Technological Stewardship Principles Exercise

Autonomous Vehicles

Background:

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. These cars can do everything an experienced human driver can do. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all.

Some benefits include increased safety as these vehicles would not be susceptible to alcohol abuse, speeding and driver distraction. Another benefit is a cleaner environment as autonomous vehicles uses electric power, therefore less carbon emissions.

While autonomous cars have been praised as innovations that will several benefits but it also produced unintended negative consequences. This includes increases unemployment, if trucks and buses start driving themselves or hackers taking over vehicles for malicious acts like striking objects or pedestrians

Discussion Questions

1. Discuss the benefits and challenges of autonomous vehicles
2. As a group, debate and discuss the 2 most important principles to address within the next 10 year for autonomous vehicles
3. How can engineers as leaders influence positive change in stewarding autonomous vehicles?

Adapted from: https://www.synopsys.com/automotive/what-is-autonomous-car.html

Cyberweapon: Stuxnet

Background:

Stuxnet was a cyber worm that was spreading across the world and embedding itself into control systems. Stuxnet was a complex piece of malware which the world had never seen before. Thousands of computers were being infected in countries like India and the United State. It was discovered that 60% of the infections were in Iran. Many experts believed this was due to their lack of cyber security. This was not the case, as in 2010 a team of German security experts discovered that Stuxnet was targeting certain operations in a Nuclear facility in Iran.

Stuxnet infiltrated Iranian nuclear scientists' laptops. These cyber-attacks was not obvious to the scientist as it didn't shut down the centrifuges, but it ran a series of subroutines that caused tiny adjustments to the centrifuges that caused minor damages. As a result, Stuxnet was embedded inside Iranian network for over a year where scientist though the nuclear plant was just suffering from a series of breakdowns. Iranian engineers did not suspect a cyber-attack as Stuxnet had no obvious effect on the hardware, but over time this cyber-attack even caused low morale within the Iranian scientists. Stuxnet exploited not just technical vulnerabilities, but human trust that the computer systems would accurately and honestly describe what was taking place.

Questions

1. Discuss the advantages and disadvantages of using cyberweapons to traditional war weapons
2. As a group, debate and discuss the 2 most important principles to address in the next 10 year for cybersecurity.
3. How can engineers as leaders influence positive change in stewarding cybersecurity?

Personalized Medicine

Background:

        Personalized medicine is the tailoring of medical treatment to the individual characteristics of each patient. The approach relies on scientific breakthroughs in the understanding of how a person's unique molecular and genetic profile makes them susceptible to certain diseases. This increases the ability to predict which medical treatments will be safe and effective for each patient, and which ones will not be.

        Physicians can select a therapy or treatment protocol based on a patient's molecular profile that may not only minimize harmful side effects and ensure a more successful outcome, but can also help contain costs compared with a "trial-and-error" approach to disease treatment. Personalized medicine is typically discussed in a positive light, but there are some concerns about the privacy and confidentiality of patients. For example, in the future, insurance companies may use this information to not offer certain policies to people with a genetic predisposition. Another concern of personalize medicine is, if a disease with no treatment is discovered in a patient, this may lead to unintended mental health issues.

Questions

1. Discuss the benefits and challenges of personalized medicine.
2. As a group, debate and discuss the 2 most important principles to address within the next 10 year for personalized medicine.
3. How can engineers as leaders influence positive change in stewarding personalized medicine?

Adapted from:
http://www.personalizedmedicinecoalition.org/Userfiles/PMC-Corporate/file/pmc_age_of_pmc_factsheet.pdf

Engineering Change Lab-Technological Stewardship Principles

Seek purpose	**Direct technological development to maximize positive outcomes for all.** e.g. Consider broad outcomes. "Should we do this?" vs. "Can we do this?".
Take responsibility	**Consider, anticipate, and manage the complex impacts of technology across the entire life cycle.** e.g. How might this technology be misused or abused, who could be affected, and what preventative measures are in place?
Expand involvement	**Integrate a broad range of non-technical experts and ideas into technological development.** e.g. Who are we working with aside from our immediate team, and how?
Widen approaches	**Explore alternative ways to solve problems.** e.g. Are we considering a broad range of new and existing technologies to address the problem?
Advance understanding	**Foster dialogue about technology and technological stewardship through clear, audience-focused communication.** e.g. In what ways do our communications create barriers to understanding?
Realize diversity	**Ensure technological development contributes to creating equity.** e.g. How are different perspectives incorporated into choices? Whose voices are missing?
Deliberate values	**Consider underlying values inherently infused with technological development and make intentional decisions.** e.g. What values are connected to this project, and which are we choosing to reinforce?
Shared action	**We can only succeed together.** e.g. Complex, interconnected activities require shared attention and collective efforts to ensure optimal results.