Humanitarian Robotics & Automation Technologies: Improving the Quality of Life for Humanity

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April 21, 2015

What is Humanitarian?





• Hurmanrirtarriran adjective

- having concern for or helping to improve the welfare and happiness of people
- pertaining to the saving of human lives or to the alleviation of *suffering*
- Quality-of-Life Index (Economist Intelligence Unit)
 - Nine QoL Factors: Material wellbeing/Health/Political stability and security/Family life/Community life/Climate and geography/Job security/Political freedom/Gender equality
 - Worldwide ranking of countries
- **Buddhist saying:** *Happiness* is that which can be borne with ease; *Suffering* is that which cannot be borne with ease

Humanitarian Robotics & Automation?

McKinsey&Company

McKinsey Global Institute



May 2013

Disruptive technologies: Advances that will transform life, business, and the global economy



- Robotics & Automation (R&A) Technologies for
 - Benefit of humanity
 - ➡ Improving the Quality of Life
- Applied Systems Engineering vs Fundamental Research
- Quality of Life (QoL) vs Standard of Living (SoL)

- Sustainability of Envisioned R&A Solutions
 - ➡ Bottom-up Vs Top-down
 - Economically Viable/Financially Sustaining

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Humanitarian R&A Domains

- Urban Search and Rescue
- Disaster Prevention, Response and Recovery
 - Unmanned Aerial Vehicle Terrain Mapping
 - Airborne Environmental Monitoring/Surveillance
- Humanitarian Demining
- Animal Anti-poaching
- Healthcare/Medical Robotics
- Agriculture
- Education
- ...



Unmanned Ground Vehicles for USAR

- Urban Search and Rescue
 - Extrication Assistance
 - Medical Stabilization
- Complex Environments
 - Hazardous conditions
 - Unstable structures
 - Undulating terrain
- Utility of UGVs in USAR
 - Situation Assessment
 - Remote situational awareness
 - Tool for responders





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Unmanned Aerial Vehicles (aka Drones)





About Robolution Capital

Hobolution Capital is the tirst private equity fund dedicated to service robotics in the world. Hobolution Capital's mission is to invest in innovative companies of the fast growing service robotics market, mainly within Europe. Robolution Capital is managed by Orkos Capital, an experienced and well known private equity management company.

Production capital aims to invest in professional and personal service robotics companies (including integrated products, activater, software, components, services, smart products, etc.) from seed to expansion capital run by outstanding entrepreneurs. The Robolution Capital team intends to play a major role in propelling the service robotics industry forward, through its expertise and its wide-ranging connections provided to the investee companies, for the benefit of their development.









Unmanned Aerial Vehicles in Humanitarian Response

> OCHA POLICY AND STUDIES SERIES June 2014 010

Credits: Drone Adventures & DJI Phantom

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UAVs: Case for Brazil

- Southern Brazil Coastal Plain
 - Sea level changes & Patos Lagoon Coastal Flooding
 - Damage to natural resources & population displacement





Joint work with Profs. Tatiana Silva and Flavia Farina, UFRGS

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UAVs: Case for Brazil



- Use of UAVs for hydrological modeling
 - ➡ Prediction of water levels
 - ➡ Assistance to local govt. for recovery and response efforts
 - Relocation monitoring



Image Credit: Drone Adventures

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Prones for Good

The UAE Drones for Good Award (www.dronesforgood.ae/)



The International competition is dedicated to rewarding the most promising prototypes of future services that may benefit humanity at large.

Submissions must be able to demonstrate a working prototype that could conceivably be developed into a working system within the next 1 to 3 years.

The goal of the international competition is to highlight the most advanced research into UAVs and drones and accelerate their application in humanitarian, development and public service applications.

