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How Robots Could Explore Other Worlds

FOXNews -

The airship **could** look even closer at a region to find the best landing site, and finally drop a rover or some **other** surface **explorer**. ...

Oscar-winning cinematographer revolutionizes film industry

Kviv Post, Ukraine -

The ?Russian arm? has been used for more than 10 years and helped create blockbusters like Batman, Titanic, War of the **Worlds** and many **other** movie hits. ...

Luc Bernard's Pitch For A Castlevania-Like Game On WiiWare

WiiWare World, UK -

Where the player has this huge **world** to **explore** and can only access new areas with the right weapon or new ability. The main game is expected to be 10 hours ...

The Weekend Warrior: July 2 - 6

ComingSoon.net - Jul 1, 2008

Unlike the Superman and Spider-Man movies, these are reluctant and imperfect heroes, three from the world of comics, and one an original concept, ...

10 PC gaming classics - get your nostalgia on!

Den Of Geek, UK -

Perhaps it **could** be set in a fantasy **world** populated by a mish-mash of mythological creatures, with different playable factions to meet everyone?s demands. ...



'The Prodigal Tongue'

Wall Street Journal - Jun 27, 2008

So were millions of **other** people in dozens of countries?this had been the **world's** top-selling album in 2005. One day I came across a futuristic, ...

Wall Street Journal

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io9, CA - Jun 30, 2008

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Revisiting Malaysia?s Social Contract

Asia Sentinel, China - Jun 30, 2008

Not so, scream a vociferous minority, who not only see the social contract as far from having outlived its purpose but insist that it also includes **other** ...

The Week in Demos and Patches: June 22-28

FileFront, TX - Jun 28, 2008

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10 Rules of Flat Stomach

Cut Off 9 lbs of Stomach Fat every 11 Days by Keeping these 10 Rules. FatLoss4ldiots.com

Hugh Downs Reports

Little known heart attack symptom many people tragically ignore. www.bottomlinesecrets.com

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www.superdroidrobots.com

Moon Again: Yes or No?

1-Minute Poll Should We Land At The Moon Again?

GiftForVote.com/Moon-Again/

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1 of 6 $21/07/2008 \ 20:14$

Martians vs **Robots**: Who **could** have believed it? The Earthlings invented a race of **robots** and wiped themselves out! Now the Martians are the only ones left ...

Internet & Technology

Investor's Business Daily (subscription) - Jun 27, 2008

That makes it easier to show children how the movie relates to science in the real world, Fink says.

"Robots will be the next big thing to come," Fink said. ...DIS

Source: Google News

Integrating behavioral, perceptual, and world knowledge in reactive navigation

RC Arkin - Designing Autonomous Agents: Theory and Practice From ..., 1990 - books.google.com

... constructed under these conditions, a **robot could** use this ... sch?mas success- fully

completing the **robot's** mission. ... maintain-al- titude with **other** sch?mas such ...

Frontier-based exploration using multiple **robots** -

B Yamauchi - Proceedings of the second international conference on ..., 1998 - portal.acm.org

... As a result, the **robot could** waste a great deal of ... rangefinders commonly found on

mobile **robots** are limited ... reading is independent of every **other** sensor reading ...

Cooperative multi-robot box-pushing -

MJ Mataric, M Nilsson, K Simsarian - ... 1995 IEEE/RSJ International Conference on Intelligent **Robots** ..., 1995 - doi.ieeecomputersociety.org

... The other is to handle the communication with other robots to which one of the ... here,

we used a 5-meter cable between the robots that could easily transmit ...

[PDF] Multi-robot exploration of an unknown environment, efficiently reducing the odometry error -

IM Rekleitis, G Dudek, E Milios - Proc. of the International Joint Conference on Artificial ..., 1997 - users.cs.dal.ca

... are a vision system that could locate a ... finder with a retroreflective target on the

other robot. ... The robots explore the unknown environment by pro- gressively ...

A frontier-based approach for autonomous exploration -

B Yamauchi - Proceedings of the 1997 IEEE International Symposium on ..., 1997 - doi.ieeecomputersociety.org

... motor control of a real **robot** in the real **world**. ... As a result, the **robot could** waste

a great deal of ... sensor reading is independent of every other sensor read ...

Multi-robot collaboration for robust exploration -

I Rekleitis, G Dudek, E Milios - Annals of Mathematics and Artificial Intelligence, 2001 - Springer

... The first approaches centered on the exploration of an unknown world using a single

sensor such as ... The fact that two robots could see each other was not ...

Integrating Exploration and Localization for Mobile Robots -

B Yamauchi, A Schultz, W Adams - Adaptive Behavior, 1999 - adb.sagepub.com

... A mobile **robot** needs to **explore** in order to learn the spatial structure of the

world, and to incorporate this structure into some form of map. ...

