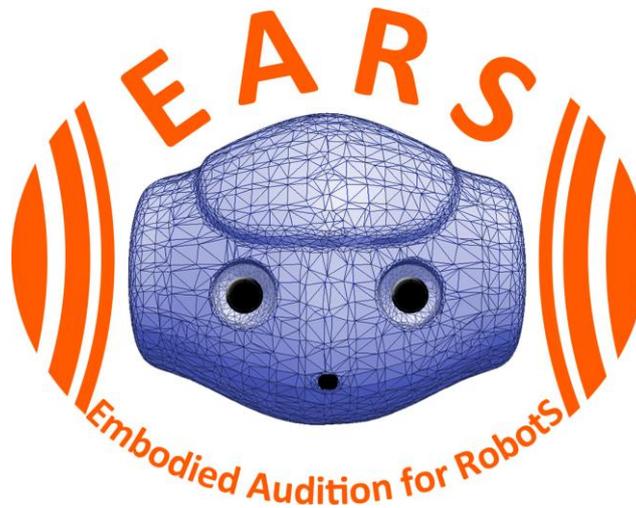




# EARS



## Minutes of SUAB Meeting

Collaborative Project – EARS			
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**Date and time of the meeting:** 01.12.2016 from 16:10 – 17:10

### Participants

- Walter Kellermann (Chair)
- Heiner Löllmann
- Heidi Zinser
- Patrick Naylor
- Boaz Rafaely
- Verena Hafner
- Rodolphe Gelin
- Akihiko (Ken) Sugiyama (SUAB member)
- Martin Heckmann (SUAB member)
- Tim Haulick (SUAB member)
- Tobias Wolff (guest)

### Agenda

1. Opening
2. Feedback and discussion of the project results
3. Closing

Prior to the SUAB meeting, an overview of the EARS project and its achievements was given to all the present SUAB members by public presentations of Walter Kellermann and Rodolphe Gelin as well as a demonstration of the prototype system developed within the EARS project.

### Meeting Protocol

#### 1. Opening

The Project Coordinator Walter Kellermann opened the Scientific Usage and Advisory Board (SUAB) meeting at 16:10. He welcomed all participants and outlined the agenda and purpose of the meeting.

#### 2. Feedback and Discussion of the Project Results

The SUAB member Prof. Kazuhiro Nakadai has provided his assessment of the project results prior to the meeting. His report has been presented by Walter Kellermann (see appendix). In summary, Prof. Nakadai has provided a very positive feedback on the project results and recommended more dissemination activities in the robotics community. This has been addressed by the members of the EARS project by participation at the ROCKIN Challenge, a demo and a Special Session at IROS, but more can be done and the dissemination of the project results within the robotics community will also be pursued beyond the project. (W. Kellermann)

The achievements of the project are quite impressive, but how can they be incorporated into a product (robot) given that the presented prototype system uses external laptop computers for the data processing? (T. Haulick)

It can be expected that the new prototype system provides a better performance than the current, commercially available NAO robot, but this needs to be clearly proven. Otherwise, it is difficult for Softbank Robotics to justify the additional costs, e.g., for a more powerful CPU or more head microphones. (R. Gelin)

The new prototype system will be evaluated against the current NAO robot. The question about the developed algorithms that should be integrated into future products is closely link with the expectation of the customers (user satisfaction, costs etc.). It is not always easy to determine the features which lead to a (significantly) increased user satisfaction at the end. (W. Kellermann)

The production of humanoid robots is more challenging and a less mature technology than the production of mobile phones. Therefore, the results of the EARS project can be integrated into a commercial product or might be implemented on a robot research platform. (P. Naylor)

For researchers, the development of the algorithms is done primarily without consideration of the computational complexity and it might hence only be possible to implement them on future platforms with a higher computational power. (P. Naylor) However, in the course of algorithm development, it is also important to consider their implementation on a real system to identify potential bottlenecks. (K. Sugiyama)