	ELIGIBILITY	Eligibility
	CRITERIA	The International competition is open to anyone in the world. Individuals, teams, or companies are eligible. An individual, team or company may submit up to three (3) separate entries.
	CATEGORIES	Eligible participants from the National competition may also enter the International competition as well.
	TIMELINE AND KEY DATES	Criteria
		Submissions must:
	AWARD	 Be forward looking and use the most advanced civilian UAV technology available Describe the human need
	APPLY	 Describe the proposed solution for meeting that need Describe how it will be done Submissions can suggest new ways of improving an existing service using drones, or new kinds of services that could be practically and economically implemented through these technologies.
		Submissions must also be:
		 Fully autonomous Safe Effective Economical
		Categories

Flying Donkey (www.flyingdonkey.org/)

THE FLYING DONKEY CHALLENGE

The Challenge About us Team Downloads Press News Contact



Pioneering a new transport system of delivery drones in Africa and beyond.

Bundi

A project of La Fondation

Learn more

Flying Donkeys

http://www.flyingdonkey.org/[11/13/14, 12:05:18]

Flying Donkey

Flying donkeys are cargo drones with rugged air frames capable of lifting suitcase loads over long distances. The first commercial flying donkeys, due in Africa by 2020, will carry at least 20 kilos over 50 kilometres in less than one hour.

Since Africa is growing too fast to build out its road network, transportation will have to be supplemented from the sky. It is hoped that tens of thousands of low cost flying donkeys will be operating on established networks in Africa and globally within a generation, lifting Africa by creating jobs and enabling e-commerce and community to community exchanges in a shared economy.



LATEST NEWS

The Flying Donkey Challenge is on hold!



July 30, 2014

The Flying Donkey Challenge idea started almost two years ago and for the past year we have been planning the first edition in Kenya.We have had tremendous support from Kenyan partners including: IBM Research, University of Nairobi – FabLab, Lewa & NRT Conservancy, SGS, Sandstorm, and many friends of the FDC. The Kenya Civil Aviation []

Read more .

Read all the latest news

https://www.dronesforgood.ae/award/international-competition[11/13/14, 12:12:01]



IEEE Robotics and Automation Society



Voting is now OPEN for RAS members to choose their 2015 Representatives Vote Now! Deadline is 20 November 2014

- RAS has more than 12,500 members in 110 countries
 - 39% from North America
 - 21% in Europe
 - 11% in Latin America
 - 29% in Asia and Pacific
- Students make up about 14% of the RAS Membership
- Fastest growing Society in IEEE



ICRA'10 Anchorage, Alaska



IEEE RAS-SIGHT Special Interest Group on Humanitarian Technology

Formed in September 2012 (first Society/Council in IEEE to have a SIGHT!)

Motivation (Vision)

To bring together researchers, developers, interested and like-minded people to contribute to various humanitarian activities where **robotics and automation** can play a key role towards increasing the **quality of life in underserved**, **underdeveloped** areas around the globe including all Regions of the IEEE

Focus (Mission)

Application of **robotics and automation technologies** for promoting humanitarian causes around the globe; and to leverage **existing and emerging technologies** for the benefit of humanity by providing a forum for discussions and implementation of projects and ideas in collaboration with existing global communities



What does RAS-SIGHT do?

- ★ Education and Community Development
 - Student involvement (e.g. robot challenges, competitions, ...)
 - funding projects via Calls
- ★ Share technical knowledge and expertise in R&A
- ★ Provide opportunities at premier conferences such as ICRA
 - Technical sessions focused on the humanitarian theme
- ★ Help assisting in connecting with Industry, Academia, and Government
- ★ Raise awareness among members
- ★ Establish relationship with E4C & EWB-USA
- ★ Work with NGOs and NPOs



Humanitarian Robotics and Automation Technology Challenges

- ★ HRATCs are an unprecedented opportunity for technologists from around the world to collaborate using their skills and education to benefit humanity.
- Problems (challenges) framed with the environmental, cultural, structural, political, socio-economic, and resource constraints so that solutions can be developed, deployed, and sustained
- ★ Viable solutions using R&A technologies by engaging the academic and non-academic communities to address relevant world problems through several initiatives including:
 - challenges/competitions
 - funding projects
 - establishment of collaboration networks with academia, industry, and governments



HRATC'14@ICRA'14

Inside story: Minehunting with radar and rats | The Economist

http://www.economist.com/node/21603239/print

Why?

