

Midterm Presentation
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Semester Project LCAV
EPFL
29.10.2015

EXPERIMENTAL SETUP OF SOUND EMITTING AND PROCESSING ROBOT FOR ACOUSTIC- BASED SLAM APPLICATIONS

INTRODUCTION USING ECHOES FOR LOCALIZATION

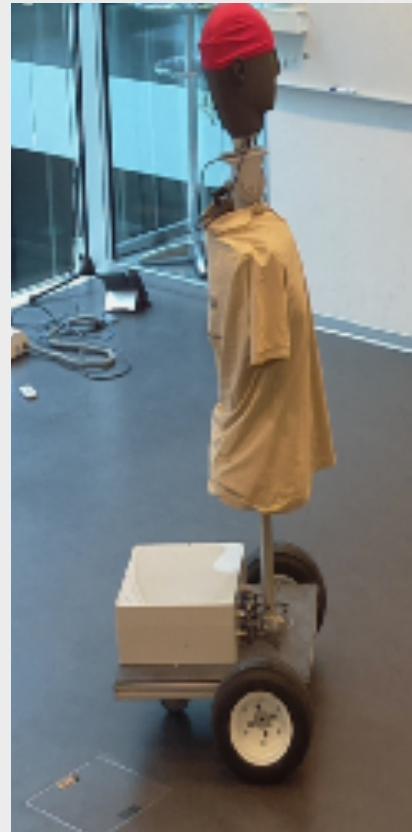


[1]

„The sense of imagery is very rich for an experienced user. One can get a sense of beauty or starkness or whatever“ [2]

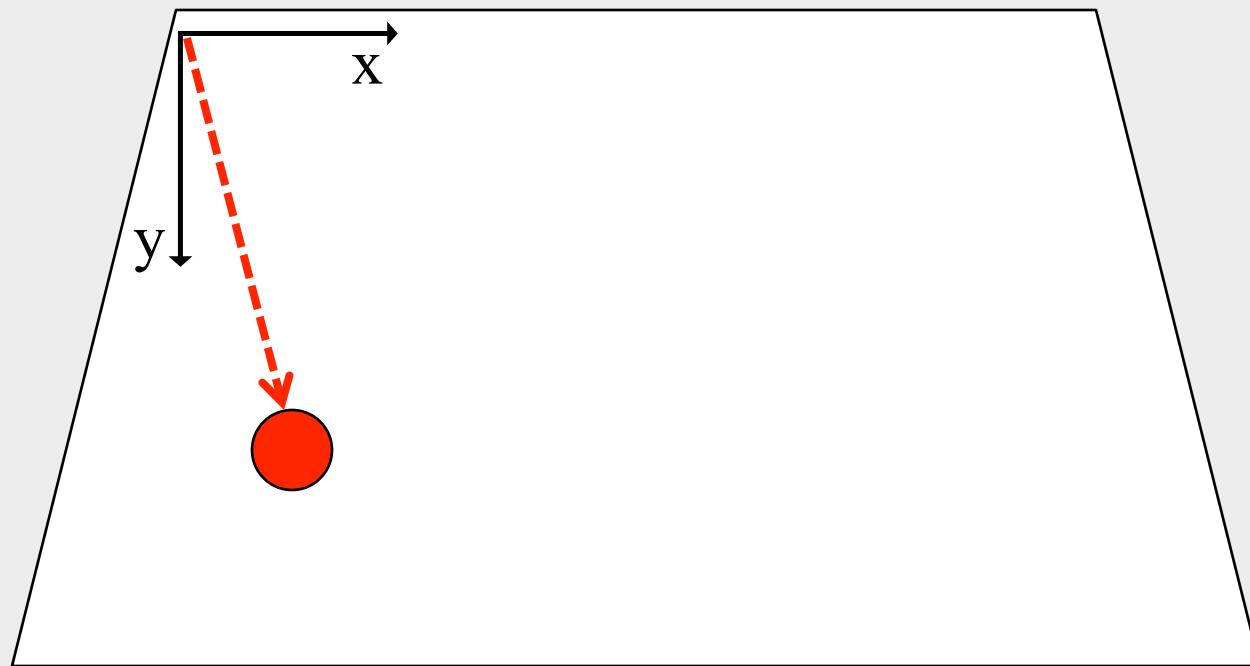
Daniel Kish, founder of *World Access for the blind*

