# Title: Use of Robotics in Smart Cities: Automotive engineers involved in designing robotic autonomous vehicles

## Part 1

Robots are machines programmed to replicate human tasks. The ability for them to be programmed and designed individually allows them to be created to perform specific tasks with high efficiency. One topic of robotics is autonomous vehicles (AVs), 'also known as automated car, driverless car, self-driving car or robotic car, is a kind of vehicle that is capable of sensing its environment and navigating without human input' (Zhu et al., 2020). Advances in this branch of robotics would place us on the point of revolution in the transportation system (Sanbonmatsu et al., 2018). Automation technology can be very useful to us as it could result in reduced traffic crashes, relieved congestion, mitigated air pollution and improved energy efficiency related to transportation (Rafael et al., 2020). Furthermore, automated cars (AVs) can also 'improve mobility of people who are unfit for driving (e.g., the elderly and the disable)' (Zhang et al., 2019). This shows that their computational nature of these autonomous vehicles makes them ideal for performing repetitive tasks and their lack of consciousness means they are less susceptible to making errors like their human counterparts. A multinational survey of 109 countries reported that 69% of the survey participants projected AVs would reach a 50% market share by 2050 (Kyriakidis, Happee, & de Winter, 2015). Overall, autonomous vehicles show much promise and opportunity in smart cities. However, there are issues with implementing and using these vehicles in smart cities.

Autonomous vehicles (AVs) also have constraints and issues that could occur when developing and using these autonomous cars in cities. One constraint would be the trolley problem which involves the endangerment of health and safety in autonomous vehicles. Trolley cases are idealised situations in which an agent (in this case the autonomous vehicles) has to decide between two actions that lead to different distributions of unavoidable harms (Himmelreich, 2018). These are some of the cases where autonomous vehicles are opposed in society due to the ethical issue at hand. Another situation like this occurred where a driver in a Tesla (autonomous car) was charged over napping while speeding when using the autopilot feature in the car (BBC, 2020). In a situation like this the driver could have injured or killed pedestrians or other drivers or could have injured or killed himself. Elon Musk (Tesla founder) also said in the news article that his cars still had 'many small problems' that would need solving through real-world testing (BBC, 2020). Another constraint would be the legal issue of cyber security of autonomous vehicles. Some people are worried that autonomous vehicles will be easily hacked due to the abundance of digital infrastructure needed for them to operate (Ryan, 2020). Criminals could use data they receive (by overriding the infotainment system of the car) in order to perform actions on the main car controls that the passenger is unable to undo, and could also harm and possibly kill the passenger onboard (Bowles, 2018).

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## Part 2 – ACM Code of Ethics implemented on Case Study

M is a vehicle manufacturer specialising in developing self-driving vehicles. Unlike their competitors, M focuses on public transparency and regularly sets press conferences to obtain feedback or advice from their customers. M also releases cars that are not completely tested on the premise that they've informed their users of the risks and dangers that could come with the purchase of their product. Bugs could include errors with car sensors and cameras which may cause the car to perform an incorrect action. As a business, M focuses on being a pioneer in the industry for self-driving vehicles and can ignore testing procedures in order to release a new product quickly before competitors. Due to the fast producing pace of these autonomous cars have caused M's engineers to resign. This is due to protesting for a slower production time to carry out thorough checks and testing, but no action has been taken whatsoever. To improve their future products, M ensures to collect as much data as possible from customers such as biometric, facial recognition or even passenger tastes in terms of comfort. The large supply of sensitive data allows them to assess the quality of features in their products and provides statistical information on how future products should be designed. The large amount of sensitive data collected has made M a target for hackers and data has been previously leaked from the company numerous times.

Principle 1.2 of ACM Code of Ethics and Professional Conduct is gradually violated due to M's bugs and errors that occur when using autonomous vehicles. These bugs of car sensors and cameras could cause unintended harm when used in public. These especially include motor vehicle crashes. No matter how many reports of these bugs occurring with customers. However, M's policy on focusing on public transparency does comply with Principle 1.3. This allows M to be open, honest, and straightforward about various company operations. M could share information relating to performance and pricing of their product into the market. Engineers who protested and resigned due to M's lenient testing process and fast paced production can be justified due to Principles 1.2, 2.7 and 3.7. Engineers were right to protest these issues to foster public awareness of the consequences of careless testing. Since these systems (autonomous vehicles) are now integrated into society we have to take special care of them, as they could impact all aspects of society. So engineers protesting and resigning would be ethically justified. Furthermore, M's collection of sensitive data and leaks of those data due to hackers could violate Principle 1.6. Technology used in autonomous vehicles produced by M has failed to respect privacy of the consumers of the product. This could include faces and fingerprints of M's customers. Hackers may obtain control of M's autonomous vehicle main functions and cause serious harm to the users of the vehicle. This would again infringe Principle 1.2.