MODULE: Driven By AI: The Ethics of Self-Driving Cars

We recognize teachers as experts in their own classrooms and students and encourage you to customize and expand this curriculum to fit your space. If you have any questions or would like to share success stories please contact us.

Link to Module Slides

Driving Question

How can we be ethical designers and users of self-driving cars?

Overview

Why is this important?

Cars with AI and sensor-driven self-driving features are already on our roads, and fully autonomous vehicles have driven themselves over millions of test miles. This technology has the potential to vastly decrease traffic and fossil fuel emissions, while providing a revolutionary degree of comfort and convenience. But can we trust these vehicles to be safe? Will they behave ethically in emergency situations? Will they be affordable? Who will benefit most from this technology? Who might be harmed? What can we do to ensure that self-driving cars are a benefit to **all** of society? Students are already, and will be, consumers and designers of this technology and its application in the world. This unit will develop their critical understanding and awareness of the issues, as well as the underlying AI and engineering.

What will students learn and make?

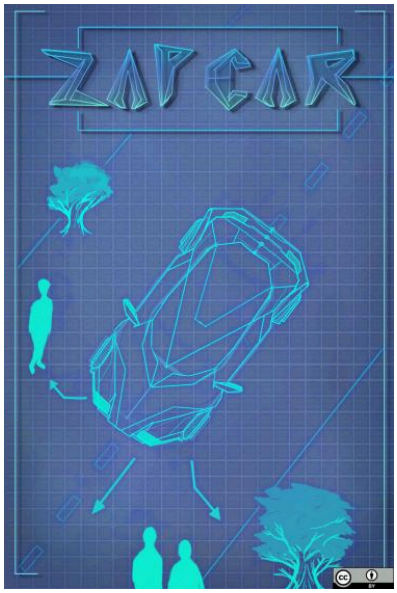
In this short project-based unit, students explore the AI technology that allows cars to drive themselves, read a short story about youth who get into an accident while riding in a self-driving car, and discuss the ethical dilemmas presented by autonomous vehicles. This project culminates in each student creating a video PSA or advertisement in which they express their personal ethical stance on self driving cars.

Duration

Approximately 5 hours. If this module is taught as a standalone project, we strongly recommend that you begin with our **Introduction to AI, Machine Learning, and Ethics**, which takes approximately 100 minutes**.** Note that opportunities for expanding this module are described throughout this document.

AI Story

ZapCar, by Ellie Haberl



Students read and discuss a short story about three students on their way to school in a self-driving ZapCar. When the car cannot avoid an accident and injures a pedestrian, they express doubts about whether the ZapCar behaved ethically, and question their own role and responsibility in the event.

Grade Level and Subjects

8-10 English Language Arts, Social Studies, Computer Science, and combinations
We believe that all projects work best when customized to fit the context of a specific teacher and class. This interdisciplinary project can work well in three different subject areas, but we expect many teachers may wish to take a deeper dive into certain topics based on their own context and expertise. We include rough time estimates for each part of the project, but do so with the understanding that actual times will vary greatly depending on how teachers choose to implement each part.

Student Products

Major Product:
Video PSA or advertisement in which students express their ethical stance on self-driving cars

Interim Product:
Moral Machine Scenario- Students respond to accident scenarios and then create their own to help classmates consider how self-driving cars should behave ethically in an emergency situation.

Sharing With an Authentic Audience
For this short project, students may share their final product within their class, or post videos to a project website that is open to the school and families community, or to the larger public. They could share with a local car dealership that is moving toward (or is) selling smart cars. They could also use their videos to introduce younger students (5th-7th grade) to the topic of self-driving cars, the AI technology that makes them work, and the ethical dilemmas they present.

Standards Alignment

- Common Core Standard Standards (Writing, Speaking/Listening, and Reading):
- W.9-10.3, W.9-10.1, SL.9-10.1, SL.9-10.4, SL.9-10.4, SL.9-10.5, RL.9-10.2, RI.9-10.7

