SkyNet 2020 Team Description Paper

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Abstract. The present document serves as template for the 2020 Team Description Papers to be submitted for qualification in the 2020 RoboCup@Home international competition to be held in Bordeaux, France.
We strongly recommend abstracts to be limited to 250 words, and follow the three-paragraph rule: introduction and relevance, approach, and contributions. This will help your readers to get a better understanding of what you're about to present.
Your abstract must state your main research line and your scientific achievements of this year, namely which problems have been solved and where the research group focus is directed. Summarize your achievements and why the conducted research is relevant in robotics. Additionally, you may address your approach to the problem solution and which results do you expect to obtain.

1 Introduction

The present document is a template for the Team Description Paper to be submitted for qualification in the 2020 RoboCup@Home international competition to be held in Bordeaux, France.

A Team Description Paper (hereinafter referred as TDP) is an 8-pages long scientific paper, detailing information on the technical and scientific approach of the team's research. An updated version of this template can be download from `https://github.com/RoboCupAtHome/TDPTemplate`. Contributions to enhancing this template (e.g. typos, grammatical errors, etc.) are always welcome either as issues or pull requests.

Copyright note: All TDPs sent for qualification are made publicly available in the RoboCup@Home Wiki for further reference. On submitting, teams implicitly grant permission to RoboCup@Home and the RoboCup Federation to copy, distribute, upload, publish, and use the manuscript to promote the event and the league at convenience.

2 TDP contents

While writing the TDP, focus on your current research, clearly stating all scientific contribution, and why are they important for you and the league. The length of the TDP is limited to 8 pages including references. **Exceeding the number of pages will automatically void your application**.

The Team Description Paper shall use the *Springer LNAI format*[1] used in the RoboCup Symposium submissions, and has a hard limit of 8 pages without altering margins or spacing (including references but excluding the annex). Please notice that changes to the margins, space between paragraphs, and font size are not allowed (such TDP will be rejected). We suggest to leave the hardware and software description for the end of the paper in the annex.

Important Notice: Attaching to the requested format is important for the camera ready version of the TDPs can be included in the memories of the competition.

The TDP must contain the following information:

- Innovative technology and scientific contribution
- Focus of research/research interests
- Re-usability of the system for other research groups
- Applicability of the robot in the real world
- **DSPL & SSPL:** When the robot depicted in the TDP or Team Video is different from the league's standard one, the TDP must clearly state how the addressed approach and described software will be adapted to the standard platform robot.

The language for the whole TDP, including graphics, tables, images, and all additional content must be English. Content in other languages must be translated.

3 Do's and Don'ts

This section elaborates on a set of *hits* about what to do (or what to avoid) when writing a TDP. Following these guidelines may help your team to obtain qualification, although none is mandatory. When writing a TDP, the best guidelines are the ones that help you to present your research in a clear, concise, and effective manner.

3.1 No more than 8 pages

Seriously. Exceeding the number of pages is the easiest way of forfeiting your qualification.

[1] `http://www.springer.com/computer/lncs?SGWID=0-164-6-793341-0`

3.2 Summarize your achievements

In order to promote participation in local tournaments, experience is heavily weighted during the qualification process. Dedicating one paragraph to summarize the experience and achievements of your team in local tournaments is therefore strongly advised.

3.3 Save space for Science

Describing your team in detail (e.g. number of undergrads, grads, and PhD students) is of little interest for the league, and uses some valuable space that can be used instead to describe your research. It is strongly advised that teams describe instead their approaches and achievements. Our reviewers are far more interested in knowing how your robot manages to solve a task and reading about your ground-breaking discoveries, than in the history of the team.

3.4 Avoid describing your robot

Unless your research revolves around hardware design and implementation (e.g. mechanical schematics, control, low-cost solutions), it is better to omit this section, specially in Standard Platform Leagues (the HW is already known to us). Detailed software and hardware descriptions can be provided in the appendix, for which there is no page limit.

3.5 Avoid explaining ROS

With over 90% usage in RoboCup@Home, it can be assumed that all reviewers are familiar with ROS. Therefore, unless your research extends or enhances an specific ROS package, there is no need to explain how it works. Moreover, TDPs revolving around the basics of ROS are typically rejected.

3.6 Keep it simple

Although reviewers share a common background in the domain of service robotics, is very unlikely that they are actively involved in your research field. Therefore, you can't expect that we are familiar with the State-of-the-Art. The organizing committee kindly asks authors to keep this in mind and write in a more descriptive and less analytic way. The main goal of a TDP is tell others about your latest practical achievement, how your team managed to solve the problem, what strategy was chosen and why, while at the same time trying to convince your reader that what you are doing is useful or applicable in a daily life scenario.

3.7 Mind your writing

We strongly advise non-native speakers to double check the readability of their TDP's before submission. More often than not, a team may not obtain qualification if the reviewers can't understand the ideas of the authors.

Likewise, and as a courtesy to our reviewers, we kindly ask native speakers to write as neutral as possible and refrain from using colloquial expressions and slang. Although all reviewers are fluent English readers (even sometimes native speakers), they may not be proficient in a particular idiom such as Australian, British, or American English. This situation may lead to ambiguities and misunderstandings which could reduce the submitter's score, reducing the chances of qualifying.

4 TDP Annex

The TDP's Robot Description Annex is an appendix of arbitrary length that must be attached at the end of the TDP and summarize the robot's software and hardware technical specifications.