Delivering real reality to the World Wide Web via telerobotics -

E Paulos, J Canny - Robotics and Automation, 1996. Proceedings., 1996 IEEE ..., 1996 - ieeexplore.ieee.org

... and to comments leff by other users. ... fixed cameras in re- mote spaces where users

could observe dynamic ... of free- dom was realized by introducing robots to the ...

[PS] Reward functions for accelerated learning -

MJ Mataric - Proceedings of the Eleventh International Conference on ..., 1994 - cwis.usc.edu

... In the mean time it could be repeatedly interrupted by other activities, such as ...

the correct mapping was dicult to learn since the robots did not ...

On autonomous robots -

GA BEKEY - The Knowledge Engineering Review, 2001 - Cambridge Univ Press

... It could read sheet music, and control its arms ... future the boundary between softbots

and robots may become ... experience, and to interact with each other and with ...

Source: Google Scholar

2 of 6 $21/07/2008 \ 20:14$

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Pixar/Disney

EVE, otherwise known as the Extra-terrestrial Vegetation Evaluator, represents an intelligent probe sent to an abandoned Earth in the film 'WALL-E.'

EVE, otherwise known as the Extra-terrestrial Vegetation Evaluator, represents an intelligent probe sent to an abandoned Earth in the film 'WALL-E.'

A spaceship descends with a thunderous roar and deposits a futuristic probe before taking off again. The Extraterrestrial Vegetation Evaluator (EVE) soon activates and begins flying around, scanning the barren surface for signs of life.

Scientists today can only dream of having a robotic explorer like EVE from the Disney/Pixar film "WALL•E."

But some researchers are working on autonomous spacecraft, airships and rovers that can cooperate intelligently while exploring distant worlds.

"The orbiter gives you global perspective, the aerial platform a more regional perspective, and that helps determine where to deploy ground assets in a targeted fashion," said Wolfgang Fink, a physicist at the California Institute of Technology in Pasadena.

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Fink's vision of "tier-scalable reconnaissance" starts with an orbiting spacecraft to make a global survey for interesting scientific targets, before deciding on its own where to deploy an airship such as a dirigible.

21/07/2008 20:14 3 of 6

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The airship could look even closer at a region to find the best landing site, and finally drop a rover or some other surface explorer. That surface explorer could then move quickly to the target area.

A demonstration of how such a surface explorer might deploy will take place in the Mars Science Laboratory mission, slated for a 2009 launch.

NASA's Sky Crane carrier will hover above the surface of Mars on retrorockets while lowering an SUV-sized rover using a winch and tether.

Some Mars missions have already demonstrated the advantage of coordinating orbiters with surface explorers.

Scientists used data from three Mars orbiters to determine the landing site for NASA's Phoenix Mars Lander, and also turned orbiter cameras on the lander as it descended to the surface.

Of the three orbiters, the Mars Reconnaissance Orbiter has even helped NASA's separate Spirit and Opportunity Rovers navigate around obstacles on the Martian surface.

However, Fink and his collaborators want to take humans out of the loop and develop robots which can decide independently when and where to go.

That becomes crucial for future missions to distant places such as the moons of Saturn or Jupiter, where a command signal from Earth can take over an hour to reach robotic explorers.

The key rests with software algorithms that help robots make command decisions on their own.

Fink's group has begun testing such algorithms by using three small rovers and a camera that looks down on a simulated indoor landscape.

The camera identifies both targets and obstacles, which allows the rovers to deploy and drive around obstacles to reach their targets — all without human intervention.

"Integration is the biggest challenge," Fink noted. "At Caltech, we are now at the point where we're implementing a test-bed outdoors to develop the software to demonstrate this in action."

The outdoors test would involve a miniature airship taking the place of the camera. Researchers from around the world would be able to give commands to the airship via Internet and watch it move and deploy the rovers on its own.

The field tests may pave the way for using similar command software on the proposed NASA and European mission to Titan or Europa. Fink and other researchers involved with the planning have begun discussing how such a mission might shape up by the 2017 launch date.

"A Titan mission would have the orbiter deploying a balloon, and we're already thinking about having a lander," Fink explained. "There you have a three-tier mission."

The tiered approach may eventually take the form of a robot that "does its own reconnaissance, goes out and looks for anomalies, finds something interesting and makes contact with the sender," Fink said, pointing to the Imperial probe from "The Empire Strikes Back" which lands on the ice planet Hoth.

4 of 6 21/07/2008 20:14

Perhaps best of all, intelligent robots could react quickly to surprises and investigate anomalies — such as a geyser on Saturn's moon Enceladus, or a landslide on Mars.

"Curiosity in itself is not present in any of our machine systems," Fink said, remarking upon WALL•E's childlike tendencies which appear to distract EVE but eventually help her mission. "That curiosity drives action."

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5 of 6 21/07/2008 20:14

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6 of 6