HYDROPLANING DETECTION SYSTEM

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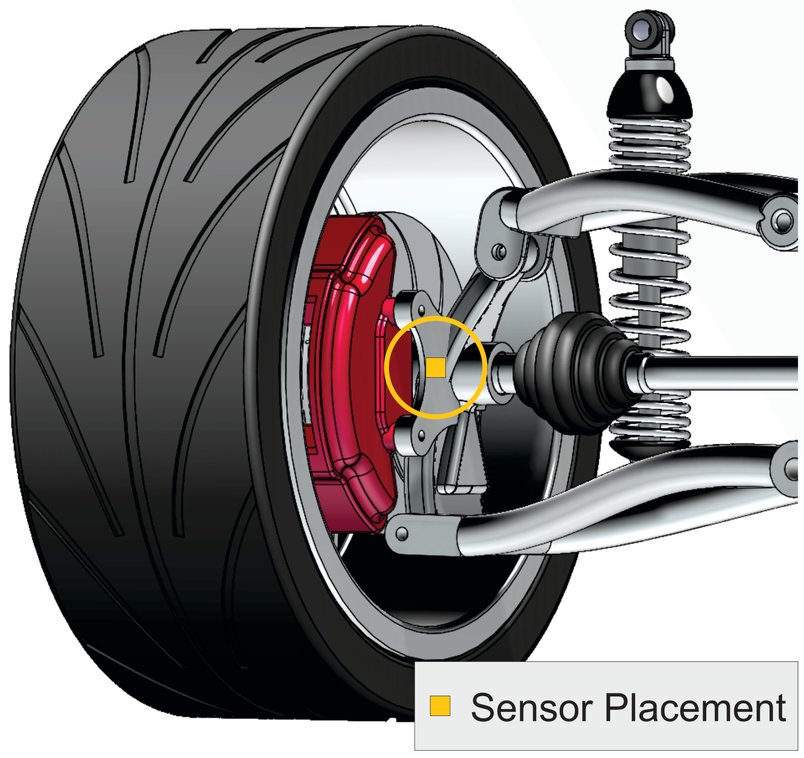
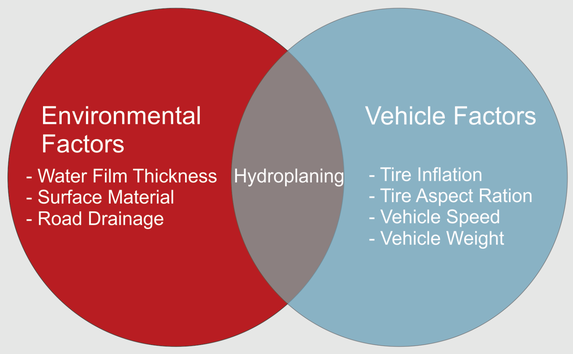
Problem Description

Currently there is no single hydroplaning detection system that is reliable enough to become industry standard. Historically, hydroplaning has only been detected by humans. Once a human has detected hydroplaning, it is often too late to recover in a controlled manner. Many people also do not know how to properly recover once their vehicle is hydroplaning and their actions may worsen the situation. Having a detection system that reacts quicker than a human would be beneficial to reduce hydroplaning related collisions, and help in the overall safety of autonomous vehicles.



Hydroplaning Mechanics

Hydroplaning depends on a number of factors, comprised of road conditions, and the nature of the vehicle. When acting together, hydroplaning can occur.

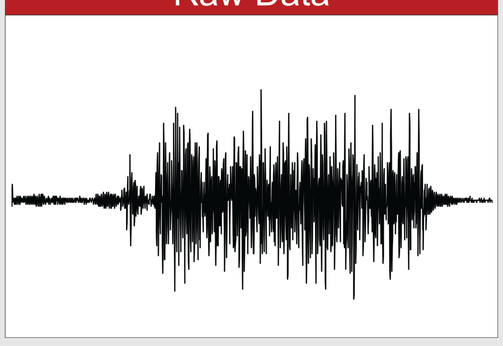


Hydroplane diagram, Retrieved from https://www.smartmotorist.com/hydroplaning

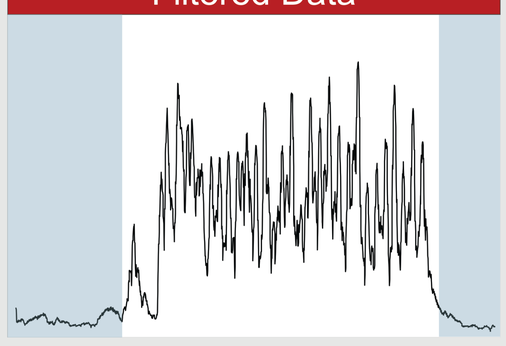
Experimental Data

- Data was collected during a simulated hydroplaning scenario.
- Filtering was applied to allow for easy separation of hydroplaning from normal conditions.
- Hydroplaning alert triggers whenever filtered data is below a certain threshold.

Raw Data



Filtered Data



Proposed Solution

Vibrations occur during driving due to the tire being in contact with the road. When hydroplaning, vibrations are reduced due to the smoothness of the water surface. The proposed solution is a sensor system that will monitor and analyze vibration data. The system was implemented as follows:

- A MPU9250 Internal Measurement Unit (IMU) sensor is mounted on each wheel bearing.
- Resulting data for each wheel is filtered to detect the hydroplaning condition.
- Driver will be notified as soon as any tire begins to hydroplane.

This will allow preventative action to be taken before a total loss of vehicle control occurs.

Future Considerations

Looking ahead to a full scale implementation of this system in a car, certain parts of the design will need to be revised, and new components added. Primarily the next stage of the design will need to :

- Utilize tire RPM data in conjunction with road roughness to make detection more accurate.
- Interface the system with the vehicle's processing unit, instead of an external microprocessor.
- Investigate the use of more accurate sensors to detect the changes in road roughness.

While other issues are sure to come up, these points will serve as a starting point for the next phase of this system.

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