- Landmines kill 15,000-20,000 every year & maim countless more
- In addition to antipersonnel mines, bomblets delivered by air or artillery, multipurpose weapons and unexploded ordnance
- Costs US\$ 300-1000 per mine; for every 5000 mines cleared, one killed and two injured
- **UN Mine Action Service &** International Campaign to Ban Landmines (ICBL) [Landmine Monitor Report: Toward a Mine-free World]

What?

- Focus on **Fachnology Quarterly:** ne detection and classification
- Low entry barrier with radar and rats
- Scoring Jun /th 2014 1 From the print edges respect toudetection and (non-section), Afghanistan's Helmand coverage rate and coverage in 2010, and the approximate in the coverage rate and the and the approximate a
 - (10%)

USA)

hicles had been destroyed nearby by IEDs (the crews were uninjured). The commander, Lieutenant-Colonel Matt Bazeley, fired a rocket that pulled 200 metres of a fat, coiled hose out over the route ahead. Packed with about 1.5 tonnes of explosives, it detonated upon landing with such a force that the shock wave was felt at a command centre



13km (8 miles) away Co-Organizers: Lino Marques (UCoimbrain he Portugate) ing E-d som a drone first scanned the Prestes (VIFRES, Brazil), their daily lives, mine-breaching alone cannot ensure that land is clear

nay survive blasts and some are designed to do so. For example, the MAT/5 and Valmara 69, Italian anti-tank and anti-personnel mines, are detonated by the momentarily sustained pressure from a passing vehicle or foot. This means there is often no option but to resort to the laborious and dangerous process of clearing mines manually.

Humanitarian demining, as post-conflict mine clearance is known, is carried out by the army, non-governmental organisations (NGOs) and commercial companies. It usually involves deminers, dressed in moderately blast-resistant clothing (the heavy, full-body armour used by bomb squads is considered by many to be too restrictive), checking the ground with metal detectors and carefully prodding to find buried objects.

When the Anti-Personnel Mine Ban Convention, known as the Ottawa treaty, came into force on March 1st 1999, landmines were killing or maiming more than 9,000 people a year. By 2012 casualties were down to some 3,620, roughly three quarters of them civilians, according to Landmine Monitor, the research arm of the International Campaign to Ban Landmines. Improved detection methods have helped, and there has been a big decrease in mines being planted-more than 130 countries are signatories to the Ottawa treaty (America is not, but follows its precepts). Even so, the Pentagon reckons that at least 45m landmines remain in the ground worldwide.

Deminers can struggle to find them with metal detectors because for decades most mines have been made largely from plastic. They might contain only one metal component: a firing pin smaller than a sewing needle, says Eddie Banks, a retired deminer and author of a book on landmine design. But some hand-held detectors are sensitive enough to detect even

http://www.isr.uc.pt//HRATC2014/

1 of 4

10/11/14 10:48 PM





HRATC'14

How?

Three Phases: Simulation, Testing, & Finals

Simulation Phase

- Sensors, robot, and environment modeled very similar to the real setup
- Teams down-selected from $14 \rightarrow 10$
- Conducive to developing strategies for exploration and detection





HRATC'14

Testing Phase (April 30 – May 23)

- Real robot operating in an outdoor scenario at the University of Coimbra, Portugal
- Robot: Clearpath Husky A200
- Sensors: IMU, GPU and Odometry (fused for navigation), Stereo pair of GigE cameras and SICK LRF mounted on a pan/ tilt unit (for perception and obstacle avoidance), & Vallon VMP3 three-coil, pulse induction metal detector (metal detection)
- Mines: Metallic sphere with 1 cm diameter







