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Tiny flying robots! Meet the quadrotor

By **Jeremy Bradley**, CNN

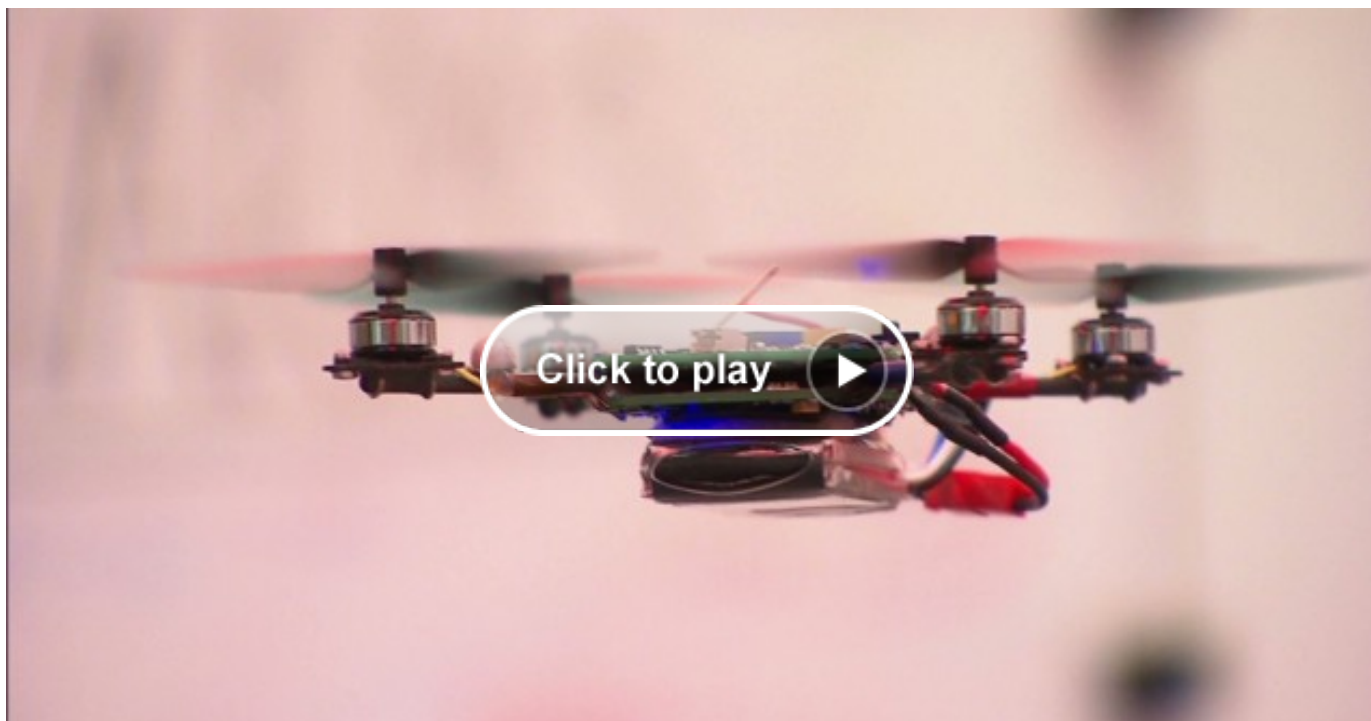
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Tiny robots fly in formation

STORY HIGHLIGHTS

- At Penn lab, researchers have created small aerial robots
- The quadrotor takes commands but is programmed to decide how to do them
- A YouTube video of quadrotors playing the James Bond theme reached millions
- They were used in post-earthquake Japan to investigate damaged buildings

(CNN) -- It's a mesmerizing, surreal scene. Eight tiny, unmanned aerial vehicles -- called quadrotors -- begin to rise from the ground in unison.

They hover at eye level, filling the room with a heavy buzzing sound. Then they move through a makeshift window, one at a time, and reform as a group on the other side.

This isn't happening on a Spielberg set, and it isn't science fiction. These real-life flying robots are at the University of Pennsylvania's [General Robotics, Automation, Sensing and Perception Lab](#).