As for Amazon Echo, the computational load might be moved to a Cloud by using robots with a wireless connection. (W. Kellermann)

A problem might be the delay that is linked with a cloud-based processing and a robot needs to react faster than Amazon Echo to utterances of a speaker. (M. Heckmann)

Within the EARS project, a variety of algorithms has been developed which have a very different computational complexity. Some of them can be executed on the current NAO robot with 4 microphones while others require the 12 microphone prototype head and a more powerful CPU. (B. Rafaely)

Some members of the EARS consortium plan to conduct a challenge on localization and tracking which should be announced at the HSCMA workshop in 2017. Recordings with the new 12-microphone prototype head will also be included in the corpus for this challenge. Therefore, it would be nice if the new prototype head could also be ordered by research institutes. (W. Kellermann) If the new prototype head with 12 microphones is commercially available, it might become a standard platform for research on robot audition (somehow similar to the Eigenmike) and would allow to exchange and compare research results more easily.

The manufacturing and maintenance of the prototype head is currently quite expensive. A Letter of Intent to buy such a robot (head) from research institutes might be helpful for Softbank Robotics to invest into this niche product.

Algorithms which run in real-time on the NAO robot are a unique selling point for the project. (M. Heckmann)

The implementation of the developed algorithms on the NAO was quite difficult as many unexpected technical problems had to be addressed (non-synchronized data streams etc.). Therefore, a lot of efforts (person months) had to be spent to solve these issues, which

prevented the project partners to spend more efforts in the actual real-time implementation of the algorithms. (B. Rafaely)

A company might do the implementation of the developed algorithm on the robot platform (K. Sugiyama) This approach was not an option for the EARS project as the regulations for this project do not allow any subcontracting (except for financial auditing). (H. Löllmann) Besides, it is not easy to find suitable companies for this special task.

The presented demo was quite impressive and it's difficult to run such a system in a non-controlled environment. It was not always clear to whom the robot listened. (M. Heckmann) A scenario with multiple speakers (hotel customers) has been implemented, but did not always function properly in practice. Therefore, only a single user scenario has been considered for the public demo where the robot looked around to sense the environment. (H. Löllmann)

It would be nice if the developed algorithms were publicly available. (T. Wolff) Some databases and the MATLAB code of some algorithms are already available on the [EARS homepage](#). (H. Löllmann)

### 3. Closing

Walter Kellermann thanked all SUAB members for their efforts to join this meeting and the helpful and positive feedback on the project results. He gave thanks to Ken Sugiyama and Martin Heckmann for their very interesting public presentations. The contributions of all SUAB members within the last three years are highly appreciated and were very helpful for the project.

## Comments for EARS Project progress report

Kazuhiro Nakadai  
Principal Researcher  
Honda Research Institute Japan Co., Ltd.  
Nov. 29, 2016

Overall, the project is going well in my opinion. In particular, they tried to integrate their methods in the so called code camp, which seems to work as the organizers expected. This was due to the fact that each party successfully developed algorithms. In addition, having an event such as a code camp is a good idea not just for integration, but for mutual understanding between parties. By considering these points, I feel that collaborations in this project have produced a synergy effect.

In the last year, I pointed out some topics such as T1.3 and T2.3 were delayed, but it looks like that delay was minimal. It looks like they succeeded in accelerating progress in these topics.

Elemental topics such as WP-1 have produced achievements, and thus, I feel that it is time to put more importance on system related research topics such as WP4-6. Regarding robot audition, it is essential to know the performance of the integrated system in the real world in terms of accuracy and real-time factors. Although the analysis of the results with such a system in real conditions is complicated, it will have a big impact on the research area of robot audition.

I also strongly recommend that all benchmarks and methods are open to the public before the project is completed (not after completion). I believe that the devolved methods and benchmarks are helpful to accelerate this research field.

As for publication, I was able to find some papers in robotics and AI, but still most of them are published for signal processing. I strongly recommend accelerating publications to such fields since robot audition is a kind of interdisciplinary research topic.