Low Speed Motorcycle Stabilization Device

Team: Adam Sears, Alexander Segala, Jessica White
Advisors: Kenneth Stafford, Torbjorn Bergstrom
Mechanical Engineering Department

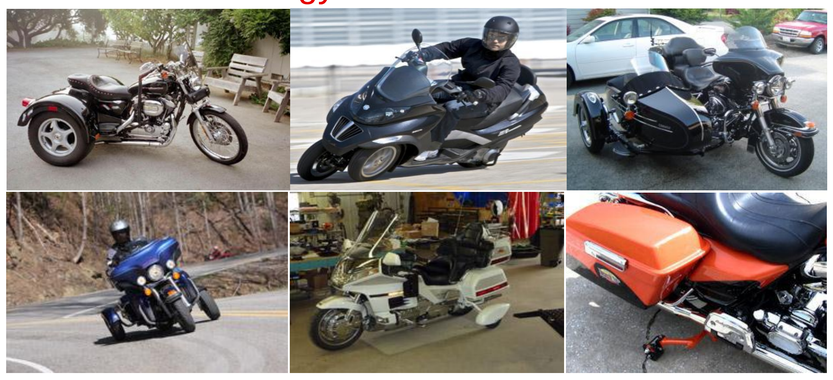
Abstract

The objective for this Major Qualifying Project was to create a low speed motorcycle stabilization device for a partially handicapped client. The system would remove the need for the rider of the motorcycle to place his feet on the ground at low speeds or stops, but allow uninhibited motorcycle riding at standard to high speeds. The final design focused on three major aspects, the mechanical assembly, fluid power, and microprocessor control. The outrigger deploys at 14 miles per hour with some compliance for low speed turns and becomes increasingly rigid until 4 miles per hour when the device locks to keep the motorcycle steady at a stop. The finished system was installed on a Harley Davidson Sportster.

Design Approach

- Investigate Existing Solutions
- Decide on System to Use
- Design System
- Manufacture Components
- Assemble and Test

Previous Technology



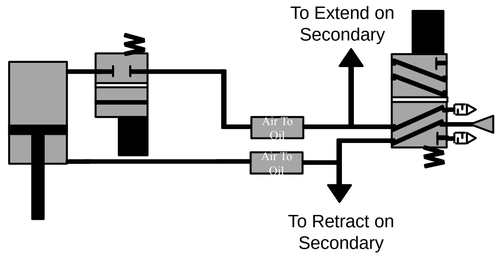
Existing Stabilization Devices; Top: Delta Trike, Tadpole Trike, Sidecar;
Bottom: Ghost Wheels, Retract-a-Trike, Leg-Up

Design Decision

	Dynamic Stability	Static Stability	Rider Safety	Motorcycle Feel	Design Reliability	Rank
Weighting Factor	0.27	0.23	0.3	0.08	0.12	
Delta	2 / .54	10 / 2.3	3 / .9	6 / .48	7 / .84	5.06
Tadpole	2 / .54	10 / 2.3	8 / .24	3 / .24	5 / .6	6.08
Leaning Tadpole	5 / 1.35	2 / .46	5 / 1.5	7 / .56	3 / .36	4.23
Sidecar	3.5 / .945	10 / 2.3	4 / 1.2	5 / 1.5	7 / .84	6.785
Smart Training Wheels	5 / 1.35	10 / .23	9 / .27	9 / .72	5 / .6	7.67

Table 1: Design Matrix

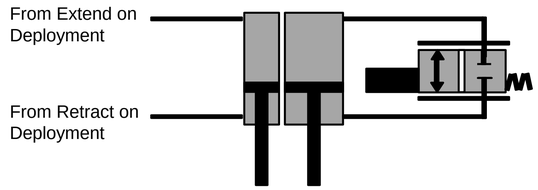
Deployment Cylinder



Deployment Cylinder Schematic

- 5/2 electro-pneumatic block valve drives air to hydro convertor
- 2/2 electro-hydraulic cartridge valve installed directly into actuator to control locking