"This is a robot that's completely autonomous," said doctoral student Matthew Turpin, "and by that I mean there's no remote control in the background."



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The lab is a mechanical engineer's dream. Quadrotors in all shapes, sizes and colors -- and in various degrees of assembly -- cover nearly every surface. Shelves line the walls, filled to the brim with tools and toys.

Most noticeable is the lab's state-of-the-art Vicon motion-capture system. Infrared cameras placed throughout a test-flying area communicate with tiny sensors on the quadrotors, feeding into a computer-based navigation system.

"We have the Vicon system, or the red lights, which allow us to figure out where the robot is," Turpin explained. "Then we're able to send it commands about what we'd like it to do and group behaviors that you'll see."

Turpin gives the quadrotors simple instructions via computer, but the vehicles decide how to get from Point A to Point B on their own. The results are a dazzling display of formations, from spinning in circles in midair to navigating obstacles in sync with each other.

Other quadrotors at the GRASP Lab have worked together to [carry cargo and build structures](#).



"These robots are able to pick up these simple, almost LEGO-like bricks, and they're able to carry them from one location to another," Turpin said.

But perhaps the quadrotors' most memorable moment was when they played instruments to [perform the James Bond theme song](#). The video has more than 3 million views on YouTube.



As much fun as Turpin and his colleagues seem to be having, he says their ultimate goal is to put quadrotors to good use outside the lab.

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Want a robot? Try your iPhone



After the 2011 earthquake in Japan, a team from the University of Pennsylvania and Tohoku University in Sendai took quadrotors into the disaster zone. Led by Vijay Kumar, a former GRASP Lab director and professor at Penn, they achieved some remarkable accomplishments.

Among them: sending quadrotors -- equipped with cameras and lasers -- into an unstable building to see what sort of information they could gather.

"We went into a collapsed building; we mapped three floors," Kumar said. "We got three-dimensional maps, and we were able to show that this sort of thing is feasible today."

Quadrotors could also use sensors to detect radiation levels and other biological hazards, Kumar said. That could help keep first responders out of harm's way.

"Clearly, humans will always have a role to play in emergency response for law enforcement," Kumar said. "But if there's an emergency, if there's a 911 call, the question is, do you want a human dashing off to respond to it right away?"

Kumar also saw an opportunity for quadrotors to be used when law enforcement was close to apprehending a suspect in the Boston bombings.

"After the tragic incident in Boston, you saw that robot actually ripping away the canvas on top of the boat to try to look behind the cover" for the suspect, he said, "It's an excruciatingly, painfully slow operation. What we'd like to do is accomplish these tasks really quickly."

There are plenty of positive uses for quadrotors. But the concept of stealthy, camera-toting robots does cause concern for some people.

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Kumar often fields questions about misuse of the technology and privacy concerns.

"I think we should engage in a public dialogue about when to use them, what the potential benefits are, and recognize that we can protect ourselves against abuse of these devices -- as opposed to saying 'we don't want to develop this,' " he said.

For now, most of the research on these robots is still done in the lab. But you could say their potential is sky high.

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Maxomega · 7 months ago

Now, they fly in pretty formations.
Next, they hunt for Sarah Connor.

120 ^ | ▾ · Reply · Share ›



Richard Bergstrom → Maxomega · 7 months ago

Then, they help Sarah Connor.

13 ^ | ▾ · Reply · Share ›



Riley Martin → Maxomega · 7 months ago

This uh technology is quite uh obviously the work of the Targzissians. Do not uh ha with these uh beings. Do you understand?

13 ^ | ▾ · Reply · Share ›



Count Von Count → Maxomega · 7 months ago

Do they make any that look like bats? Ah! Ah! Ah!

8 ^ | ▾ · Reply · Share ›



Michael Cohen → Maxomega · 7 months ago

Blame it on a young middle eastern, then kill him. It seems to work for everything. I

blame it on a young middle eastern...then kill him. It seems to work for everything. I
any US government official. I think the doctrine is named WYRFCT 420

1 ^ | 7 v · Reply · Share ›



Giorgio A. Tsoukalos → Michael Cohen · 7 months ago

No, when one is confronted with the overwhelming evidence then one has to
that this is the work of ancient astronauts.

