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TEDTalk Tuesdays



Invasion of the flying robots

By **Richard Galant**, CNN

updated 10:12 AM EST, Sun March 4, 2012

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Vijay Kumar: Robots that fly and team up

STORY HIGHLIGHTS

- Vijay Kumar demonstrated fleets of flying robots that could revolutionize industries
- Kumar spoke at the TED2012 conference, "Full Spectrum," in California
- Talks highlighted the contrast between technological progress and social issues
- Technology has improved health, lifespan, productivity, yet it poses challenges, speakers said

Long Beach, California (CNN) -- It was after the robotic hummingbird flew around the auditorium -- and after a speaker talked about the hypersonic plane that could fly from New York to the West Coast in 11 minutes -- that things got really edgy.

Vijay Kumar, an engineering professor at the University of Pennsylvania, showed the more than 1,300 attendees at last week's TED conference several videos in which fleets of tiny flying robots performed a series of intricate maneuvers, working together on tasks without colliding or interfering with each others' flightworthiness.

It seemed that, at least for some in the audience, a bridge had been crossed into a new era of technology, one that could change the way we think about robots and their application to such fields as

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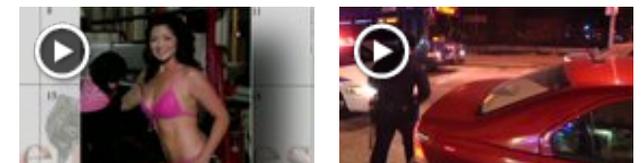
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construction, shipping and responding to emergencies.

Kumar's devices (he calls them "Autonomous Agile Aerial Robots") cooperated on building simple structures and showed they were capable of entering a building for the first time and quickly constructing a map that would allow for assessment and response to a structural collapse or fire.

He held up one robot, designed by his students Daniel Mellinger and Alex Kushleyev, which weighs a little more than a tenth of a pound and is about 8 inches in diameter. The device has four rotors; when they spin at the same speed, the robot hovers. If you increase the speed, Kumar explained, the robot flies up. Spinning one rotor faster than the one opposite it causes the robot to tilt. It also can flip over multiple times without losing its ability to fly and can recover its stability when thrown into the air.

The robots are capable of learning trajectories and maneuvers that can enable them to literally fly through hoops -- and other confined spaces.

When the robots are formed into a flotilla, they calculate (a hundred times a second) and maintain a safe distance between them. He showed a video of 20 robots flying in a variety of formations -- and moving through obstacles -- inches from each other without interfering with the stability of their neighbors.

To cap his presentation, he showed a video, created by his students in three days, of nine flying robots playing the James Bond theme on musical instruments.

TED began in the 1980s with the intention of focusing on "Technology, entertainment and design," and its conferences typically are sold out, attracting an audience of high achievers willing to pay \$7,500 to attend. TED, a nonprofit, makes many of the talks freely available on [its site](#). (CNN has a partnership with TED in which it regularly publishes selected TED Talks).

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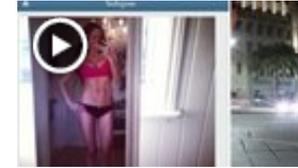


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TED aims to feature cutting-edge technology at its conferences, and this year's event, labeled "Full Spectrum," was no exception. Yet the uneasy balance between technology and the social issues it spawns seemed to be highlighted more than ever as speakers took the stage to give their talks (and be filmed by eight high-def cameras for eventual viewing on the web).

In the first session Tuesday, a sharp contrast was drawn between the unbounding optimism that a technological solution could be found for every one of the Earth's problems and a vision of a planet headed for doom due to mankind's inability to control its inventions and its consumption.

Paul Gilding, former head of Greenpeace, declared "the Earth is full, full of us, full of our stuff, full of our waste and full of our demands," and warned of harsh and potentially violent disruption ahead as the reckoning comes for a planet living beyond its means. The idea that the planet can sustain 9 billion people without making disruptive changes is wrong, he said.