The purpose of the annex is to provide an overview on how the robot operates. This has several purposes. First, it allows the league to track changes in hardware and software trends over time. Second, it helps experienced teams to find alternatives to their solutions when looking to improve or conducting benchmarking. Third, it serves as a quick reference guide for new teams while preparing their robots. Finally, it helps the Technical Committee to keep the rulebook's specifications within the reach.

The annex must contain the following information:

- Photo(s) of the robot
- **OPL only:** Brief, compact description of the robot's hardware.
  - Robot's dimensions and weight.
  - Traction type (base, e.g. differential pair, omnidirectional, synchro-drive).
  - Manipulators, count and number of DoF.
  - Torsos (pan-elevation unit supporting the head), count and number of DoF.
  - Heads (pan-tilt unit with a camera and optionally a microphone), count and number of DoF.
  - Number and type of LIDAR sensors.
  - Number and type of RGB-D sensors.
  - Number and type of cameras.
  - Number and type of microphones.
  - Number and type of other sensors.
  - Number and type of other actuators.
- **DSPL & SSPL:** Do **NOT** include hardware description.
- Brief, compact description of the robot's software (including commercial products, freeware, Open Source, etc.).
  - Audio filtering

  - Automated speech recognition
  - Manipulation
  - Natural Language Processing
  - Navigation, localization, and mapping
  - Object recognition
  - People recognition
  - People tracking
  - Pose/Gesture recognition
  - Sound source localization
- List of all external computing devices and the software running on them.
- List of all cloud computing resources intended to be used.
- Brief, compact description of all external devices (e.g. smart home devices, transceivers, helper robots, etc.).

Examples are provided at the end of this document in page 9 (DSPL), page 10 (OPL), and page 11 (SSPL).

5 Background

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6 BnL Trash Seeker Algorithm (Main research)

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7 BnL All-purpose Speech Recognizer (Main research)

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8 Other relevant contributions

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8.1 Dirt Detector Algorithm

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8.2 Green Plant Seeker Algorithm

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8.3 Trash Seeker Algorithm

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9 Experiments and results

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10 Conclusions and future work

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TDP must **NOT** exceed 8 pages

EVA Software and External Devices [DSPL Template]

We use a standard EVA robot from *Buy'N Large*. No modifications have been applied.

Fig. 1. Robot EVA

Robot's Software Description

For our robot we are using the following software:

- Platform: Operating System
- Face recognition: None. Not designed for human interaction.
- Object recognition: Green Plant Seeker Algorithm (See previous sections).
- Arms control and two-hand coordination: automatic controller [1].

External Devices

EVA robot relies on the following external hardware:

- Mother-ship
- Data Cluster
- 3× Ultra-Power laptops.

Cloud Services

EVA connects the following cloud services:

- Localization and mapping: Geolocalization system [2].
- Navigation: Navigator
- Speech recognition: All-purpose recognizer [3].
- Speech generation: Speech synthesizer.

Robot WALL-E Hardware Description [OPL Template]

Robot WALL-E has the patented *Optimized Design* for garbage recollection. Specifications are as follows:

- Base: all-terrain base (differential pair), 2.5m/s max speed.
- Torso: compressor with solar charger.
- Left and right arms: Mounted on torso. 7DOF, anthropomorphic. Maximum load: 20kg.
- Neck: telescopic neck with pan and tilt.
- Head: 3DOF Expressive Eyes
- Robot dimensions: height: 1.2m (max), width: 0.7m depth 0.8m
- Robot weight: 50kg.

Fig. 2. Robot WALL-E

Also our robot incorporates the following devices:

- Battery charge indicator
- Auto-focus all-purpose cameras
- 7DOF heavy duty fingers
- Cockroach

Robot's Software Description

For our robot we are using the following software:

- Platform: Operating System
- Navigation: Navigator
- Face recognition: None. Not designed for human interaction.
- Speech recognition: All-purpose recognizer [3].
- Speech generation: None. Not designed for human interaction.
- Object recognition: Trash Seeker Algorithm (See previous sections).
- Arms control and two-hand coordination: automatic controller [1].

External Devices

WALL-E robot relies on the following external hardware:

- Garbage Compactor
- EVA unit
- Data Cluster
- 3× Ultra-Power laptops.

Cloud Services

WALL-E connects the following cloud services:

- Localization and mapping: Geolocalization system [2].

M-O Software and External Devices [SSPL Template]

We use a standard *Buy'N Large* M-O robot unit. To differntiate our unit, an orange marker has been added on its top.

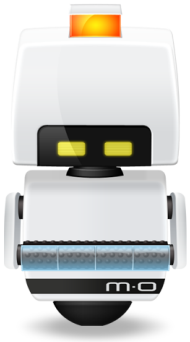

Fig. 3. Robot M-O

Robot's Software Description

For our robot we are using the following software:

- Platform: Operating System
- Face recognition: None. Not designed for human interaction.
- Speech generation: None. Not designed for human interaction.
- Object recognition: Dirt Detector Algorithm (See previous sections).
- Mop unit: automatic controller [1].

External Devices

M-O robot relies on the following external hardware:

- Mother-ship
- Data Cluster
- 3× Ultra-Power laptops.

Cloud Services

M-O connects the following cloud services:

- Localization and mapping: Geolocalization system [2].
- Navigation: Navigator
- Speech recognition: All-purpose recognizer [3].