HRATC'14 Finals @ ICRA'14

HUMANITARIAN TECHNOLOGY

2014 Humanitarian Robotics and Automation **Technology Challenge**

By Raj Madhavan, Lino Marques, Edson Prestes, Prithviraj Dasgupta, Gor Bruno Gouveia, Vitor Jorge, Renan Maffei, Guilhe

Finals @ ICRA (May 31st - June 1st)

- Two day affair: Best trial of each time was taken to determine the winner
- Four Finalists
 - Geeks of the Square Table (UBremen, Germany)
 - ACROSS (UZagreb, Croatia)
 - USMiners (USM, USA)
 - ORION (UTA, USA)
- Awards (IEEE SIGHT Sponsorship)
 - 1st Place: \$1000 and Plaque; 2nd & 3rd Place: \$500 and \$250, and Certificate
- Winner & Runner-ups announced at ICRA'14 Awards Luncheon



obotics and automation (R&A) cost US\$300-1,000 per technologies have the potential mine, and, for every 5,000 to transform and improve the mines deared, one person is lives of people around the globe addressing the world's toughest chal- Thus, clearing postcombat society (RAS) Special Interest Group Jumanitarian Technology (SIGHT) is agaging the academic and nonacademic sive task with enormous s cial implications for civilians. Motivated by these ropose viable solutions in vant world problems civilians. Motivated by these considerations, the first ough the Humanitarian Robotics and ation Technology Challenge HRATC edition took place HRATC), The HRATC is an unpred at the 2014 Internat dented opportunity for IEEE Members from around the world to collaborate Conference on Robotics and Automa-tion (ICRA) in Hong Kong and remotesing their skills and education to bound out in (CoNy in Fong Kong units) focused on VMP3 metal detector. humanity. The problems (challenges) are promoting the development of new For the simulatio framed with the environmental, cultural, strategies for autonomous land mine desing them some same cucation to even in the contrast, Fortugan. In forces of my muranity: The problems (challenges) are promoting the development of new ranged with the environmental, cultural, strategies for autonomous land mine de-tructural, political, socioeconomic, and tection using a mobile (ground) robot. straints so that solutions can developed, deployed, and sustained. RAS is the first and only IEEE Society bave a SIGHT. The mission of the RAS SIGHT is the application of R&A tech- gies, ten teams were short-listed to move nologies for pr noting humanitarian s around the globe and to leverage ng and emerging technologies for

learance arm equipped with a Vallor

For the simulation stage (March-April 2014), a software framework (hereafter referred to as the HRATC Initially, 14 teams from eight countries framework) that runs on a Linux-based submitted their entries. Based on the de perating system and uses the robot on erating system (ROS) to communicat with the client and the robot was devel oped. Figure 2 presents the software an forward with the three stages of HRATC 2014: simulation, testing, and finals. The 2014 edition was the first HRATC event chitecture. In the simulation, as show anity and toward where teams from around the globe had zebo Simulator, through the Husky increasing the quality of life in under- the chance to participate and remotely modules, provides the data of the robot equilibrium data and the character to participate and remover modules, provides the data of the robot red, underdeveloped areas in collabo-develop autonomous demining strategies sensors, cameras, and its localization, for detection and classification in a physi-organizations. According to the United Nations and service robotics (FSR) Husky, as sets collected with the real metal deter Mine Action Service, land mine and service rooting testy russy, as see concette min are tail meter and acted Mine Action Service, land mine tail service in a latterna, tor. In the core of the framework is the 15,000–20,000 people every year (most-by children) and main countless more robot built around a Clearpath Husky tor. In the core of the framework is the HRATC Judge, which extracts several

refers. Demining efforts A200 base, comprising several sensors, such as stero cameras, a laser range find-er, a global positioning system (GPS), and exploded unknown mine-inertial measurement unit (IMU), and a swell as the covered area and cover-age time, and computes the scores of

and organizations



x: -1.52988047809 y: -1.74501992032 Channels: [-156837.96, -139612.63, -103896.88] Zeros: [-153452.00, -135734.00, -103976.00]