**The Earth is full,
full of us, full of
our stuff, full of
our waste and full
of our demands.**

Paul Gilding

”

Peter Diamandis, founder of the X Prize, countered with a catalogue of the ways [technology has radically improved our lives](#) -- it has lengthened the human lifespan, conquered many killer diseases, expanded economic opportunity and made possible a worldwide web of communication, already connecting 2 billion people, with 3 billion more on the way to logging in this decade.

"Technology is a resource-liberating force," he said, maintaining that a planet bathed in solar energy and covered with water won't lack the ingredients for a productive life.

For every tech evangelist, though, there was a cautionary note sounded by other speakers.

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Feels Like I'm Floating.

I'm so much lighter and less bloated now it feels like I'm on the moon

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NASA scientist [James Hansen](#), one of the leading voices warning of global climate change due to carbon emissions, presented an urgent case for taking action to deal with the effects of economic activity before ice caps melt and cities get inundated by dramatic rises in sea level.

But an MIT professor, [Donald Sadoway](#), offered reason to hope that the use of non-carbon-emitting solar and wind power could become much more widespread through a new battery technology he and his students are developing to store power for use at times when the wind stops and the sun sets. Sadoway, whose work has attracted an investment from Bill Gates, said successful use of his "liquid metal battery" could reduce the need for new fossil-fuel burning power plants.

Technology is a resource-liberating force.

Peter Diamandis



Regina Dugan, who demonstrated the robotic hummingbird and directs the [Defense Advanced Research Projects Agency](#), talked of research on a prosthetic arm controlled by thoughts alone, of sturdy cars built with metals lighter than Styrofoam and of a robot that can run like a cheetah.

[TED.com: Susan Cain on the power of introverts](#)

And yet technology didn't seem to have a solution for the problems highlighted by Bryan Stevenson, director of the [Equal Justice Initiative](#). He talked of the rise in the number of imprisoned Americans from 300,000 40 years ago to 2.3 million today, the large number of black Americans who have been permanently deprived of their ability to vote due to prosecution on low-level drug offenses and the question he said is posed by the death penalty -- not whether criminals deserve to die, but whether America as a society, deserves to kill.

Stevenson's talk drew a standing ovation -- and the following day, after TED curator Chris Anderson appealed for funds, Anderson

said \$1.12 million had been raised for Stevenson's nonprofit on the spot.

A longtime enthusiast for digital technology, MIT professor Sherry Turkle, spoke of being on the cover of Wired magazine when her book "Life on the Screen" was published in the 1990s. In her new and darker book, "[Alone Together](#)," she writes of everyday family and social relationships put at risk by the compulsion to interact constantly with mobile devices as a substitute for face-to-face interaction.

People text during board meetings, shop and text during class, and even text during funerals, she said. Technology gives us the illusion of being constantly in touch with people, yet we shirk the real demands of friendship. And Turkle pointed out that Japanese researchers are developing robots to provide care to the elderly and to children.

As if to emphasize her point, a day after her talk, Danish scientist Henrik Scharfe demo'ed [Geminoid-DK](#), a shockingly realistic robot version of himself. While its movement and speech is limited, the robot's technology is likely to evolve quickly.

And so it seemed that it wasn't only in jest that Scharfe said, "Ten years from now, I'll be at home having a beer in Denmark and the robot will come to TED to give a talk."

Scharfe said after his talk that he recognized the dangers Turkle talked about, but he thought developing the robot was well worth doing.

"This can never be about replacing the human being," he said in his talk, "but about using technology to understand the full spectrum of being human."

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7685540 · 2 years ago

If its remote control killing, no doubt the U.S. will be looking into it.

28 ^ | ▾ · Share ›



Wastrel Way → 7685540 · 2 years ago

You should probably let us know the area code, too, so we don't call you by accide

13 ^ | ▾ · Share ›



tonizek → 7685540 · 2 years ago

no brain

5 ^ | ▾ · Share ›



GEMSoFwisdom → 7685540 · 2 years ago

If they didn't, they wouldn't be doing their job. Yes, it would be nice if we could all si
sing Kum by ja, but until that time I want the US to have the best weapons we can c
very much.

