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Welcome to the machines

Carnegie Mellon University embarks on a mission to archive the robotics field

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Tech News

In 1997, a group of researchers at Carnegie Mellon University described their latest project with "official stats" on the back of a trading card.

Year: 1996. Model: Pontiac Bonneville. Top Speed: 100+ Autonomous Miles: 5,000+

The card is one in a series that shows how self-driving technology has evolved at CMU. The 1997 card features the seventh "Navlab," or Navigation Laboratory. The first iteration, from 1986, is considered one of the first cars to be controlled by a computer and the start of what is now the autonomous tech industry.

The trading card boasts that the seventh-generation Navlab was the first to be equipped with a realistic driver interface, showing what a driver might see when autonomous capabilities became commercially available.

It's not clear just how many Navlab trading cards there are but a group of researchers at CMU are on a mission to collect the full set.

It's part of a larger initiative to preserve and document the history of robotics at the university, from self-driving cars to soccer-playing robots to the "Trojan Cockroach," a six-legged robot that resembles a larger version of the bug and is considered the first computer-controlled walking machine capable of carrying a human.

In an ever-evolving field that has a tendency to re-purpose machines as quickly as they are built, the clock is ticking to create a record of how robots evolved.

With virtual, interactive exhibits, CMU hopes artifacts like video footage of that giant cockroach taking its first steps or the Navlab embarking on its first mission will help future generations of roboticists, as well as the public, understand how the field got started.

"We've got to say, 'Look, this stuff is going to change the world' and we need to preserve its history to understand where we came from and how we got here," said Chris Atkeson, a roboticist and professor at CMU's Robotics Institute who is helping create the archive.

Steve Mellon/Post-Gazette

The Direct Drive Arm, the first robot arm built at Carnegie Mellon University's Robotics Institute, is on display in the university's Newell-Simon Hall at the bridge to Wean Hall.

A partnership between the School of Computer Science and the University Libraries, CMU launched the Robotics Project in July with its first digital exhibit, called Building the Robot Archive. The exhibit walks visitors through the process of documenting the robotics field and the questions that they are still working to answer. Later on, the project will likely include physical exhibits where visitors can interact with the robots, but organizers stopped short of promising a robotics museum.

"Robotics is a relatively young field," said Katherine Barbera, an archivist who is leading the project. She referenced the founding of the Robotics Institute at CMU in 1979. "In human history, that's a drop in the bucket. But in that amount of time, it has had a massive influence on society.

"It's important for us to start preserving history now before we lose that first generation of roboticists, before we begin to lose those original perspectives, those founding perspectives on the field."

Creating a robotics archive

Mr. Atkeson had long been keeping a record of robotics throughout his 40-year career. But after several fights with the fire marshal about keeping the hallways clear at CMU, it seemed like he would have to find somewhere else to keep the artifacts he had collected.

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Continued from previous page

It didn't seem like many people in the field were "capturing" their work as they went, he said. Most were constantly moving on to the next robot on their mind.

After many conversations with roboticists at CMU, Ms. Barbera said she noticed the same thing: Most people weren't focused on or weren't sure how to preserve the artifacts at scale. Now, she hopes the project will also create a model for other universities or researchers to document both past and future innovations.

Creating that model might look simple from the outside, she said, but it's not as easy as putting a robot in a glass box and keeping it safe from the elements.

First, it isn't always clear what counts as a robot. Often prototypes are made of duct tape and string or pieced together with different materials. They don't start out looking like R2-D2, and deciding how to define a robot is one of the first steps, she said.

Second, the materials aren't consistent and aren't always durable.

"You're talking about the hardware, which degrades physically over time. You're talking about the software, which degrades digitally over time," she said. "You're talking about all these different dependencies that each require a different preservation strategy."

As Mr. Atkeson put it: "How do you keep your toaster in tip-top shape for 100 years?"

"People understand a lot about archiving things that are on paper," he said. "What do you do with a piece of metal?"

Locating materials

The group also has to figure out where all these materials ended up, Ms. Barbera said. Since announcing the project, they have gotten calls from people who worked on a project 20 years ago and have a piece in their garage, or people who have an attic full of artifacts. Some of the large pieces have even ended up on farms where they can find room to store such a large machine.

On top of that, roboticists have a tendency to "cannibalize" their work, she said. In other words, they build a robot, then take it apart again to build a new one.

Now, the members of the group are piecing together the history of robotics without physical evidence of the machines they are trying to commemorate.

"How do you preserve a robot is really the ultimate question that we are tackling," Ms. Barbera said. "What are you preserving if you don't have that object itself? It gets very complex as you dig into some of these issues."

The group often turns to supporting material, like emails, letters, photographs, videos and first-person accounts from the roboticists themselves.

The School of Computer Science has nearly a quarter petabyte of video footage documenting the research process for different projects, Ms. Barbera said. One petabyte is equal to about 1 million gigs of data.

The Robotics Project started as a "ragtag team" in 2019 and has grown to include 15 part-time workers and one full-time archivist.

The CMU Libraries received $150,000 from the Alfred P. Sloan Foundation, based in New York, in February to fund 12 months of research for the robotics archive.

In 2022, the group plans to release a prototype of a digital collection that will go into more detail about some of the inventions the first exhibit touched on, like the Navlab.

Because it is easier to understand and connect with a robot by watching it move and function, the Robotics Project will likely include in-person components and physical exhibits in the future, Ms. Barbera said, but that doesn't mean a robotics museum is coming to Pittsburgh just yet.

"That is the first question everybody asks us: 'So, are you creating a robot museum?' " she said. "Right now, we're really focused on laying the groundwork and beginning to put together these exhibitions...and then we'll see where it goes."

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