AUTONOMOUS OBSTACLE AVOIDANCE FOR UNMANNED AERIAL VEHICLES

IMPLEMETING AUTONOMOUS OBSTACLE AVOIDANCE ON WHEELCHAIRS: DOES IT TRULY BENEFIT WHEELCHAIR USERS?

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SOCIOTECHNICAL SYNTEHSIS

Autonomous obstacle is a technology that is rapidly growing in popularity due to its ability to allow vehicles to avoid collisions without human input. The technical report focuses on implementing autonomous obstacle avoidance on an unmanned aerial vehicle, or UAV for short. By developing a UAV that can use autonomous obstacle avoidance, insight can be gained as to how it works on an aerial vehicle along with potentially assigning tasks to the UAV that can be assisted with autonomous obstacle avoidance such as map planning. The science, technology and society (STS) topic analyzes the benefits and drawbacks of implementing autonomous obstacle avoidance for wheelchairs on wheelchair users. By analyzing these benefits and drawbacks, the paper seeks to answer if implementing autonomous obstacle avoidance is truly beneficial for wheelchair users, which can potentially help spur the development of a wheelchair with autonomous obstacle avoidance assuming it provides enough benefit. These topics are tightly coupled since they both focus on the implementation of autonomous obstacle avoidance on a vehicle.

The technical report focused on the development of an aerial platform to enable shared autonomy and obstacle detection for unmanned aerial vehicles, or UAV for short. This would allow a human operator to place more focus on tasks other than navigating the aerial vehicle. In order to do this, distance sensors were used to collect data that was transmitted to the onboard Jetson, which used the sensor readings to control which direction to move assuming there was an obstacle in one of the sensors' line of sight. In addition, a program was developed to transform the sensor readings into potential commands for the aerial vehicle's movement.

In the end, an aerial platform that allowed for shared autonomy was made. Three LiDAR sensors on the front, left, and right sides of the aerial vehicle were used to collect data that was

transmitted to the Jetson, which used Python scripts to parse the data and transform them for potential commands for the aerial vehicle. In addition, a game controller was used to manually control the aerial vehicle when there wasn't an obstacle close enough to any of the LiDAR sensors.

The STS report focuses on analyzing the benefits and drawbacks of implementing autonomous obstacle avoidance on wheelchairs in order to determine if a wheelchair with this functionality is truly beneficial for wheelchair users. By providing the benefits and drawbacks of implementing autonomous obstacle avoidance on wheelchairs along with using the Social Construction of Technology framework by Trevor Pinch and Wiebe Bijker to analyze the interests of various stakeholders to prove that, while a wheelchair with autonomous obstacle avoidance would be useful to wheelchair users, it would be too costly to make this wheelchair safe and comfortable.

In order to show that implementing autonomous obstacle avoidance is beneficial for wheelchair users, I state the benefits and real-world examples of wheelchairs that were developed that may address some of the issues. For example, one of the major benefits of this wheelchair is that those with issues navigating the wheelchair on their own will not have to worry as much about crashing into obstacles since the obstacle avoidance algorithm will cause the wheelchair to move out of the obstacle's way. Then I proceeded to use the Social Construction of Technology Framework to show how the interactions of various stakeholders with the engineer would lead to the wheelchair to be too costly. For example, wheelchair manufacturers and investors will be more concerned with profits and minimizing the costs of production than the wheelchair being adopted on a larger scale whereas robotics researchers may be focused on patenting any of the technology they developed when making this wheelchair.

These factors would cause the price of a wheelchair with autonomous obstacle avoidance to be too high to be adopted on a large scale.

The technical and STS work illuminate the potential of autonomous obstacle avoidance, even if it does have some limits. This technology is most useful when it can assist those who have trouble navigating either because of a disability or because they need to focus on another task. As such, autonomous obstacle avoidance is great for reducing the workload on these individuals who can put greater focus into other tasks.

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