INTRODUCTION USING ECHOES FOR LOCALIZATION



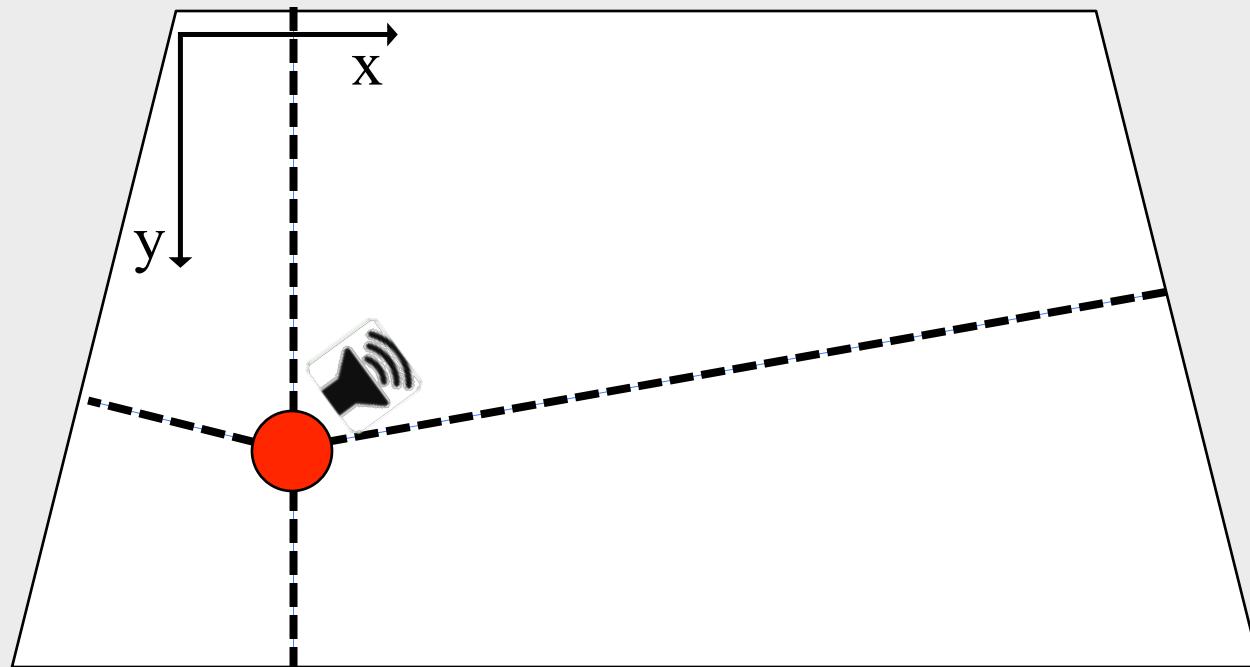
INTRODUCTION

ACOUSTIC-BASED SLAM



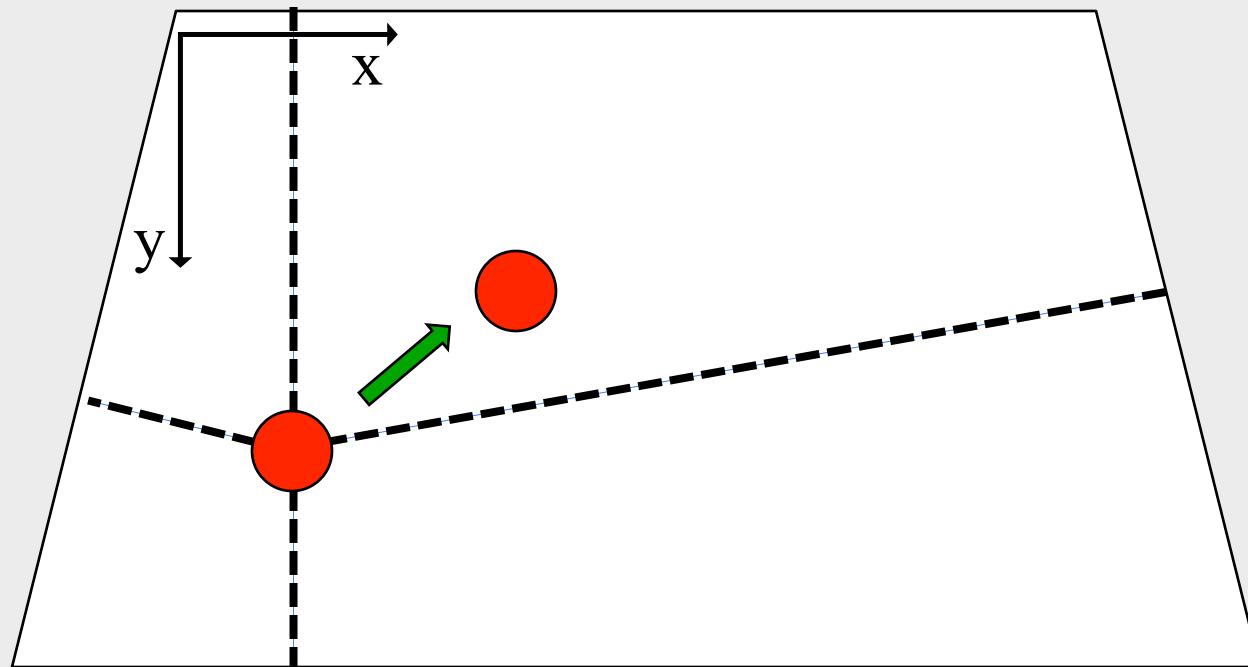