HRATC'15

@ ICRA'15 (May 26-28)

- Scenarios TBD
- **Revised Scoring Metric**
- Call for Participation: Sept. 21st
- Submissions Due: Nov. 15th
- Notification: Dec. 15th
- Simulation Phase (10-12 weeks)
- Testing Phase (6-8 weeks)
- Finals @ ICRA'15 (May 2015)

http://www.isr.uc.pt//HRATC2015/

IEEE-RAS Humanitarian Robotics and Automation Technology Challenge "Help us to eradicate landmines and improve the quality of life for civilians" IEEER May 26th to 28th, 2015 ICRA, Seattle, USA (Coimbra, Portugal remotely)



http://www.isr.uc.pt/HRATC2015 (accessible from Sept. 25, 2014)

Call for Participation

According to the UN Mine Action Service, landmines kill 15,000-20,000 people every year (mostly children) and maim countless more across 78 countries. Demining efforts cost US\$ 300-1000 per mine, and, for every 5000 mines cleared, one person is killed and two are injured. Thus, clearing post-combat regions of landmines has proven to be a difficult, risky, dangerous and expensive task with enormous social implications for civilians. Motivated by these considerations, the IEEE Robotics & Automation Society - Special Interest Group on Humanitarian Technology (RAS-SIGHT) is inviting the academic and non-academic community to participate in the second Humanitarian Robotics and Automation Technology Challenge (HRATC) at the 2015 International Conference on Robotics and Automation (ICRA'15).

The 2015 edition of HRATC will focus on promoting the development of new strategies for autonomous landmine detection using a mobile (ground) robot. The strategies developed by the participating teams will be objectively and quantitatively evaluated according to the following criteria: exploration time and environmental coverage; detection and classification quality, i.e., when a metallic object is detected, it should be classified correctly as a landmine or non-landmine; landmine avoidance, i.e., while navigating, the robot should not go over landmines. The Challenge will take place in three phases: 1) Simulation Phase, 2) Testing Phase, and 3) Challenge Phase. Teams will be progressively eliminated after each phase and the remaining teams would

move on to the next phase culminating in the Challenge (Finals) phase at ICRA'15. It should be noted that the teams do not need to purchase or build a robot instrumented with sensors or any of the accompanying software. Every team can participate remotely in each of the phases.

How To Participate in the Challenge

All potential participants should submit a paper (2-3 pages maximum) in the standard IEEE format including figures that describes the motivation, previous experiences and research (if any), and the main techniques that will be used during the Challenge. The organizers will then evaluate this paper and an acceptance notification containing further steps would follow. All submissions should be sent to <hratc2015@gmail.com>.

All teams will use the same robot, called Husky, that will be available before (for remote practice runs) and during the Challenge. Furthermore, participants will have access to a ROSbased simulator to develop and test their code before testing it remotely on the real robot.

The Challenge will take place remotely in Coimbra, Portugal, and beamed in real time to the Washington State Convention Center in

Seattle during ICRA'15. Necessary logistics and travel support will be provided depending on the number of qualifying teams. Further information about the 2014 Challenge is available from http://www.isr.uc.pt/HRATC2014/.

About IEEE RAS-SIGHT

The IEEE RAS-SIGHT is the first and only IEEE Society to have a SIGHT! The mission of RAS-SIGHT is the application of robotics and automation technologies for promoting humanitarian causes around the globe, and to leverage existing and emerging technologies for the benefit of humanity and towards increasing the quality of life in underserved, underdeveloped areas in collaboration with existing global communities and organizations. To engage the international community in these causes, since 2014, RAS-SIGHT is organizing an HRATC in RAS-sponsored conferences. See http://www.ieee-ras.org/educational-resourcesoutreach/humanitarian-efforts for more details.

