

# SkyNet 2023 Team Description Paper

Main-author      Co-author      Team Members

November 2, 2022

**Abstract** The present document serves as template for the 2023 Team Description Papers to be submitted for qualification in the 2023 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 2023 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*<sup>1</sup> 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.

#### 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.

<sup>1</sup> <http://www.springer.com/computer/lncs?SGWID=0-164-6-793341-0>

### 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

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

## 6 BnL Trash Seeker Algorithm (Main research)

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst.

Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

## 7 BnL All-purpose Speech Recognizer (Main research)

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consectetur a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consectetur. Nullam elementum, urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla. Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus.

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetur odio sem sed wisi.

## 8 Other relevant contributions

Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetur tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

### 8.1 Dirt Detector Algorithm

Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.

## 8.2 Green Plant Seeker Algorithm

Etiam ac leo a risus tristique nonummy. Donec dignissim tincidunt nulla. Vestibulum rhoncus molestie odio. Sed lobortis, justo et pretium lobortis, mauris turpis condimentum augue, nec ultricies nibh arcu pretium enim. Nunc purus neque, placerat id, imperdiet sed, pellentesque nec, nisl. Vestibulum imperdiet neque non sem accumsan laoreet. In hac habitasse platea dictumst. Etiam condimentum facilisis libero. Suspendisse in elit quis nisl aliquam dapibus. Pellentesque auctor sapien. Sed egestas sapien nec lectus. Pellentesque vel dui vel neque bibendum viverra. Aliquam porttitor nisl nec pede. Proin mattis libero vel turpis. Donec rutrum mauris et libero. Proin euismod porta felis. Nam lobortis, metus quis elementum commodo, nunc lectus elementum mauris, eget vulputate ligula tellus eu neque. Vivamus eu dolor.

## 8.3 Trash Seeker Algorithm

Nulla in ipsum. Praesent eros nulla, congue vitae, euismod ut, commodo a, wisi. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Aenean nonummy magna non leo. Sed felis erat, ullamcorper in, dictum non, ultricies ut, lectus. Proin vel arcu a odio lobortis euismod. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Proin ut est. Aliquam odio. Pellentesque massa turpis, cursus eu, euismod nec, tempor congue, nulla. Duis viverra gravida mauris. Cras tincidunt. Curabitur eros ligula, varius ut, pulvinar in, cursus faucibus, augue.

## 9 Experiments and results

Donec et nisl id sapien blandit mattis. Aenean dictum odio sit amet risus. Morbi purus. Nulla a est sit amet purus venenatis iaculis. Vivamus viverra purus vel magna. Donec in justo sed odio malesuada dapibus. Nunc ultrices aliquam nunc. Vivamus facilisis pellentesque velit. Nulla nunc velit, vulputate dapibus, vulputate id, mattis ac, justo. Nam mattis elit dapibus purus. Quisque enim risus, congue non, elementum ut, mattis quis, sem. Quisque elit.

Maecenas non massa. Vestibulum pharetra nulla at lorem. Duis quis quam id lacus dapibus interdum. Nulla lorem. Donec ut ante quis dolor bibendum condimentum. Etiam egestas tortor vitae lacus. Praesent cursus. Mauris bibendum pede at elit. Morbi et felis a lectus interdum facilisis. Sed suscipit gravida turpis. Nulla at lectus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Praesent nonummy luctus nibh. Proin turpis nunc, congue eu, egestas ut, fringilla at, tellus. In hac habitasse platea dictumst.

## 10 Conclusions and future work

Vivamus eu tellus sed tellus consequat suscipit. Nam orci orci, malesuada id, gravida nec, ultricies vitae, erat. Donec risus turpis, luctus sit amet, interdum quis, porta sed, ipsum. Suspendisse condimentum, tortor at egestas posuere, neque metus tempor orci, et tincidunt urna nunc a purus. Sed facilisis blandit tellus. Nunc risus sem, suscipit nec, eleifend quis, cursus quis, libero. Curabitur et dolor. Sed vitae sem. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Maecenas ante. Duis ullamcorper enim. Donec tristique enim eu leo. Nullam molestie elit eu dolor. Nullam bibendum, turpis vitae tristique gravida, quam sapien tempor lectus, quis pretium tellus purus ac quam. Nulla facilisi.

## References

1. Ivan Petrovich Sidorov. A universal manipulation system. *The Unique Journal in Advanced Robotics*, 66(51):55–90, 2099.
2. John Doe and Jane Doe. Worldwide geo-localization from outer space. *The Unique Journal in Advanced Robotics*, 66(51):55–90, 2099.
3. Si Li and Wu Li. A unified multilanguage recognition system. *The Unique Journal in Advanced Robotics*, 22(01):42–69, 2098.
4. John Doe and Jane Doe. *Introduction to Robotics*, volume 1. RoboCup press, Trantor, 2050.
5. Erika Mustermann and Max Mustermann. *Philosophy in the Artificial Mind*, volume 2. RoboCup press, Trantor, 2050.
6. Jan Jansen, Mieke Modaal, and Janneke Publiek. *A Socialist Base for Robot's Rights*, volume 3. RoboCup press, Trantor, 2050.
7. Sicrano da Tal and Beltrana da Tal. *Endowing Consciousness into Machines*, volume 4. RoboCup press, Trantor, 2050.
8. Tizio Rossi and Caio Rossi. *Empathic Robots*, volume 4. RoboCup press, Trantor, 2050.
9. Tarou Yamada and Hanako Yamada. The day a robot taught me how to cook. *Transactions in Domestic Robotics*, 1(01):1–69, 2050.




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.

### 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].



**Figure 1.** Robot EVA





### 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.

*Also our robot incorporates the following devices:*






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



**Figure 2.** Robot WALL-E





## 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].

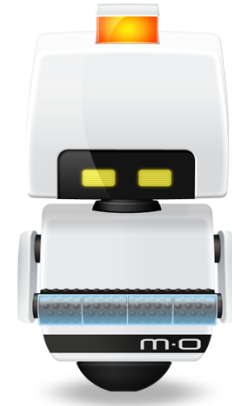
## M-O Software and External Devices [SSPL Template]

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

### 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].



**Figure 3.** Robot M-O

### 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].