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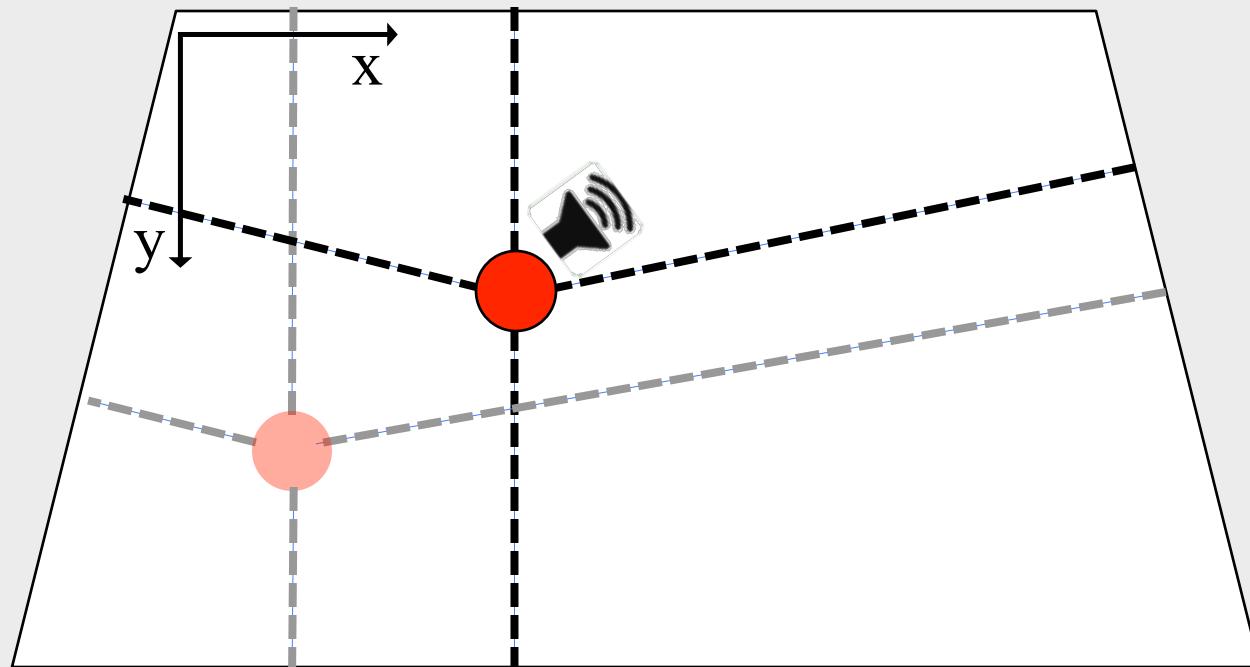
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ACOUSTIC-BASED SLAM