Acknowledgments The Challenge organizers thank the FP7-TIRAMISU project (http://www.fp7-tiramisu.ew) and Clearpath Robotics, Inc. for their support and partnership in organizing HRATC'15.

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Raj Madhavan

Raj Madhavan (IEEE-RAS & UMD-CP, USA) Lino Marques (UCoimbra, Portugal) Edson Prestes (UFRGS, Brazil) Raj Dasgupta (UNOmaha, USA)

Organizing Committee

Organizers

Vitor Jorge (UFRGS, Brazil) Gonçalo Cabrita (UCoimbra, Portugal) Adam Gryfe (Clearpath Tech., Canada) Renan Maffei (UFRGS, Brazil) Guilherme Franco (UFRGS, Brazil) Jose Baca Garcia (UNOmaha, USA) Mariana Kolberg (UFRGS, Brazil)

Important Dates

Entry Submissions - November 15, 2014 Acceptance Notifications - December 15, 2014 Challenge@ICRA'15 - May 26 - 28 2015

ICRA'15 WS

ICRA 2015 RATHA Workshop Tuesday, May 26 2015, 08:30-17:30

Robotics & Automation Technologies for Humanitarian Applications: Where we are & Where we can be

Organizers: Raj Madhavan (Vice President, IEEE-RAS Industrial Activities Board & University of Maryland, College Park, USA), Edson Prestes (Federal University of Rio Grande do Sul, RS, Brazil) and Lino Marques (University of Coimbra, Coimbra, Portugal)

Robotics & Automation (R&A) technologies have the potential to transform and positively impact the lives of several people around the globe by addressing some of the worldis toughest and unsolved challenges and elevating the quality of life for humanity. Many of the underlying theoretical frameworks of existing R&A technologies are at a sufficient level of maturity and are widely accepted by the academic community after having undergone the scientific rigor and peer reviews that accompany such works. Yet, several of these frameworks, when subjected to the demands of deployment in practical situations, reveal their brittleness and lack of robustness (e.g. Deepwater Horizon oil spill in the Gulf of Mexico and the Fukushima Daiichi nuclear disaster). A fundamental reason behind such failures is that there exists a chasm between technological innovators and humanitarian field workers: Innovators rarely know what technological tools humanitarian workers in-the-trenches need; and only humanitarian field workers know what innovations are truly sustainable. Developing sustainable tools, methodologies, and robotic hardware platforms with useful sensor suites, and identifying gaps and initiating a dialog between different stakeholders will help alleviating suffering and will increase the effectiveness and/or efficiency of humanitarian workers on the ground.

In this workshop, we propose to bring together researchers, practitioners, humanitarian relief workers, responders, analysts from the field and humanitarian aid agencies, and foundations from several countries to understand the current and future role R&A technologies play in alleviating suffering of humanity in times of need. The proposed workshop will allow for the discussion and identification of the use of R&A technologies applied to humanitarian efforts and gaps in dealing with natural calamities and man-made disasters. Emphasis will be placed on important factors that need to be taken into consideration such as environmental, cultural, structural, political and socio-economic and resource constraints while developing R&A solutions that can be developed, deployed, and sustained. The workshop will, thus, consist of presentations of research, first-hand experiences and field knowledge, both as invited and regular talks addressing the monitoring (e.g. early warning preventative systems) and/or the support of post-disaster and emergency relief operations (e.g., search and rescue) of several humanitarian areas from different ends of the technological spectrum and end-users, including but not limited to:

- · Avalanches, landslides, earthquakes, and volcano eruptions
- Floods and tsunamis
- Wind storms (hurricanes, tornadoes)
- Mining and mineral disasters
- Pollution monitoring and cleaning (e.g. oil spills, inland water monitoring)
- · Chemical emergencies from industrial accidents
- Nuclear incidents and similar cleanup efforts of contaminated sites
- Structural collapse (e.g. bridge and dam failures)
- Fires (wild and urban)
- Demining (landmine detection and clearance)

