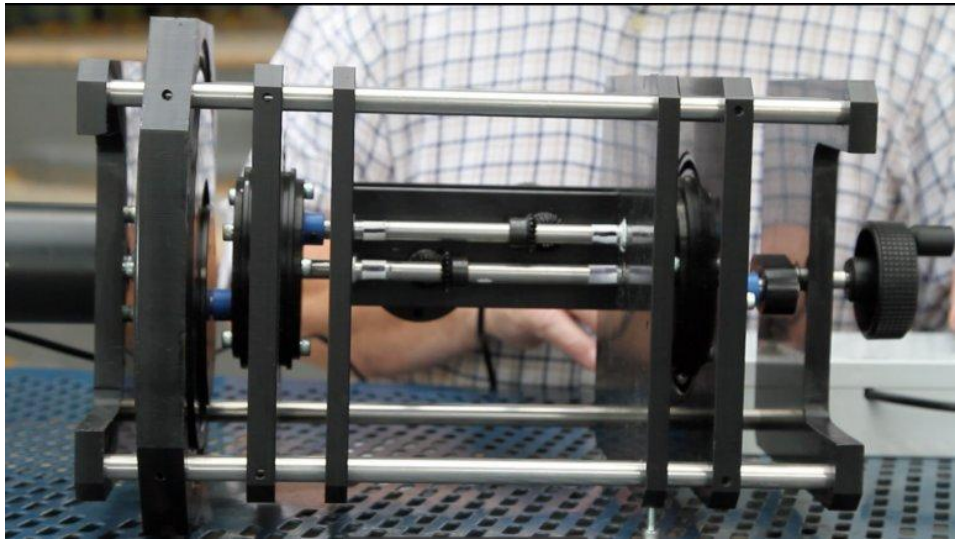
Gear CVT

Pros:

- Ease of use
- Variability of Gear Ratios
- Efficiency
- Reverse Gear

Cons:

- Cost
- Weight
- Simplicity of Design



(Gear CVT)

Decision Matrix

Scale 1-5 5 = Best, 1 = Worst	Cost	Gear Ratio Range	Efficiency (Loss of Power)	Weight	Simplicity of Design	Reliability	Size/Volume	Reverse Gear Capable	Total
Sequential	3	5	5	4	3	4	4	3	3.95
Manual	3	5	4	3	4	4	3	4	3.85
CVT Belt	2	3	2	3	5	2	5	1	2.35
CVT Gear	2	5	4	3	3	4	3	5	3.85
Automatic	2	4	3	3	2	4	2	4	3.2
Straight (One Gear Ratio)	5	2	5	5	5	5	5	1	3.75
Customer Weighting	15%	15%	20%	10%	5%	10%	5%	20%	

