# DESIGNING AN AUTONOMOUSLY PLATOONING GOLF CART FOR SHORT DISTANCE CAMPUS TRAVEL

# AN EXPLORATION OF THE INFLUENCES ON THE INTEGRATION OF UNMANNED ROBOTICS INTO LAW ENFORCEMENT

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Unmanned and autonomous robotics are a rapidly developing industry that has been circulating beyond the traditional manufacturing robot into countless aspects of people's daily life. The technical research project focused on developing a platooning system for a pair of golf carts. Platooning is a simplified method of implementing autonomy in vehicles by having the autonomous vehicle follow a manually driven vehicle. This platooning system is important to refine because by reducing the amount of autonomous capability required for functionality, it is a useful step in the process of developing the technology for fully autonomous vehicles. While developing new technology is important, it is also important to understand how similar devices are currently being used, and how people are reacting to them. In robotics it is especially important to consider the potential outcomes of a technique as it is implemented because it is removing a potential safeguard by automating processes that were previously done by humans. The STS portion of this research project focused on the approaches various groups have taken to integrate unmanned robotics into law enforcement, and the reactions of various groups to those attempts.

Platooning is an important technique for creating fully autonomous vehicles. By having a manually driven vehicle guide one or more autonomous vehicle, it simplifies the amount of decision making needed from the autonomous vehicle. It also has noticeable advantages over manually operated vehicles because it reduces the risk from human error while driving, increases traffic flow, and decreases fuel consumption. This technical project focused on developing the platooning system by tracking the motion data of the braking, acceleration, and steering for the lead vehicle and transmitting it to the follower vehicle. That information was then corrected by tracking a series of heat lamp bulbs on the lead vehicle using an infrared camera on the follower, which was processed to get the distance between the two vehicles.

The distance between the two vehicles and the motion data from the lead vehicle were then combined by using a particle filter to track the motion of the leader and follower vehicles over time. A particle filter works by taking the current sensor data and matching it with which positions in the environment could lead to that sensor output. Then, after a time step, the next batch of sensor data is matched again, but it also uses the previous step's estimate to find the new matching positions that would be reachable over the length of the time step.

The STS research project worked to answer the question of what factors influence the success of attempts to integrate unmanned robots into law enforcement. There have been several projects aiming to use robots in policing that failed or had limited success due to failing to consider a broader perspective beyond the technical problem. Law and Callon's Actor-Network Theory was used to demonstrate some alternative perspectives that could be utilized and the influences that these perspectives highlight. This paper analyzed the implementation of robots in law enforcement with an emphasis on the design, the marketing, and the legality of the project. These categories were explained through comparative analysis of case studies from attempts to integrate robots into law enforcement that had similar goals, but differing approaches.

The cases in the design section emphasized the importance of understanding the desires of the intended user because while one project created a more technologically complex device, the other group interacted with law enforcement officers to better understand what features were important. The marketing section compares two groups that tried to make use of patrol robots with one that focused on maximizing the utilization of the robot, while the other also prioritized gaining the surrounding community's support and trust. This trust was vital when the project faced setbacks because people still thought positively of it the attempt, while the first case faced public disapproval without any actual failure in its duties. The legality section differed from the

other two because it broke down the theories of legal scholars on how robots in law enforcement will affect the relationship between law enforcement and society. Overall, these attempts show that there is not a singular path to making a project succeed, but it is important to consider the people who will be using law enforcement robots and the broader community they will be integrated into.

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