The workshop consists of 3 keynotes and 10 regular talks with a poster session in parallel with the afternoon coffee break. The technical works will be finished by a panel discussion with all attendees. The agenda with titles, abstracts and bios of speakers is also available from www.isr.uc.pt/RATHA2015

Program

Session 1 – 8:00 – 12:30					
8:30	8:45	Opening			
8:45	9:15	Keynote Satoshi Tadokoro (IEEE RAS President-Elect, Tohoku University, Japan) Disaster robotics gaps between researchers and users			
9:15	9:35	Mario Gianni (Sapienza University of Rome, Italy) Human-robot teaming in disaster response – a user centric approach.			
9:35	9:55	Tatiana Silva (Federal University of Rio Grande do Sul, Brazil) Information systems and robot-based solutions in dealing with natural disasters in South Brazil: needs, constraints, available technologies, and how to deal with it all together.			
9:55	10:15	Jonathan Ledgard (Red Line at EPFL, Switzerland) A proposal to accelerate the development of cargo drones and droneports in order to save lives and build economies.			
10:15	10:45	Coffee Break			
10:45	11:15	Keynote Robin R. Murphy (CRASAR, Texas A&M University, USA) Unmanned Aerial and Marine Systems for Disasters			
11:15	11:35	Stefano Stramigioli (University of Twente, Netherlands) SHERPA: Robotics for people, robotics with people.			
11:35	11:55	Haris Balta (Royal Military Academy, Belgium) Field experience on deploying unmanned aerial systems for search and rescue and demining.			
11:55	12:15	Giovanni Muscato (University of Catania, Italy) Applications of UGVs and UAVs for monitoring volcanic eruptions: Summary of fifteen years experience.			
12:15	13:30	Lunch			

Session 2 – 13:30 – 17:55

13:30	14:00	Keynote Gisli Olafsson
14:00	14:20	M. Bernadine Dias (Carnegie Mellon University, USA)
		Bridging the Gap Between Academic Work and Field Deployments: A Decade of
		Lessons Learned.
14:20	14:40	Maya Cakmak (University of Washington, USA)
		Teaching English in Rural Africa through Conversational Robotic Agents.
14:40	15:00	Paulo J.S. Gonçalves (Polytechnic Institute of Castelo Branco, Portugal)
		Prevention, Combat and Aftermath of Forest Fires: a Robotic Solution.
15:00	15:20	Zvi Shiller (Ariel University, Israel)
		Giving a hand to weak segments of society.
15:20	16:00	Coffee Break/Poster Session ¹
16:00	17:15	Panel Discussion
17:15	17:30	Adjourn

¹Poster Session will also include the presentation of HRATC 2015 finalists, besides the selected posters through the standard submission. For more information about HRATC 2015, please visit www.isr.uc.pt/HRATC2015

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Concluding Thoughts: Economics, Virtue & Ethics

WORLD HAPPINESS REPORT 2013

Chapter 5. RESTORING VIRTUE ETHICS IN THE QUEST FOR HAPPINESS

JEFFREY D. SACHS





The keynote of Buddhist economics is simplicity and non-violence. ... For the modern economist this is very difficult to understand. He is used to measuring the "standard of living" by the amount of annual consumption, assuming all the time that a man who consumes more is "better off" than a man who consumes less. A Buddhist economist would consider this approach excessively irrational: since consumption is merely a means to human well-being, the aim should be to obtain the maximum of well being with the minimum of consumption.

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"Be the change you want to see in the world.

- Mahatma Gandhi

The Dalai Lama, when asked what surprised him most about humanity, answered "Man. Because he sacrifices his health in order to make money. Then he sacrifices money to recuperate his health. And then he is so anxious about the future that he does not enjoy the present; the result being that he does not live in the present or the future; he lives as if he is never going to die, and then dies having never really lived."



Thank you for listening! <rajmadhavan.tech4humanity@gmail.com>