11 ^ | v · Reply · Share ›



fnugget → Michael Cohen · 7 months ago

I tried looking it up, but got no results. Google suggested a few corrections.

Did you mean WHARF CAT?

5 ^ | v · Reply · Share ›



Bob Marshal · 7 months ago

Robots can work in factories and go to war but they do not have a voice in our system. We
and grant suffrage to the robot masses.

22 ^ | 1 v · Reply · Share ›



phlpdvs → Bob Marshal · 7 months ago

If corporations are people too, why not robots?

10 ^ | v · Reply · Share ›



Richard Bergstrom → Bob Marshal · 7 months ago

"A whole generation of disposable people." - "Measure of a Man", Star Trek TNG

4 ^ | v · Reply · Share ›



SilentBoy741 → Richard Bergstrom · 7 months ago

I think that's also the Wikipedia definition of "reality TV".

2 ^ | v · Reply · Share ›



EchoAgent1 → Richard Bergstrom · 7 months ago

Starfleet is not an organization that ignores its own regulations when they b

1 ^ | v · Reply · Share ›



Guest → EchoAgent1 · 7 months ago

Its a quote from the episode the other poster mentioned

^ | v · Reply · Share ›



1nd3p3nd3nt → Bob Marshal · 7 months ago

they owe us for bringing them into existence.
the nice thing about being the creator :)

4 ^ | v · Reply · Share ›



Paul Harper → 1nd3p3nd3nt · 7 months ago

will they give us credit or blame?

2 ^ | v · Reply · Share ›



Michael Wolf → Bob Marshal · 7 months ago

Once the Three Laws of Robotics are indelibly engraved into every robot's OS ...

2 ^ | v · Reply · Share ›



materic · 7 months ago

the day I see one flying over my back yard is the day I own its crashed remains. . .

38 ^ | 4 v · Reply · Share ›



Gerald Spencer → materic · 7 months ago

Be sure you own the air rights, in many places people can not even claim or capture comes down over their property, most people do not own air rights or mineral rights municipality.

4 ^ | v · Reply · Share ›



Weston Moss → Gerald Spencer · 7 months ago

That's accurate, but its not right.

5 ^ | v · Reply · Share ›



RealVoiceOfReason · 7 months ago

I've been using mine, that I developed ten years ago, to spy on my local law enforcement. watching them eat doughnuts after a few minutes.

9 ^ | v · Reply · Share ›



Michael Frye · 7 months ago

WOW - this is really old news. I think I remember seeing this last year, and now - not so in

7 ^ | v · Reply · Share ›



SilentBoy741 → Michael Frye · 7 months ago

Me too, though the first time, I was impressed. But that was because its creator had a deceased cat, and was flying it around the room. Tell me you can look upon that as having finally arrived.

4 ^ | v · Reply · Share ›



Richard Bergstrom → Michael Frye · 7 months ago

Says the guy giving himself two thumbs up in his pic... harsh.

2 ^ | v · Reply · Share ›



WeThePe0ple → Michael Frye · 7 months ago

I'd consider it news if the AR Drone wasn't available to consumers as a toy already but the basic technology being used is not new nor is the idea.

2 ^ | v · Reply · Share ›



Bob Marshal · 7 months ago

A few days ago a fraudulent tweet saying a bomb went off at the WH caused a selloff of the caused by automated systems monitoring all forms of communication and a programmed Let's hope we haven't put such automated "Safeguards" on our missile systems. As nerdy seem to be getting closer to that "Judgment Day" society.

6 ^ | v · Reply · Share ›



maelfatiel → Bob Marshal · 7 months ago

Not every news story is about bombs, Bob.

^ | v · Reply · Share ›



Guest · 7 months ago

SkyNet has arrived.

