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Supplementary Still Image Based Negative Obstacle Detection

As recently stated by a congressional mandate, one-third of the American Army's ground operational and transport vehicles must be autonomously driven by 2015. An autonomously driven car is a vehicle that is able to travel large distances without any human assistance from start to finish. There are many problems preventing the successful creation of such vehicles. Problems and setbacks frequently encountered include successfully detecting and classifying possible obstructions to the vehicle.

As of now, there are three basic methods being developed to detect obstacles that pose a threat to the vehicle, or the cargo onboard. One method is LIDAR, Light-Imaging Detection and Ranging; this works like RADAR, except using light waves rather than sound. Lasers are emitted at an object, and with the knowledge of the reference angle and the speed of light, an XYZ-coordinate can be calculated. This is done thousands of time per second, constructing a full 3D image. Another method, Infrared imaging, is based on the theory that negative obstacles will retain more heat into the night than the surrounding environment, and that the amount of heat present can be measured to determine if there are negative obstacles in the vicinity. Lastly, Stereo-Images are used to detect obstacles. Like the human eye, cameras are programmed to use ambient light to locate edges, and then to analyze if there is a difference in depth, or a shadow within the boundaries. In my project, these important aspects related to autonomous robot navigation will be explored, particularly the detection of negative obstacles, such as ditches, trenches or potholes.

The intention of my research was to lay the foundation for a system which could either replace or compliment preexisting obstacle detection systems. Using a still image from a standard digital camera, I was able identify simply many of the edges in a photograph. This Still-Image Based Obstacle Detection process, abbreviated as SIBOD throughout this paper, is simple and does not require much equipment or time to perform. The SIBOD process was able to successfully identify negative obstacles 80% of the time. Future research would be to couple SIBOD with LADAR systems and see if obstacle detection is improved.

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