Secondary Cylinder

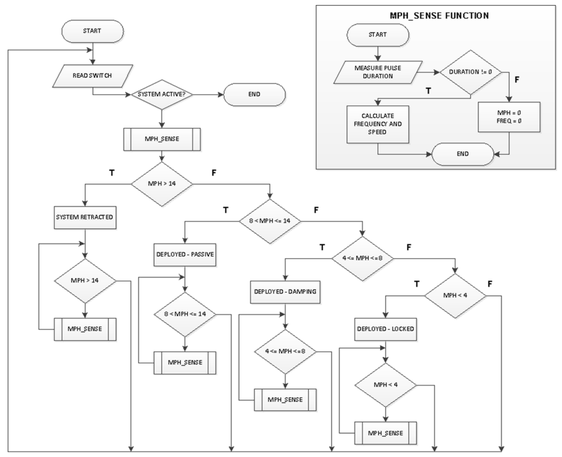


Secondary Cylinder Schematic

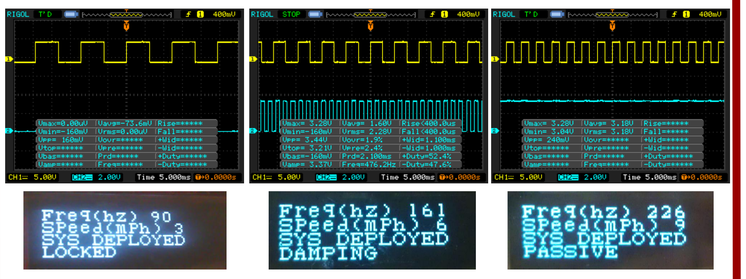
- 2/2 electro-hydraulic proportioning cartridge controls damping characteristic of actuator
- Integral pneumatic cylinder supplies force for road following and retraction states

Controls

- Arduino Compatible PIC32 Microcontroller
- Speed input via gear tooth sensor in transmission

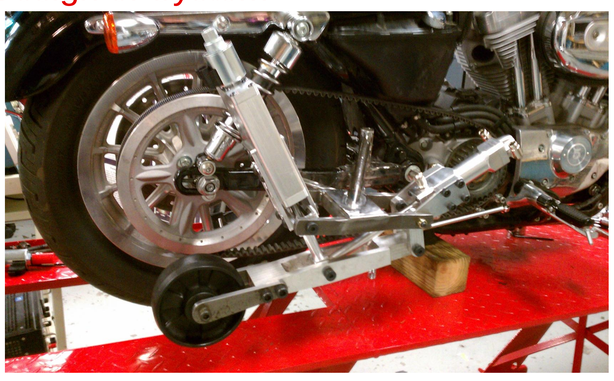


Program flow chart

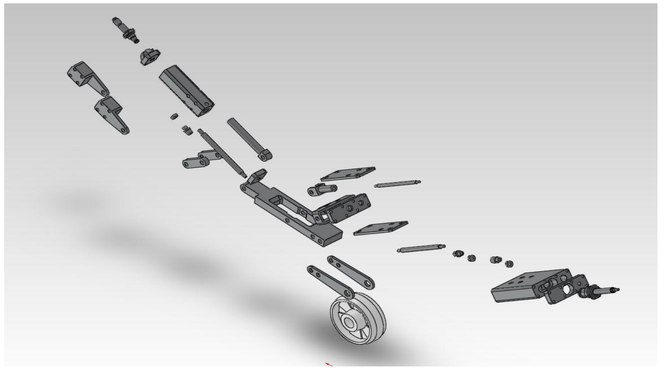


Examples of varying input and corresponding output

Design of System



Assembled Mechanical System



Exploded Solid Body of Assembly

Conclusions

The system was mounted on a Harley Davidson Sportster motorcycle and functioned successfully while meeting all and product specifications. The new design takes aspects of several existing models to make one streamline mechanism to fit all of the customer needs.

Acknowledgements

Donald Cottrill - Hydro Air Hughes
Jesse Avery - LADD Industries
DP Technology
WPI HAAS Technical Education Center