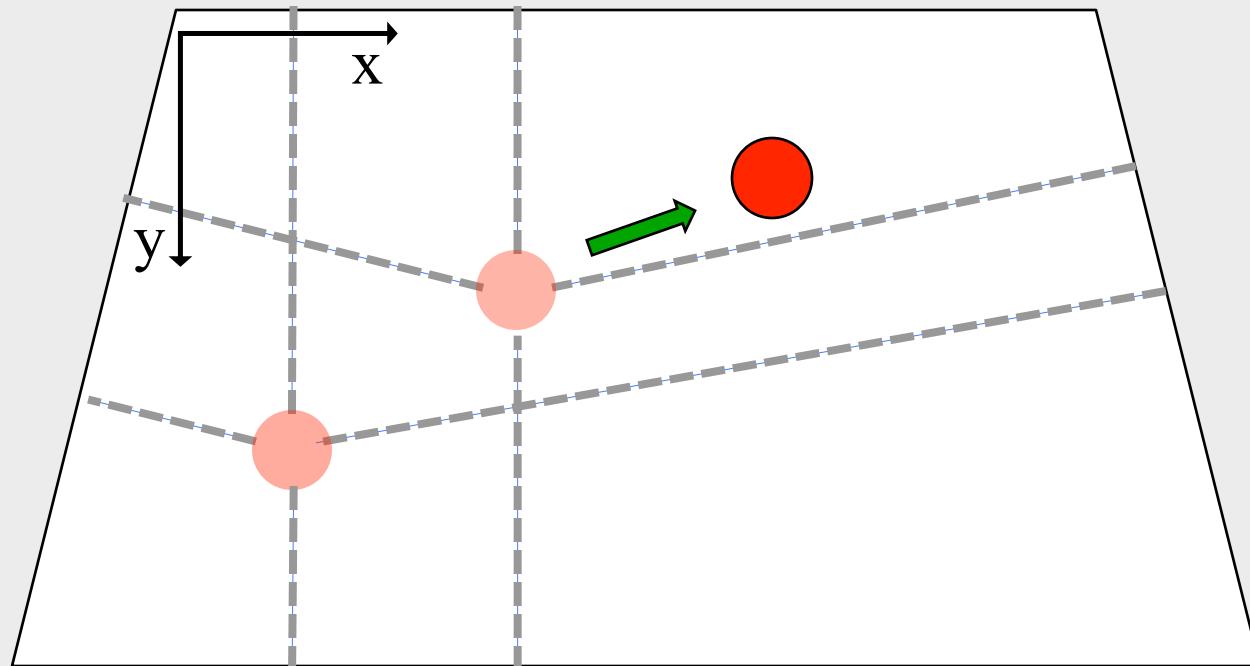
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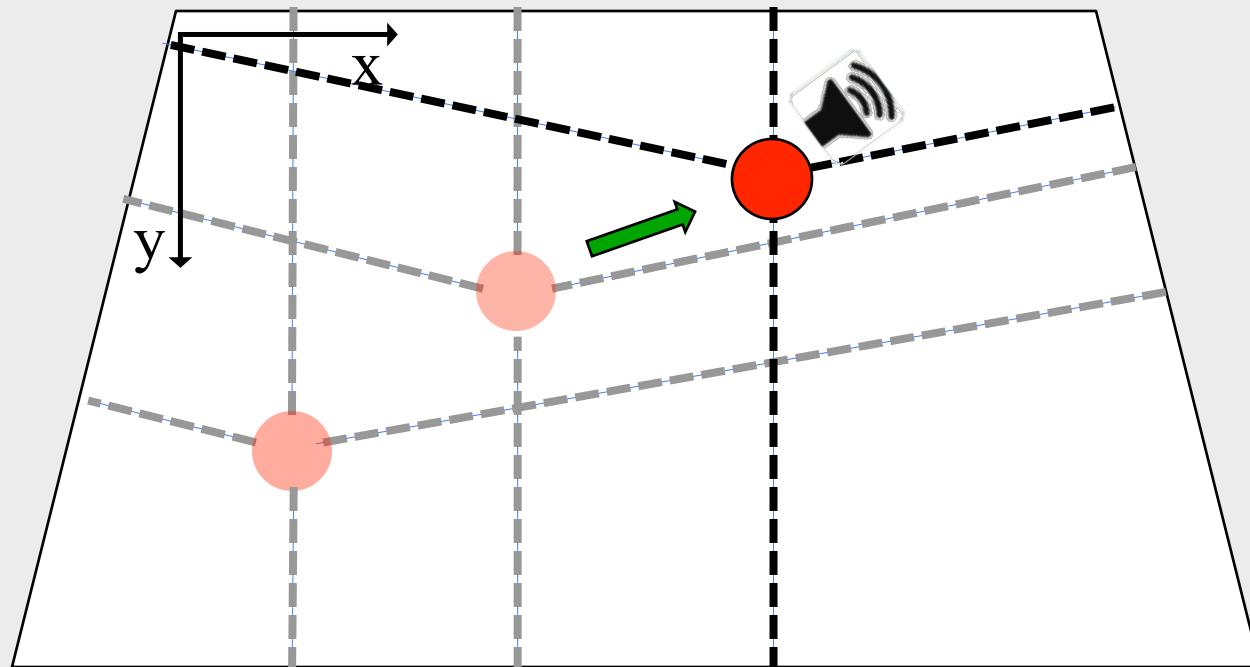
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ACOUSTIC-BASED SLAM



