Toward Robotic Prizes

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IROS Workshop on Robotic Competitions

Overview

- Context
- Project Overview
- Designed Challenges
- Toward Robotic Challenges
- Call for Action

Context of Horizon Prizes

- European Commission Inducement Prizes, named **Horizon Prizes** are a new competition for European innovators that aim to deliver breakthrough solutions to specific issues

- Social Innovation focused, ICT grounded
- Launched in 2015
- Example of Horizon Prizes (6M€)
  - Materials for Clean Air (3M€)
  - Antibiotics (1M€)
  - Food Scanner (1M€)
  - Collaborative Spectrum Sharing (500k€)
  - Breaking the optical transmission barriers (500k€)

The Project

Consortium funded under EU's Horizon 2020 programme to design 8 – 12 ambitious ICT inducement prizes for DG Connect

Undertaking research, interviews with experts, prize prototyping and communications planning

Submitted first set of prize designs in summer 2015, second will be delivered in early 2016

The European Commission is not yet committed to funding prizes on these themes

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FUTURE CHALLENGES
Designing ICT Prizes for Europe

Centre for
Challenge **Prizes**
Nesta...

"Nesta is an independent charity with a mission to help people and organisations bring great ideas to life."

What? A hub to bring together expertise on challenge prizes and to run challenge prizes to solve challenges for the public good.

Why? To increase practical evidence and understanding about challenge prizes so they can be used effectively by governments, charities and businesses. To have a tangible positive impact on society through challenge prizes.

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FUTURE
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PRIZE DESIGN JAN '15 – FEB '16

1 SCOPE

- Landscape reviews & research
- Problem, needs & market analysis

2 VALIDATE

- Expert interviews & workshops
- Refine problem definition

3 PROTOTYPE

- Iterate challenge statement
- Define success (judging criteria & prize structure)

4 COMMUNICATE

- Planning for dissemination channels & platforms
- Strategy for reaching entrants & stakeholders

Burson·Marsteller

Centre for Challenge Prizes

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Science Practice

FUTURE CHALLENGES
Designing ICT Prizes for Europe

Designed Challenges 2015

- Sized 1-10M€ prizes
- **Challenges of Phase 1**
  - Zero-Power Water Monitoring
  - Online Personal Security
  - Decentralised P2P Tech For Social Good
  - Cloud Inducement Prize

- **Challenges of Phase 2 (running)**
  - Approximate Computing
  - Long-term Data Storage

- **And 2 Challenges in Robotics**

Methodology

- How to identify a good topic?
- Approach:
  - Research Roadmaps
    - euRobotics, SRA2020, DARPA Topics, US Roadmap
  - Existing Challenges and Prizes **Large and Small**
    - DARPAs, Rockin, Eurathlon, RoboCup, ECHORD++ PDTI, ELROB, EuRoC, MBZIRC, Cybathlon, RoboSub, Lunar Xprize …
    - Different in size and scope
  - Relevant Workshops
- Subject to constraints
  - Challenge Execution Costs
  - Maturity of Technology
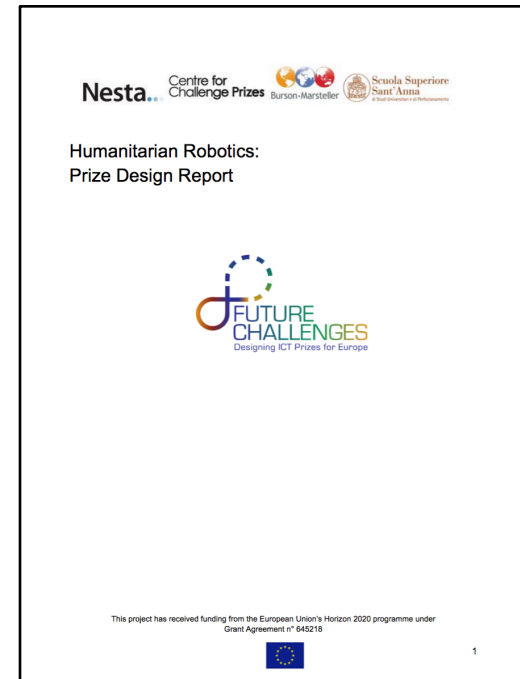 - Availability of Team participating