3 ^ | ▾ · Share ›



Dennis → 7685540 · 2 years ago

There's no doubt that some sick, power hungry elitist defense contractor is coming
people. That's what they do.

3 ^ | ▾ · Share ›



GEMSoFwisdom → 7685540 · 2 years ago

Dear Dennis, Would you rather our troops use a slingshot against a AK-74?

1 ^ | ▾ · Share ›



PatriotEagle → 7685540 · 2 years ago

Um the US invented this technology just like we've invented almost everything else known. So yeah I'd say the US will be looking into it.

^ | v · Share ›



Spencer Tomczak · 2 years ago

I like the part where they play a little song at the end before killing us.

18 ^ | v · Share ›



Dennis → Spencer Tomczak · 2 years ago

ED-E from Fallout New Vegas is a hover-bot that plays music before blasting enerr

2 ^ | v · Share ›



Kathryn Lowen → Spencer Tomczak · 2 years ago

And who knew hillbilly wingnuts paid any attention to TED!? Oh that's right, they do "movin' pitchers"!

1 ^ | v · Share ›



PatriotEagle → Spencer Tomczak · 2 years ago

2nd Amendment doesn't look so bad anymore to you liberals now does it? Who's g from flying robots now? Our oh so evil warmongering military, or the oh so evil "arr police?

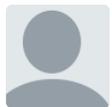
1 ^ | v · Share ›



TripleA60 → Spencer Tomczak · 2 years ago

You made me spit all over my puter... Now that was funny, thank you

^ | v · Share ›



Csense01 · 2 years ago

Lame....are some of the posts that have zero understanding of the complexity of the softwa has been achieved and the possibilities that can take the drudgery out of peoples lives, car Please go play with your Duplo.



LarryW → Csense01 · 2 years ago

The same things have been said at least since the mid-19th C. Every technological advancement to make life better with less drudgery. I can remember when it was claimed that the time and paper and make it possible for Americans to work only 10 or 20 hours a week.

10 ^ | v · Share ›



jahudini · 2 years ago

It is Diabolic for people to ridicule such technological advancement. That a robotic aerial camera with various dimensions and topologies, and implement it in real time it amazing. Am a Mathematician ; intelligence(algorithms) actually bringing Euclidean/non-euclidean spaces out of paper or blackboard. Such in air with the use of a robot is a testament to man's advancement. GOOD JOB!

12 ^ | v · Share ›



Angryman1 · 2 years ago

600 calculations a second. 8 inches in diameter. Autonomous. And Flying. How can anyone believe that?

12 ^ | v · Share ›



Max_says · 2 years ago

Technology is the only thing which is getting better. Every thing else is getting worse.

People, climate, water, air, politics !!

12 ^ | v · Share ›



littledaemon → Max_says · 2 years ago

and values..

^ | v · Share ›



erwinbw · 2 years ago

Sorry, saw a headline about "flying robots" and thought this had something to do with liberation.

My fault.

11 ^ | v · Share ›



Max_says → erwinbw · 2 years ago

Typical conservatives !!

14 ^ | v · Share ›



Dennis → erwinbw · 2 years ago

Left/Right Keep clawing at each other. Try being American for once.

4 ^ | v · Share ›



hopalong → erwinbw · 2 years ago

Constantly proving that conservatives just don't get, can't do, humor. It make no se desperate.

3 ^ | v · Share ›



IrishYank2 → erwinbw · 2 years ago

That makes absolutely no sense.

2 ^ | v · Share ›



avis007 · 2 years ago

Great Presentation Vijay !!! Lets hope they do useful things in future

11 ^ | v · Share ›



JimiAtlas · 2 years ago

Very impressive and the future applications are very clear. I am sure that Professor Kuma presentation with a trip to White Castle.

9 ^ | v · Share ›



ActivistJudg · 2 years ago

You naysayers will be singing a different tune when the honeybee is extinct and swarms of technology are responsible for agricultural pollination and keeping your food costs down ar and eating your neighbors.