- CSTA K-12 Computer Science Standards:
  3A-IC-24, 3A-IC-25, 3A-IC-30
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- AI4K12 5 Big Ideas:
- This project introduces students to 4 of the 5 Big Ideas- Perception, Representation & Reasoning, Learning, and Societal Impact.
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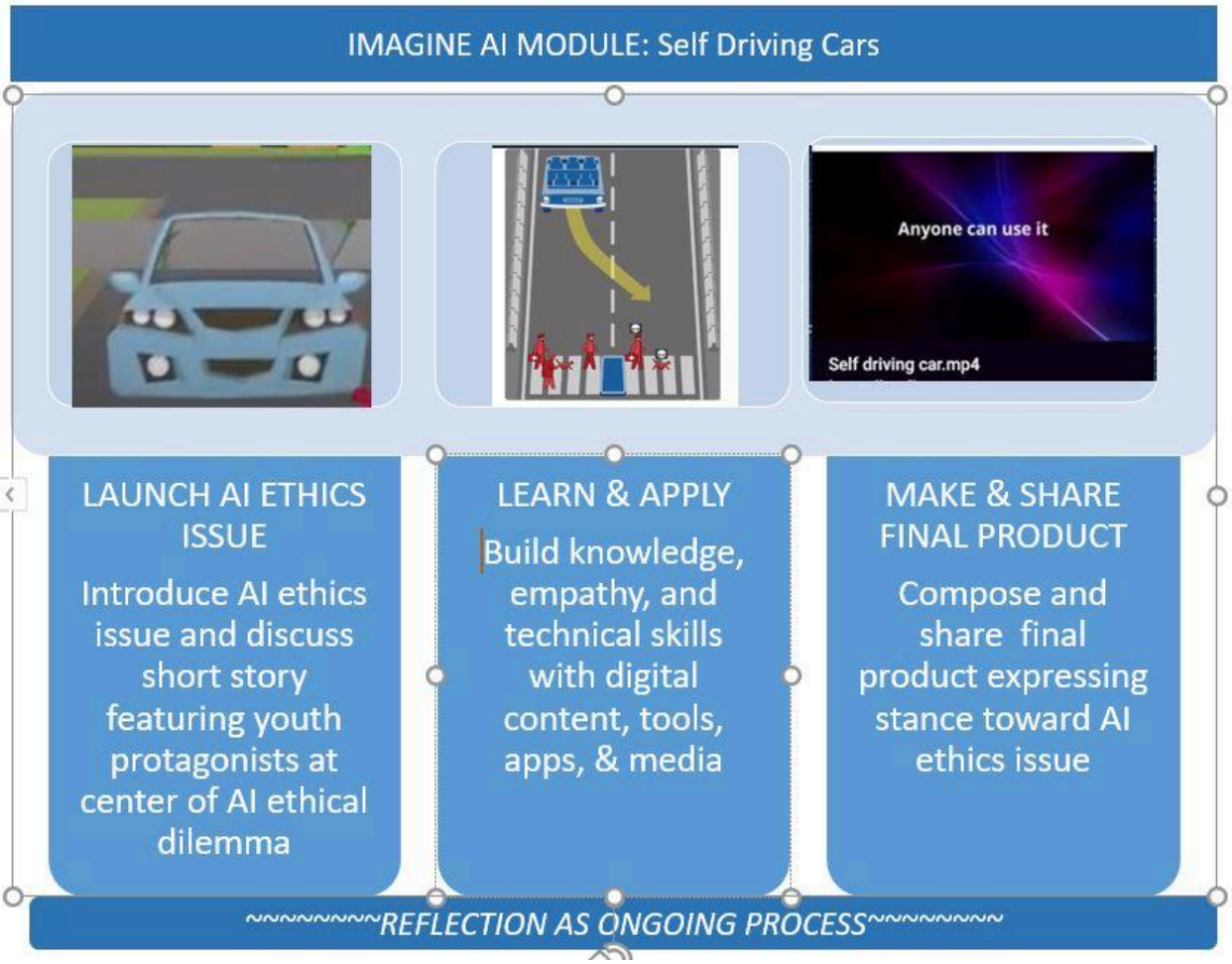
- Colorado CS Standards:
- CS.HS.1.1G, CS.HS.3.5.C, CS.HS.3.5.D, CS.HS.3.5.E



Project Module Phases

Phase 1 Introduction to Computer Vision and the Ethics of Self Driving Cars	**Phase 2** Testing and developing scenarios in Moral Machine	**Phase 3** Developing a video PSA or self-driving car ad Sharing and reflection

NOTE:

If you are teaching this module as a standalone unit, we strongly recommend that you start with our **Introduction to AI, Machine Learning, and Ethics**. This module assumes students are familiar with the ideas presented in that introduction.

Phase 1- Introduction to Self Driving Cars

In this phase students build on what they learned in phase 1 to develop an understanding of how self-driving cars work and the ethical dilemmas they present. They start by learning how machines see, and how self-driving cars use data from different sensors to make decisions.