Robotics Challenges

- The process for the design of two Challenge Prizes in Robotics has been started

- Among the many Robotic Topics two areas have been suggested by European Commission:

  1. Humanitarian Robotics / Search and Rescue

  2. Assistive Living Robotics

- Staged differently

  - HR: Prototyping (end Sep) / Workshop (mid Oct)

  - ALR: Prototyping (mid Nov) / Workshop (end Nov)

- Humanitarian Assistance and Disaster Recovery have become of greater importance in the last years
  - Due to adverse climatic situations
  - Due to socio-political events
  - Due to health-related emergencies
- As it is well known Fukushima disaster has induced a lot of investigation in this area
- Which are possible interesting topics in the field?

Nesta.. Centre for Challenge Prizes Burson-Marsteller Scuola Superiore Sant'Anna

Humanitarian Robotics:
Prize Design Report

FUTURE
CHALLENGES
Designing ICT Prizes for Europe

This project has received funding from the European Union's Horizon 2020 programme under Grant Agreement n° 645218

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Topics for Humanitarian Robotics

- ## By Task
  - Inspection
  - Search and Rescue
  - Environment Monitoring
  - Emergency Services
- ## By Capabilities
- ## By Technology
  - Specific Domain (A/G/U) or Multidomain
    - Collaboration
  - Non-Autonomous
    - Telepresence
    - Exoskeletons
    - …

Infectious Outbreak Scenario

- This is a scenario that has reached much attention in the last years, and at the time of Fukushima has raised the question of robotic possibilities
- Some example scenarios
  - Mortuary robots to transport the deceased
  - Automated materials handling for reducing health professionals
  - Detection of contamination
  - Disinfection
  - Telepresence robots
  - Physical security for workers
  - Waste Handling
  - Humanitarian Relief
  - Reconnaissance

Problem Statements

"The development of antibiotics has been vital to our survival, yet the rise of antimicrobial resistance is threatening to make them ineffective in the future. Clinicians often prescribe broad spectrum antibiotics to sick patients because doctors have to act quickly on imperfect information. These methods put selective pressure on microbes to evolve resistance to antibiotics".

Prize Statements

"The overall solution involves a long-term path towards a more intelligent use of antibiotics enabling a future of more effective prevention, targeted treatments and smart clinical decision support systems. The challenge for Longitude Prize will be set to create a cheap, accurate, rapid and easy-to-use point of care test kit for bacterial infections."

Defining Success

Wendy Schmidt Oil Spill Cleanup X CHALLENGE (2011)
A $1,000,000 USD first place prize purse will be awarded to the team that can demonstrate the highest average ORR above 2,500 GPM (approximately 35,714 barrels of oil per day, based on a 10 hour operating period) from a spill of 1-inch thickness on the seawater surface, with an average ORE of at least 70%.

UNDP / Nesta Renewable Energy Prize (2012)
A sustainable, cost-effective solution for a standalone, off-grid renewable energy supply that can produce an average of 2,25 kWh and 120 litres of hot-water a day, to cover the needs of an average returnee family in rural areas of Bosnia and Herzegovina that will not cost more than €5,000

Example of Design

Timeline: 2016-2020
Size: 10M€

- **Vision**
  - Create the next generation of telepresence and telerobotic technologies able to assist in humanitarian and health care responses to infectious outbreaks.

- **Problem Statement**
  - One of the most significant challenges in providing health care assistance and humanitarian aid during infectious outbreaks is giving those in need the help they require without further spreading infection.

- **Prize Statement**
  - **Decontamination:** The solution that represents the most significant advance in prevention of infection through decontamination of infected sites.
  - **Remote interaction**: The solution that best enables remote interaction between healthcare workers and the recipients of care.
  - **Materials handling:** The solution that represents the most efficient and safe means of transporting hazardous infectious materials.
  - **Delivery and resupply**: The solution that represents the most efficient and safe means of transporting critical supplies to remote recipients of aid.