Final Designs

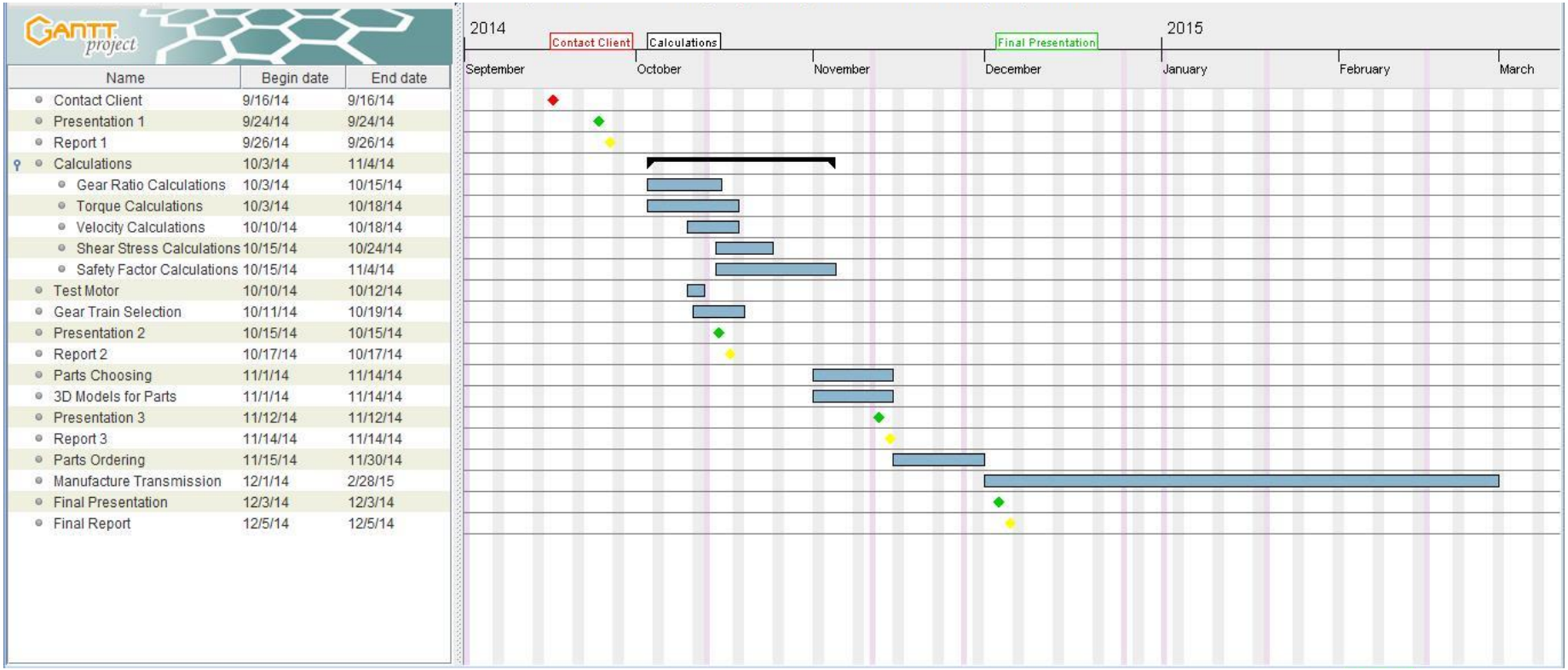
Sequential:

- Efficient (little loss of power)
- High gear ratio range

CVT Gear:

- Reverse gear capable
- High gear ratio range

Gantt Chart



Name	Begin date	End date
Contact Client	9/16/14	9/16/14
Presentation 1	9/24/14	9/24/14
Report 1	9/26/14	9/26/14
Calculations	10/3/14	11/4/14
Gear Ratio Calculations	10/3/14	10/15/14
Torque Calculations	10/3/14	10/18/14
Velocity Calculations	10/10/14	10/18/14
Shear Stress Calculations	10/15/14	10/24/14
Safety Factor Calculations	10/15/14	11/4/14
Test Motor	10/10/14	10/12/14
Gear Train Selection	10/11/14	10/19/14
Presentation 2	10/15/14	10/15/14
Report 2	10/17/14	10/17/14
Parts Choosing	11/1/14	11/14/14
3D Models for Parts	11/1/14	11/14/14
Presentation 3	11/12/14	11/12/14
Report 3	11/14/14	11/14/14
Parts Ordering	11/15/14	11/30/14
Manufacture Transmission	12/1/14	2/28/15
Final Presentation	12/3/14	12/3/14
Final Report	12/5/14	12/5/14

Worden

Conclusion

- Project Introduction - Recap of project description
- List of Concepts - Listed 6 possible designs
- Decision Matrix of Concepts - Evaluated and weighted
- Final two designs - Sequential and CVT Gear
- Gantt Chart update - Meeting deadlines/milestones

References

- The Transmission Bible: Transmission, or Gearbox? http://www.carbibles.com/transmission_bible.html
- Transmissions Textbook: Lechner, G., Harald Naunheimer. Automotive Transmissions: Fundamentals, Selection, Design and Application. Berlin: Springer, 1999.
- Direct Drive Picture http://alooroea.blogspot.com/2011/05/manuel-transmission.html
- Belt CVT Picture http://auto.howstuffworks.com/cvt2.htm
- Gear CVT Picture http://www.gizmag.com/steve-durnin-ddrive-d-drive-infinitely-variable-transmission-geared/15088/picture/114606/
- Automatic Transmission Picture http://hdabob.com/Transmission.htm

Questions?