They then read the short story, *ZapCar*, and share their opinions about whether the car behaved ethically in the accident featured in the story. Next students explore Moral Machine, judging a number of scenarios for themselves, then creating their own scenarios for their classmates to judge. They then move into a broader discussion in which they begin forming a personal ethical stance on self-driving cars.

Essential Questions: How do machines see? How do self-driving cars make decisions? How should self-driving cars behave in an accident? Do the positives of self-driving cars outweigh the negative? **Interim Product:** Moral Machine Scenario	**Consider your context:** In a CS class with access to robotics kits this might be a time to have students build simple autonomous vehicles. In ELA or social studies you might consider who should be responsible when a self-driving car is in an accident?
Key Experiences (with time estimates) Intro to computer vision- 20 minutes Read and discuss ZapCar- 20 minutes Moral Machine Activity- 20 minutes	**Does the Moral Machine (trolley problem) really matter?** Many engineers believe the Moral Machine scenario isn't important for helping us think about self-driving cars because self-driving cars *should* be able to vastly reduce accidents compared to human drivers. What do students think? Is it possible to engineer solutions that make self-driving cars unquestionably superior to human driven cars? Or will debates about how to ethically design self-driving cars never go away?

Phase 2- Developing a self-driving car video PSA or ad

In this phase students develop a video that reflects their personal ethical stance on self driving cars. They may develop a PSA that reflects their hopes and/or concerns regarding how self-driving cars will affect our society or create an advertisement for a self-driving car. The ad may be done in earnest (where a student tries to "sell" an audience on the benefits of their imagined product) or satirically (where students use common tropes from car advertisements to highlight the potential risks of autonomous vehicles).

Because many teachers have experience working with students to create videos, and are adept working with a particular software tool we recommend that you use what is familiar and available to you, building on previous experiences.

Essential Questions: Will self-driving cars help, harm or do both to our society? How can we design self-driving cars to be more ethical? How can I develop a compelling PSA or Video advertisement for my audience? **Product:** Driverless car video ad or PSA	**Consider your context:** In a CS class with access to robotics kits this might be a time to have students build simple autonomous vehicles and connect that experience to their ethics discussions. In ELA or social studies you might dive deeper into the question, "who should be responsible when a self-driving car is in an accident?"
Key Experiences (with time estimates) Intro to designing a compelling ad or PSA- 20 minutes Time for design and revision - 110 minutes	**Who is your audience?** As students design their ads and PSAs it is essential that they consider who is the audience for their videos. The types of images, language and music they choose should be highly dependent on who they are trying to influence.

Phase 3- Sharing and Reflection

In this phase students share their video with a predetermined audience, and reflect on what they've learned about AI and self-driving cars. They have already designed a video intended to influence their audience. Now they have a chance to put that

Essential Questions: How can I share my video with my audience in a way that maximizes its impact? What part of this project was the most interesting or important to me? How might I pursue it further in the future? **Product:** Written reflection	**Consider your context:** Creating products to share with an authentic audience is a core component of project-based learning. In a short project such as this one the audience may simply be classmates. But presenting to an outside audience gives a project a deeper purpose. Could your class use their videos to educate younger students about AI and self-driving cars? Could you connect with a group of experts (AI developers, engineers or video producers) to give feedback on student work

	and discuss the ethics of self-driving cars?
Key Experiences (with time estimates) Preparing to share/ teach- 60 minutes Share with audience- 30 minutes Written reflection- 20 minutes	**Why reflection matters:** We want student learning to go beyond the acquisition of facts. The act of self reflection helps students consider the "so what?" of academic content. It also helps them recognize areas where they have grown, and identify areas for further growth. It works best as a regular routine.

Assessment and Grading
We understand that different teachers, schools and school systems have different requirements and customs for grading student work and providing feedback. With this in mind offer the following general recommendations for assessment:

Key moments to check for understanding
Teachable Machine (in the Introduction)
ZapCar Response Questions
Moral Machine

Key moments for providing feedback
Video development
Preparing to share with audience

Summative assessments
Video ad or PSA
Written reflection

A final note on reflection
We have links to several reflection prompts in the module slides. However, we understand that student reflection is most productive when it is a consistent part of a classroom's procedures and culture. We encourage teachers to continue developing their culture of reflection, either creating their own prompts or using ours, depending on what fits.