6 ^ | v · Reply · Share ›



1nd3p3nd3nt · 7 months ago

innovation is here

our economy as we know it will not survive

our society is going to change, we better start mentally and emotionally preparing ourselves

the robotic revolution is coming

5 ^ | v · Reply · Share ›



Quasi Hedron → 1nd3p3nd3nt · 7 months ago

Won't be long now till paper money and coinage will disappear. Your cell phone will

^ | v · Reply · Share ›



TrevT · 7 months ago

These reminded me of those mapping orbs from Prometheus. This would be a great way to map (Afghanistan).

4 ^ | v · Reply · Share ›



maelfatier → TrevT · 7 months ago

Again with that war mentality. For as much as we complain about the state of the world, it's awful lot.

2 ^ | v · Reply · Share ›



SaurabhWorld → TrevT · 7 months ago

Time for the US to get out of others' caves.

1 ^ | v · Reply · Share ›



Scott Bast · 7 months ago

Maybe they'll find Jimmy Hoffa



4 ^ | v · Reply · Share ›



nsurround · 7 months ago

This type of technology (incl drones) is a civil liberties nightmare. This is taking us straight where you are always being watched or monitored. It is surprising that there are so many v amendment rights but pay little attention at all to the rights that are or will be taken away frc amendment. There are some local communities now addressing this issue with their polic however a national conversation needs to start dealing with this in a meaningful way and s else can build it and what might they do with it?

6 ^ | 1 v · Reply · Share ›



Scott L → nsurround · 7 months ago

You're being watched and monitored now, I hardly see this as a big change...

1 ^ | v · Reply · Share ›



nsurround → Scott L · 7 months ago

Yeah I hear you, but this could get a lot worse and is a big deal now and in t

2 ^ | v · Reply · Share ›



maelfatiel → nsurround · 7 months ago

Not really

^ | v · Reply · Share ›



maelfatiel → nsurround · 7 months ago

I can think of all sorts of nightmarish things. But I'm pretty sure that its just a fluff pe

^ | 1 v · Reply · Share ›



HRABX → maelfatiel · 7 months ago

The problem is that society is not keeping up with technology. Law enforcer get a barrage of new toys every year (thanks to DARPA) without any laws b use. The proper use of the taser is still being argued in court cases years a started using them - boundaries for drone surveillance and assault is far off wait for boundaries and guidelines to be defined in court the tech industry pi

in to the mix every year. Is this bad? I don't know. Seems good from a comr standpoint. But I wouldn't criticize anyone for having some fear about misus age in the legal system.

^ | v · Reply · Share ›



ProfLogie · 7 months ago

Just wait until some nut ads a gun or explosives. Weaponized drones are not a governmer

3 ^ | v · Reply · Share ›



maelfatiel → ProfLogie · 7 months ago

I'm sure its already been done

^ | v · Reply · Share ›



iceman777 · 7 months ago

Saying the potential is sky high, translates into the military and law enforcement will have fi using the technology.

3 ^ | v · Reply · Share ›



pillsforall3 · 7 months ago

Another quad rotor article? Ok we get it they fly around in patterns. Cool.

5 ^ | 1 v · Reply · Share ›



diavolomac · 7 months ago

This is as scary as it is awesome.

2 ^ | v · Reply · Share ›



NotYoDaddy · 7 months ago

George Orwell just keeps laughing at us from beyond.

2 ^ | v · Reply · Share ›



AlexP → NotYoDaddy · 7 months ago

It is scary. But even more scary, is the fact that majority have no idea who the Geo Brother" means.

6 ^ | v · Reply · Share ›



dhartm2 → AlexP · 7 months ago

Mother should I trust the government?

^ | v · Reply · Share ›



Goondo · 7 months ago

they can also programmed to carry bombs and detonate at a designated place autonomou

2 ^ | v · Reply · Share ›



Chris J → Goondo · 7 months ago

If we invested 10% of what we spent on the F35 JSF into a project like that, we cou
tens of thousands of these things.

I calculated once, the amount of money we spent on the F35 JSF programs could |
Predator drones (not counting the cost of the operators, support, maintenance, etc
predator drones invading a country in a swarm-like pattern.

3 ^ | v · Reply · Share ›



Bob Marshal → Chris J · 7 months ago

I am not sure if I think that is cool or just scary. I'll go with scary cool.

6 ^ | v · Reply · Share ›

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