Graphene is sort of a scientific rock star, with countless researchers studying its amazing electrical properties and tensile strength and dreaming up applications ranging from flat panel screens to elevators. The single-layer carbon sheets’ stellar qualities are only just being understood in all their capacities, say scientists at Cornell—and researchers are looking at how to guarantee the behavior is even more reliable and consistent. The idea is to code the behavior in a specification of the sort of behavior the robot understands breaking this down to side while walking through the aisles. The commands can be written concisely because the robot understands breaking the store into “regions”—and prepositional statements, such as “between” and conditional statements like “if... then.” “Instead of giving a lot of things to do in order, you give a specification of the sort of behavior it should exhibit at all times,” said graduate student Cameron Finucane, who works on the ITaMO platform. Kress-Gazit’s research is supported by the National Science Foundation CAREER program.

NSF-funded project to test cloud computing for smart grid

A Cornell research team has received a four-year, $9.5 million grant from the National Science Foundation to develop a system for computation and information sharing when designing a “smart electrical grid.” The team, led by principal investigator Ling Tong, the team, and Joan Jacobs Professor of Engineering, is exploring the computational aspects of how to manage the changing electrical grid, or so called “smart grid,” which is evolving due to a growing need to integrate renewable energy systems. The team will study a cloud-computing architecture for scalable, consistent and secure operation of smart grids, and novel stochastic optimization techniques for future energy systems. Among their goals is to develop new software tools for cloud platforms that can enhance electrical grid performance. The project is structured to allow for a large and most complex cyber physical systems in the world, according to the project team’s proposal. The grid consists of thousands of generators and substations, linked by transmission and distribution networks. But these once-engineering marvels are being challenged by a worldwide effort to mitigate climate change by going beyond existing grid structures, the proposal states.

“The fundamental question is, where should computation be done?” Tong said: “locally, centrally, what are the types of information that need to be shared at different locations, can we make things consistent, and is computing cloud a viable platform for something like the smart grid?”

Cornell collaborators on the project are Bob Thomas, professor emeritus of electrical and computer engineering; Ken Birmann, the N. Rama Rao Professor of Computer Science, and Tim Mount, professor of applied economics and management. The team also includes collaborators from the University of California, Berkeley and Georgia State University.

CAMPUS RESEARCHERS GET A PRIVATE CLOUD

Suppose you need just a little bit of computing power for a long time or a huge amount for a short period. What do you do? If you’re the Center for Advanced Computing (CAC) at Cornell, you might worry to buy and maintain your own server. So the Center for Advanced Computing (CAC) has launched Red Cloud, a on-demand service available by subscription. Two Red Cloud services are available. The basic offering provides hosting for Adobe and virtual servers and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe and virtual desktops on Dell PowerEdge C servers with 50GB of storage space, with web software applications like Adobe Cloud, which allows subscribers to run the MATLAB numerical computing environment and its graphical extension Simulink on a computer cluster. The Red Cloud environment for MATLAB includes NVIDIA graphics processing units for improved performance. Subscribers program applications on their desktops by making computing, software and data resources more readily available at an economic scale said CAD Director David Liska. To learn more visit http://www.cs.cornell.edu/coolcloud

―Bill Bole

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STRUCTURED ENGLISH BRINGS ROBOTS CLOSER TO EVERYDAY USERS

Joan Jacobs NSF-funded project to test cloud computing for smart grid

Move, listen. A humanoid robot named Mae is traipsing around Cornell’s Autonomous Systems Lab, guided by plain English instructions and sometimes even appearing to get frustrated.

Mae understands and executes English commands, thanks to a toolkit and a software suite called Linear Temporal Logic Mission Planning (ITaMO) being developed in the lab of Hadas Kress-Gazit, assistant professor of mechanical and aerospace engineering. According to Kress-Gazit, the future of robotics is in the ability of robots to easily understand everyday users and act reliably in unpredictable situations. “The big picture is that we want to have anybody tell the robot what to do,” explained Kress-Gazit, who studies how to create perfectly correct, high-level behaviors for robots. “You don’t have to have a programmer who’s been doing the job forever to have to write the code for every single behavior, as is currently done in the field. You want to take what someone said and automatically generate the code for the robot to successfully accomplish its task.”

The ITaMO toolkit combines logic, language and control algorithms. The group has invented the algorithms by getting Mae, a 2-foot robot NAO humanoid made by Aldebaran Robotics, to simulate looking for missing items in a grocery store while also avoiding spills and the aisles. Depending on what she finds, the robot takes action based on the specifications that were given to her.

The “store” is located in the Rhodes Hall Autonomous Systems Lab. Mae knows how to react in certain situations—for example, if a “missing item” is encountered, she alerts a manager. If she sees a “spill,” she’ll avoid the area.

Traditionally, a controller for the robot was written by complex tasks requiring specifically programming the robot to react in every conceivable state it may find itself in. This is the tedious and error-prone nature of robotics today, researchers say. There’s no guarantee that the code has accounted for every situation, and that it will work. There’s also no guarantee the behavior is even possible.

For their work, the Cornell researchers are looking at how to provide explanations to the user when, for whatever reason, a task cannot be done. That kind of feedback from the robot does not exist in robotics today, Kress-Gazit says.

In ITaMO’s high-level specification can be written in structured English. For example, Mae demonstrates her understanding of structured English commands during a demo in Rhodes Hall. Background from left: graduate student Isai Raman, Ann Jing and Cameron Finucane stand with Hadas Kress-Gazit.

Mae is told to visit all the corners of the “store” and to look side to side while walking through the aisles. The commands can be written concisely because the robot understands breaking the store into “regions”—and prepositional statements, such as “between” and conditional statements like “if... then.” “Instead of giving a lot of things to do in order, you give a specification of the sort of behavior it should exhibit at all times,” said graduate student Cameron Finucane, who works on the ITaMO platform.

Kress-Gazit’s research is supported by the National Science Foundation CAREER program.

Graphene is a two-dimensional atomic layer of carbon atoms arranged in a honeycomb lattice. It is the thinnest material in the world and can conduct electricity 100 times faster than copper. Graphene has levels of electronic and mechanical properties that make it an attractive material with a range of potential applications. The basic offering is that scientists in the lab can study graphene’s present and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future. The article made the cover of the printed journal and future.

Graphene has gone from an oddity in a physics lab to something that can be practically incorporated into a variety of potential devices,” said. “The ability to fabricate things in these ways, to integrate them and to use them for different types of sensors, physical and chemical, is quite a step forward in a short time, and our device group is one of the many that is leading the way.

The authors’ work is supported by the National Science Foundation.

―Anne Ju

A fake-eye microscopy image of a 30-by-30 micron square of graphene. Cornells silicon-based readout is a square that is 100 atoms thick with remarkable mechanical resonators. These devices, which are the thinnest possible microelectromechanical systems and are useful for sensing and signal processing, can now be batch-fabricated as a result of recent advances in graphene fabrication technology.