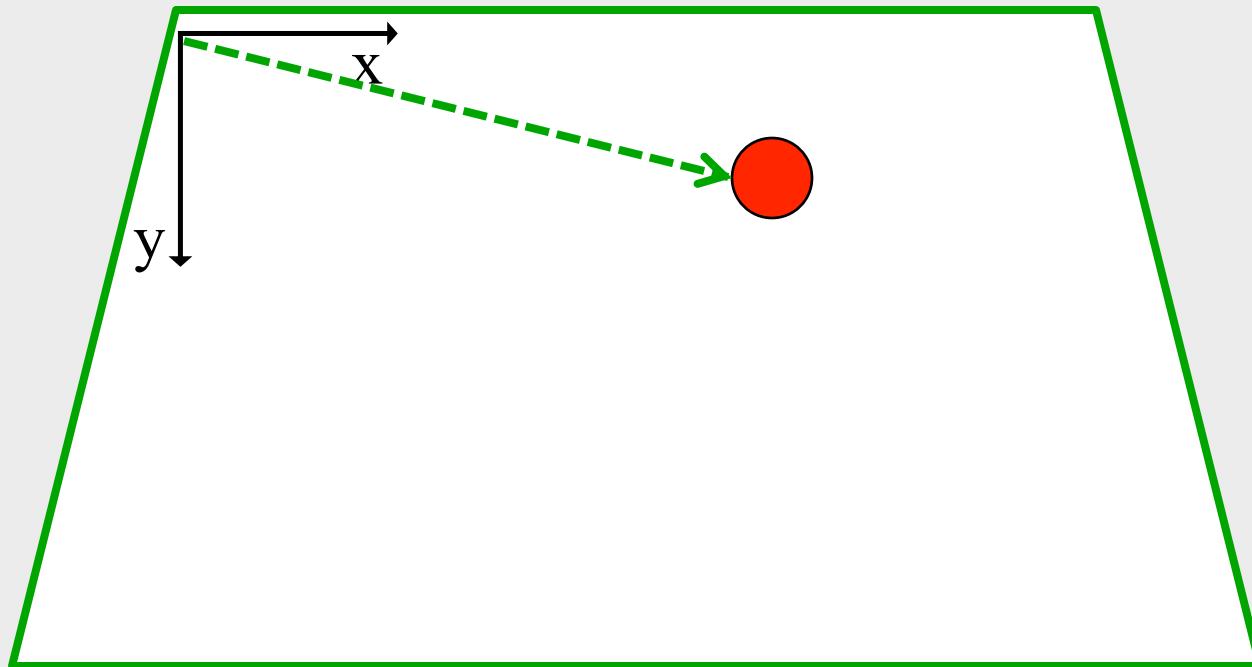
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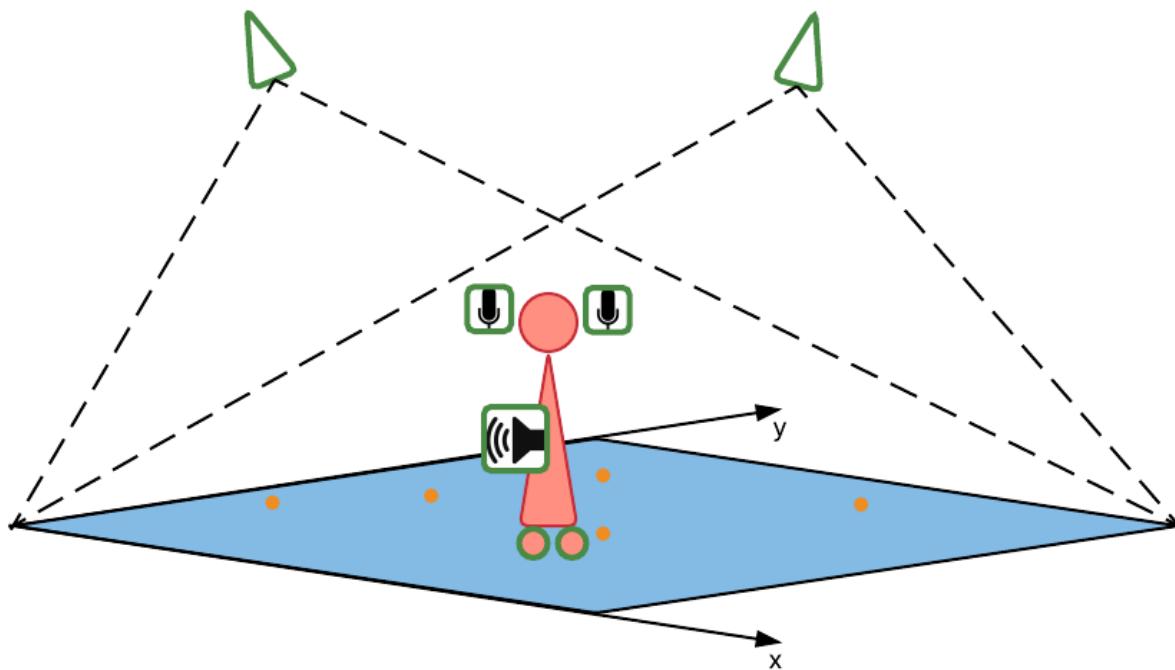
INTRODUCTION

