Baja SAE (Society of Automotive Engineer) engineering students design and build a single-seat, all-terrain sporting vehicle that will be a prototype for a reliable, maintainable, ergonomic, and economic production vehicle that serves a recreational user market. From the previous year the only systems needed to be complete were the braking, pedals, electrical, and control systems. Braking system consist of rotors, calipers, brake pads, brake lines, master cylinders. The pedal system is related with the brake due to the master cylinders being connected to the brake pedal. Moreover, a gas pedal is needed as well. Furthermore, the electrical components need are, brake lights, reverse lights, front head lights, reverse siren, two kill switches, and fuse box. To complete the project a gear shifter is need to move from forward, neutral, and reverse.

**ABSTRACT**

In Baja SAE (Society of Automotive Engineer) engineering students design and build a single-seat, all-terrain sporting vehicle that will be a prototype for a reliable, maintainable, ergonomic, and economic production vehicle that serves a recreational user market. From the previous year the only systems needed to be complete were the braking, pedals, electrical, and control systems. Braking system consist of rotors, calipers, brake pads, brake lines, master cylinders. The pedal system is related with the brake due to the master cylinders being connected to the brake pedal. Moreover, a gas pedal is needed as well. Furthermore, the electrical components need are, brake lights, reverse lights, front head lights, reverse siren, two kill switches, and fuse box. To complete the project a gear shifter is need to move from forward, neutral, and reverse.

**OBJECTIVE**

Design, build, and race a small-scale off-road vehicle that can withstand the harshest elements of rough terrain. The team will focus on braking systems, electrical system, and control systems.

**SPECIFICATIONS**

**Brakes:**
- Requirements by SAE Rules:
  - Lock all four wheels under load
  - Two separate hydraulic circuits
  - Operate on final drive
  - Shall trigger stop lamps

**Controls:**
- Requirements from SAE rule book:
  - Ability to actuate gear shifts
  - Must be able to indicate position (Drive, Reverse, etc.)
  - Reverse position must activate back-up buzzer
  - Cuts into firewall for controls must be less than .25" (6.35 mm) in diameter and contain a grommet to create a seal

**Electrical**
- Requirements by SAE Rules:
  - Two Cutoff Power switches must be mounted
  - When vehicle is in put in reverse, there must be a buzzer that makes sound in order to warn everyone in the surrounding.
  - All Light and switches have proper heights when being mounted.
  - Each component must comply to all SAE Standards

**SYSTEM UPDATE**

- Axles were replaced with high quality chromoly steel units featuring Porsche 930 constant velocity joints for improved geometry and durability
- Frame modifications included removal of the steering hoop for safety, support gussets for the shocks, and a new fuel tank mounting platform
- The fuel tank was changed from a polymer unit to a fully welded aluminum unit for safety and durability. This necessitated some frame alterations.

**PEDAL SYSTEM**

The plunger is spring loaded with a screw threaded on the inside of the cylinder to adjust the stroke length. This system was easy and adjustable for the driver's personal preference on how far they wanted the gas pedal to be pushed down. After making adjustment here all that’s left to do was tightening the throttle cable to that set position.

**ELECTRICAL**

- Foot operated brake lights
- Hand operated forward lights.
- Shifter operated reverse light

**STEERING**

The steering column was modified from previous hoop design. The hoop design after close inspection we identified that this is a dangerous design for the driver for a possible injury in the knee area. So the team redesigned the mounts as shown in the figure, so it is out of the way from the driver's leg.

**CONCLUSION**

Choosing to salvage the core components from last year’s SAE team has cut our cost significantly for the current build. However, it has presented several challenges from a system integration standpoint. Components designed by this year’s team include pedals, braking systems, and shifting controls. Strategically repositioning steering components was also necessary because of the restricted clearance in the original build. Major challenges with adequate space for components were common in all departments. Brakes and controls overcome the cylinder placement by inverting controls and switching to a double cylinder system. Custom rotors and shifting mechanism built in a house to suit specific needs of our machine. Each design team has spent many hours designing and collaborating to bring together a successful racing team for the 2020 mini Baja season.