- **Criteria**

Assisted Living Robotics

- Consolidated domain combining Ambient Assisted Living and Service Robotics
- Several EU Projects/Challenges/Companies:
  - CompanionAble FP7 (8M€) / HOBBIT FP7 / KSERA
  - RAMCIP H2020 (4M€)
  - ROCKIN@Home
- In general moving from touch-less interaction from household manipulation
- Categories of systems for elderly (Broekens 2009)

Assistive Robotics → Assistive Social Robotics → Service Robotics / Companion; Assistive Robotics → Non Social Assistive
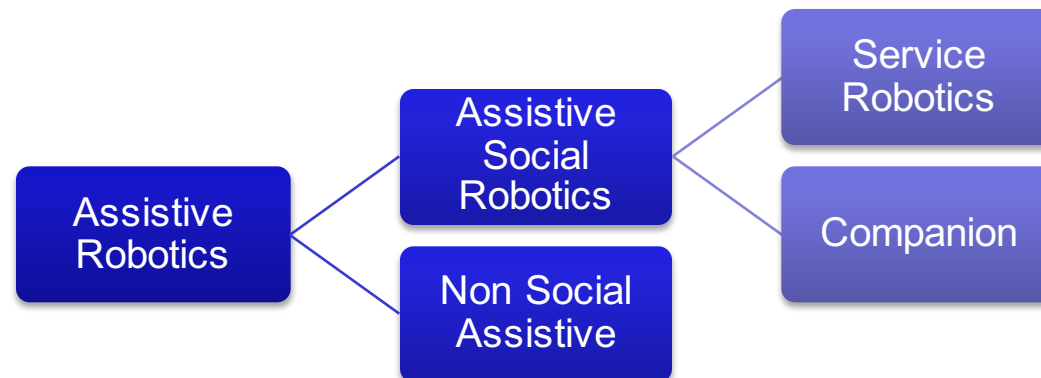
Critical Aspects for Discussion

- **Cost**
  - We are aiming at the range 5-10M€ prize
    - Robot competitions cost a lot (DARPA DRC was 3.5M$ prize, 35M$ research, overall has been estimated in 95M€)
  - Money are needed for supporting the teams
    - EuRoC is a great example in this sense
- **Feasibility/Reachability**
- **Direct Impact on Society**
- Solutions?
  - Common Hardware
  - Connection with existing challenges
  - Playful Challenge?
  - Targeting Students

Conclusions

- **Call for Action** for taking advantage of this challenge design project

- Humanitarian Robotics

  - Comments on the prize structure

  - Interviews running in **this week**

  - Participation to workshop (Bruxells, week 26thOCT)

- Assistive Robotics

  - Exploratory phase

  - Structure during November

Comments Received

- Catch word is important "Go to the Moon"
- People participate for prestige and importance

Backup

DARPA DRC history

DARPA Grand
Challenge 2004

1M$ prize
240km track

No winner,
maximum
15 km

DARPA Grand
Challenge 2005

2M$ prize
212km track

5 Teams
completed the
track (195 applied,
43 tested, 23
qualified)

Robot car "Stanley"
designed by
Stanford Racing
team was the
Winner

DARPA Grand
Challenge 2007

2M$ prize
96km track

11 teams at finals
after National
Qualification Event
6 Teams finished.

CMU was the
Winner

Some teams got
1M$ for research

DARPA Grand
Challenge 2012-2015

3.5M$ prizes, 30M$
in research support
(95M$ budget)

8 Different Tasks

KAIST was the
winner over 23 teams

Articulated Prize
process

Inducement Prizes and Challenge

Since many years structured research funding in Robotics have been complemented by challenge and inducement prizes.

RoboCup main focus is the game soccer where the research goal concern cooperative multi-robot and multi-agent systems in dynamic adversarial environments.

DARPA DRC

2015 Amazon Picking Challenge at ICRA Conference

European Robotics Challenges-**EuRoC** (industrial relevant challenges)

ECHORD++ (small scale research projects health care and urban robotics)

Eurathlon (outdoor robotics competition, which invites teams to test the intelligence and autonomy of their robots in realistic mock emergency-response scenarios inspired by the 2011 Fukushima accident)

Cybathlon 2016 (Championship for Exoskeleton and Assistive Devices: Powered Arm Prosthetics Race, Powered Leg Prosthetics Race, Powered Exoskeleton Race, Powered Wheelchair Race)

MBZIRC (organized by Khalifa university) funded every two years with funds of $5M.