ACOUSTIC-BASED SLAM



PROJECT DESCRIPTION OVERVIEW

Physical setup



Algorithms

Visual localization
ground truth

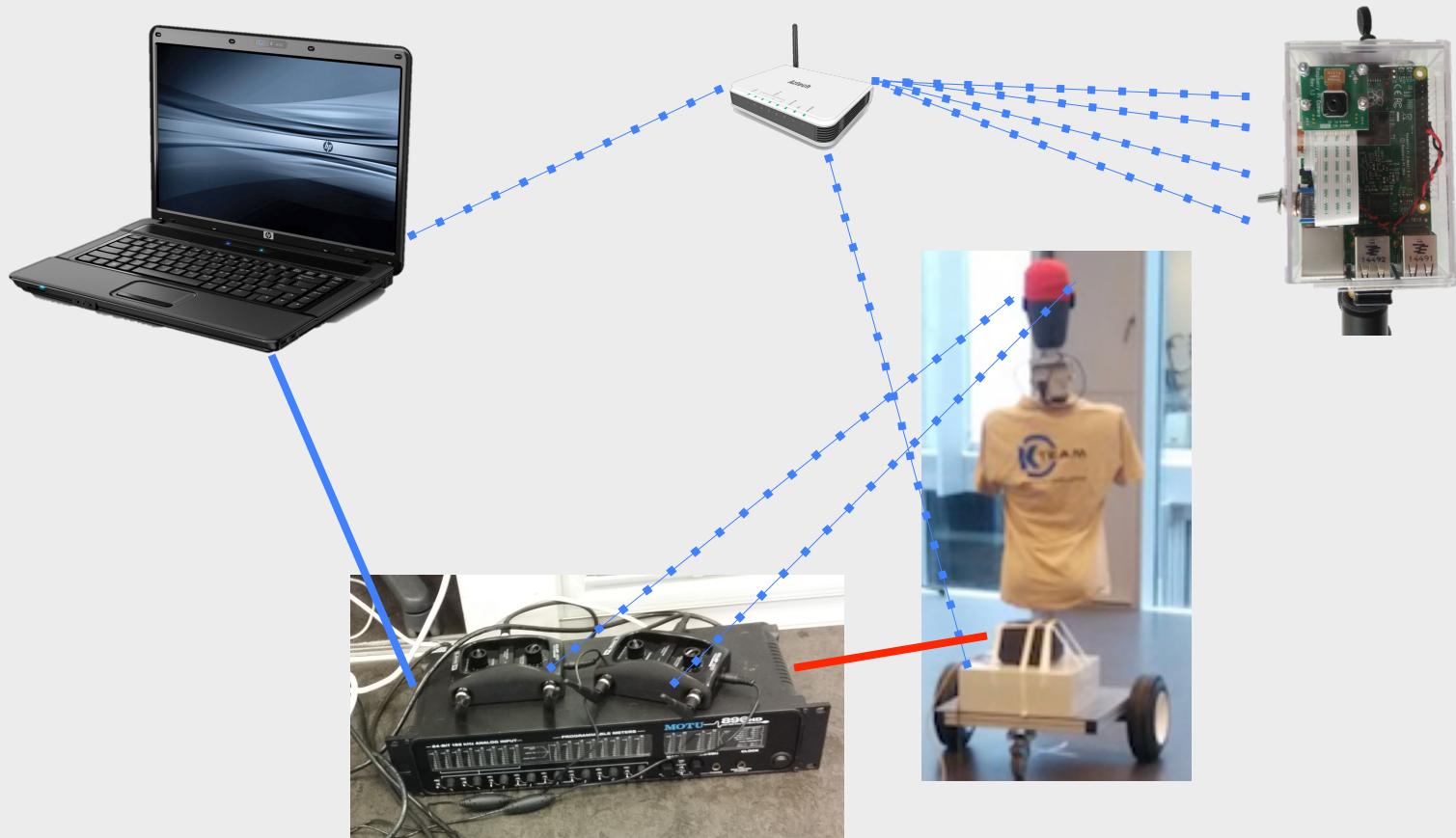
Odometry
position guess



Sound processing
new algorithm

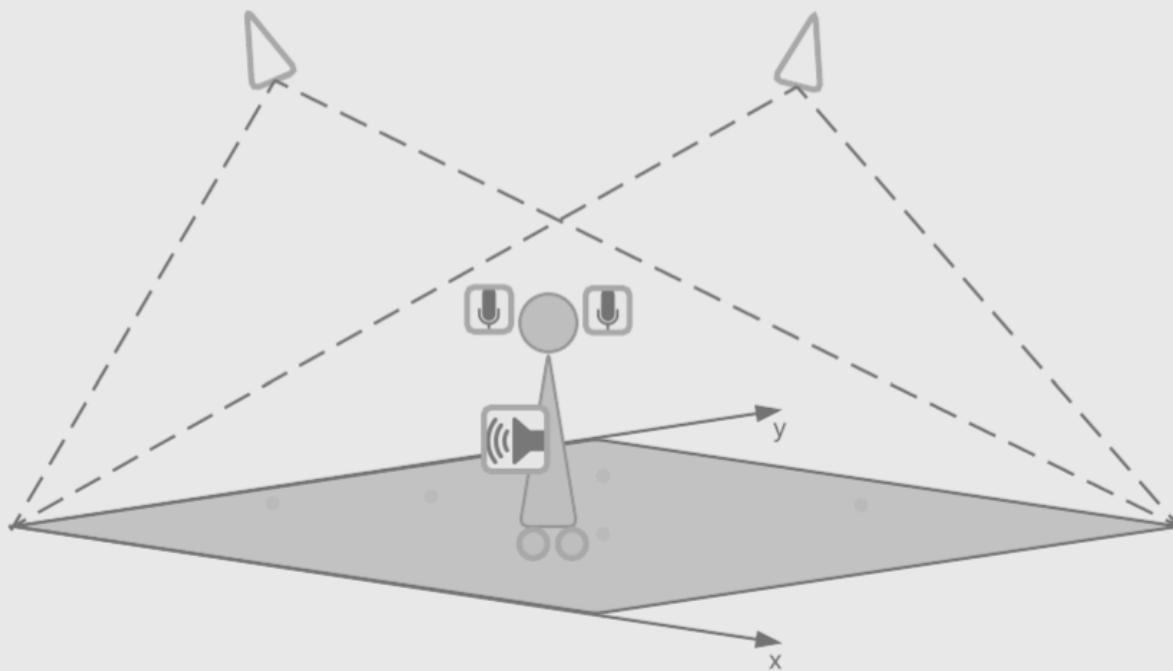
PROJECT DESCRIPTION

