Riding Lawn Mower Ride Over Accident Prevention

THE UNIVERSITY OF UTAH
Department of Mechanical Engineering

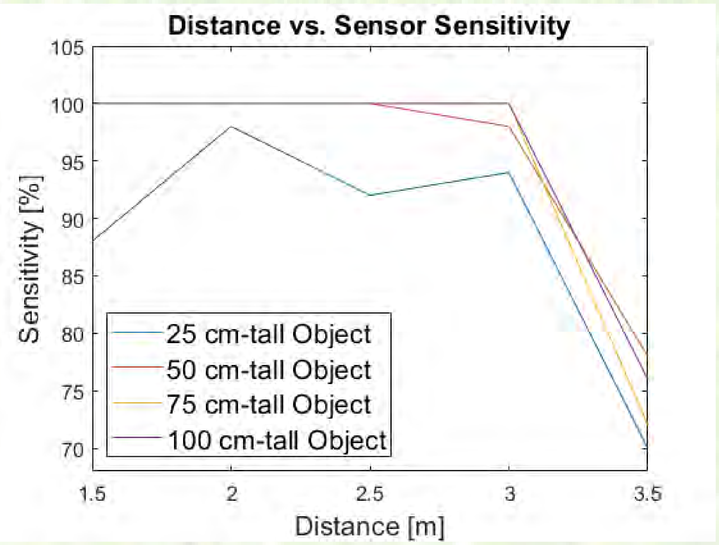
Design Team - Riley Armbruster, Robert Prescaro, Kaleb Runyon, and Spencer Shull
Advisor - Dr. Kenneth d'Entremont

Operator Awareness Sensors

Ride over accidents are most likely to occur when the mower is operating in reverse for a wide variety of reasons including limitations in the operator's range of motion and lack of situational awareness. This safety system could reduce the likelihood of a mow-over accident by enhancing the operator's effective field of view.

This operator awareness system uses forward and rearward suites of proximity sensors to enhance the operator's surrounding awareness. Each sensor suite includes five ultrasonic sensors which feed data to the operator via a heads-up display; together the sensors show a consistent sensitivity greater than 90% in a 74.5 degree lateral cone extending 3 meters in front of and behind the mower. On the same display a wide-angle backup camera also provides rearward imagery in a 90 degree field-of-view.

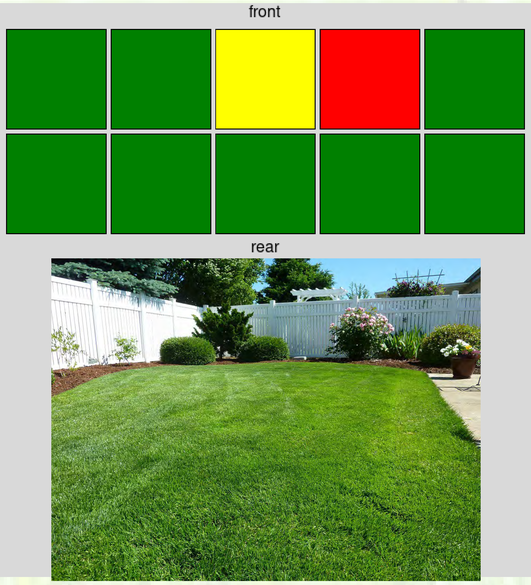
A vibration damping mounting solution reduces erroneous data in proximity sensor readings, as well as producing a clearer backup camera image. Testing shows an average increase in sensing distance of 1.97% for a damped sensor array over a non-damped array, with a reduction of over 89% of false readings due to vibrations.



Introduction

Injuries to adults, children, and pets due to negligent use of residential riding lawn mowers are devastating and avoidable. Current standards intended to decrease the likelihood and severity of ride over injuries in children have been ineffective, as injury rates have continued to rise over the last 25 years.

This project seeks to reduce the incidence of ride over injuries sustained by children, primarily by means of increasing operator awareness, and secondarily by implementing a potential mower shut down when integrated into the mower's control system if an obstacle is detected or impacted.



Backup camera image simulated; actual backup camera feed is a hardware overlay and does not appear in screen captures.

Recommended further work

Time constraints have prevented our team from fitting this system on a riding lawn mower at this point . Future development should produce a working system mounted on a mower for end-user testing.

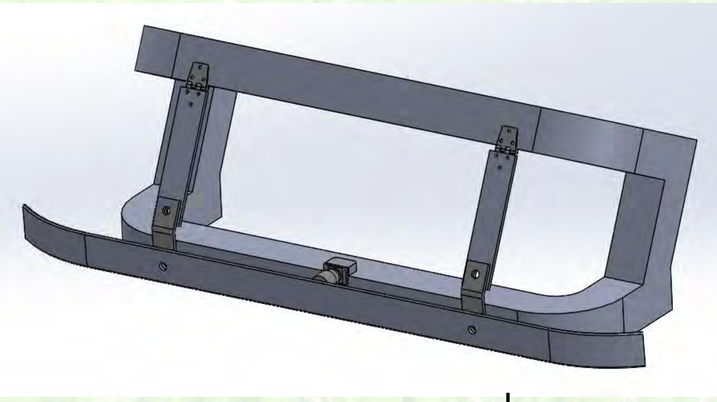
Continued testing on the vibration damping system should be conducted in order to fine tune the frequency damping range to the specific riding mower that is chosen.

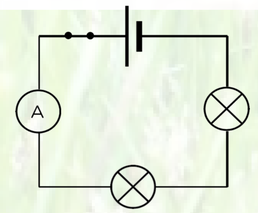
Push Bar - Kill Switch

The push bar system (as seen below) operates with two hinges, which allow the push bar to press the kill switch when more than 2.5 pounds of force is applied. The kill switch (shown below) works as a push button wired in series with the provided kill switch on the mower. This allows the system to kill the mower from either the push bar kill switch or the provided kill switch on the mower through the same circuit.

While the push bar is intended for forces from contact with bystanders, it will still withstand force in the event the mower is backed into a solid object such as a tree.

The maximum forces that may be exerted on the bumper is 6996 N which translates to 786 PSI with a 2 square inch impact area. This is much less than the 1600 PSI strength of the aluminum. In the event the contact occurs on the very end of the push bar, the maximum torque created is 1572 ft-lb. This is then diffused by rubber bumpers running along the push bar and bumper.





This project was partially made possible through cooperation and funding funding by the U.S. Consumer Product Safety Commission (CPSC). Any results, recommendations, opinions, or conclusions are solely those of the design team and do not necessarily represent those of the CPSC staff or commissioners.