9 ^ | v · Share ›



tonizek · 2 years ago

Amazing

9 ^ | v · Share ›



null · 2 years ago

I love this stuff...see what humans can do when we are being creative, not negative, and u: not evil?

8 ^ | v · Share ›



thedeaftalk → null · 2 years ago

yea thats what Spy-net thought to and then they created the terminator

9 ^ | v · Share ›



Sybaris · 2 years ago

"Skynet begins to learn at a geometric rate. It becomes self-aware at 2:14 a.m. Eastern tin

6 ^ | v · Share ›



Roberto Lituano → Sybaris · 2 years ago

Maybe we are already product of the machine mind, sort of Matrix projection... Just later you wont freak out, after waking up wired on a Starship or some underground

^ | v · Share ›



GEMSoFwisdom · 2 years ago

Simply amazing! The advancement in just the last few years boggles the mind. I hope to h years to come. Yes, some people will see only toys, others will only see new weapons, the jeer, but the truly wise will see applications to help mankind in ways we can't even dream c gentlemen.

6 ^ | v · Share ›



LostinSLC · 2 years ago

Is he changing the name of his company to Skynet by chance?

5 ^ | v · Share ›



enemyofdogma · 2 years ago

No practical applications? Thats really shortsighted. There are plenty of situations where s robots would be useful. Rescue, security, intelligence gathering...

5 ^ | v · Share ›



Emesis · 2 years ago

Kind of reminds me of the spiders in Minority Report.

5 ^ | v · Share ›



BobMc → Emesis · 2 years ago

Well that was just a preview of the future.

1 ^ | v · Share ›



Guest · 2 years ago

The bee populations have been decreasing steadily, perhaps Dr.Vijay Kumar can create s robots that can pollinate crops automonously until the bees hopefully make a comeback.

5 ^ | v · Share ›



GEMSofwisdom → Guest · 2 years ago

You know that's not such a bad idea. Bees need an area with lots of water, in area fewer bees. They may not replace bees but there is nothing wrong with helping the

1 ^ | v · Share ›



BMick · 2 years ago

Oh CNN, sometimes you know just what to name your articles in order to make me open t

4 ^ | v · Share ›



Apatheist · 2 years ago

These robots seem less robotic than most Americans these days.

4 ^ | v · Share ›



zlop · 2 years ago



GOOD video -- BUT in the article

Why include Global Warming Fraud Promoters ??

4 ^ | v · Share ›



Beancrock → zlop · 2 years ago

Because only uneducated rednecks think global warming is a hoax. The technology is better than that.

6 ^ | v · Share ›



zlop → Beancrock · 2 years ago

In the current Saturated state of the atmosphere -- Given an extra variable (atmosphere minimizes internal energy -- maximizes cooling)
"Greenhouse Gases in the Atmosphere Cool the Earth"

2 ^ | v · Share ›



Roberto Lituano → zlop · 2 years ago

Yeah its interesting how they want people to feel guilty and don't mention a lot, that corporate based!

1 ^ | v · Share ›



zoonib · 2 years ago

There is some great advances here and thinking. Firemen looking for survivors in burning I think, search and rescue if the range could be increased. Send 5000 of these looking for a I think awesome. If we could get these working on solar they could fly long range out doors.

4 ^ | v · Share ›



Roberto Lituano → zoonib · 2 years ago

Its much cheaper to install nano chip, anything for a Big brother, because we are so

2 ^ | v · Share ›



longtooth · 2 years ago

Can I have a robot wife? My real wife has too many of her own opinions.

4 ^ | v · Share ›



Tom Weiland → longtooth · 2 years ago

This thing already does more than my wife just by moving across the room!

2 ^ | v · Share ›



Meggie24 → longtooth · 2 years ago

If they could figure out how to make v!brators that earned decent money, then we v all.

1 ^ | v · Share ›



John Smith · 2 years ago

Imagine having these little guys look for people in an emergency situation like an earthquak times we live in.

3 ^ | v · Share ›

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