PHYSICAL SETUP



PROJECT DESCRIPTION OVERVIEW

Physical setup



Algorithms

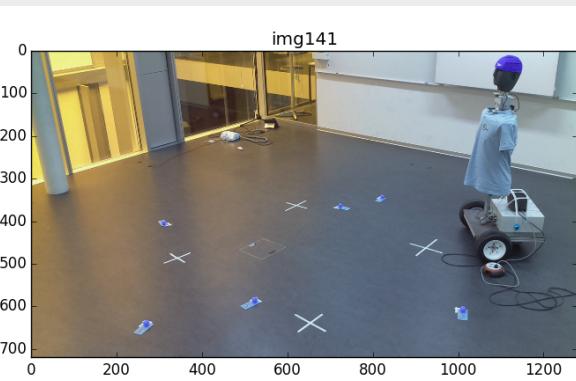
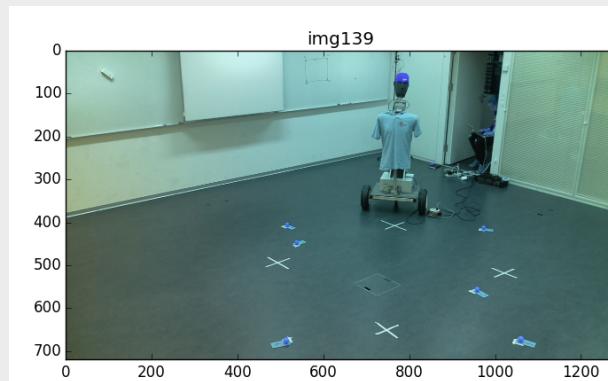
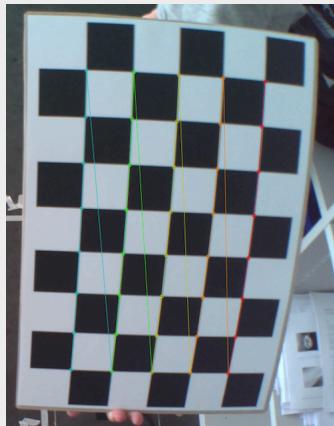
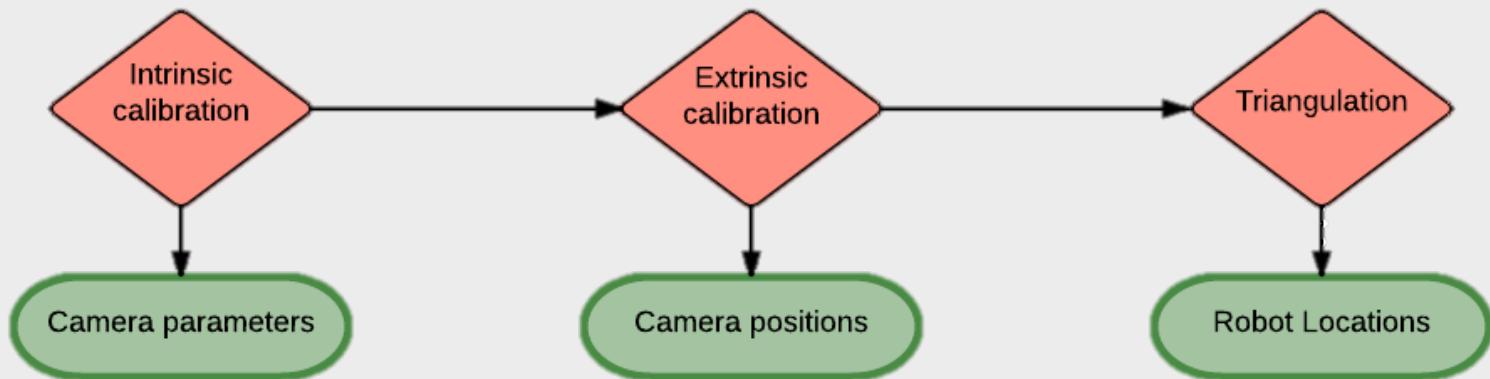
Visual localization
ground truth

Odometry
position guess



Sound processing
new algorithm

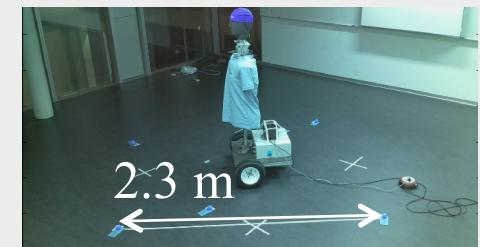
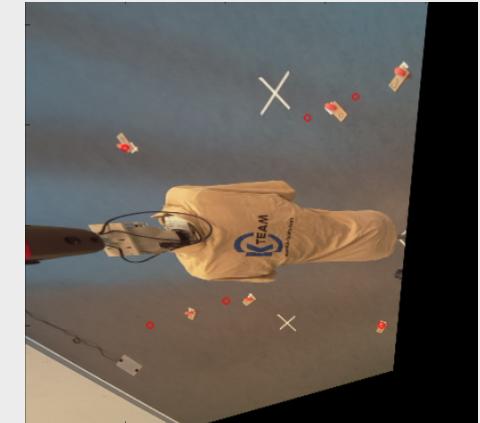
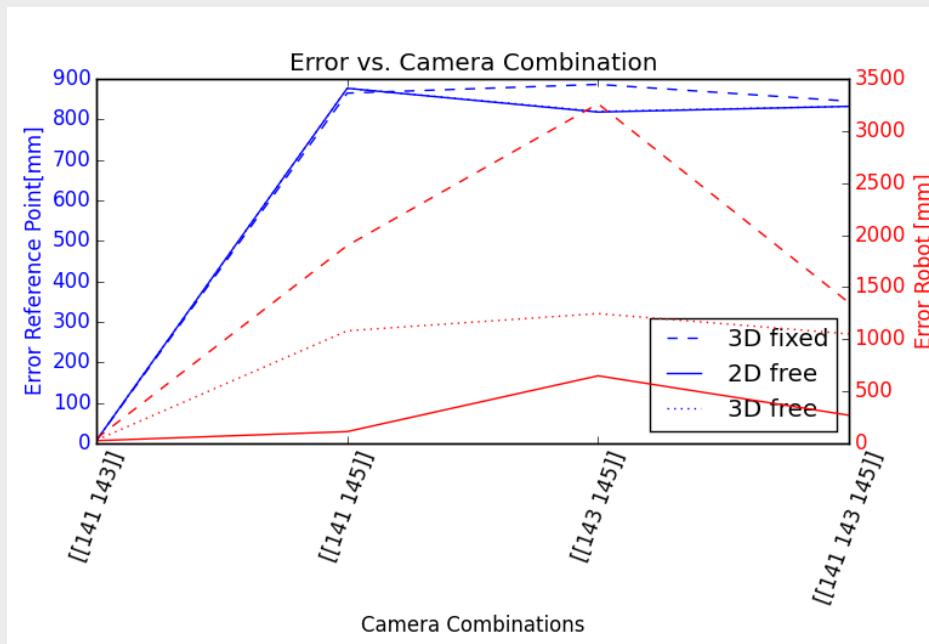
VISUAL LOCALIZATION IMPLEMENTATION



VISUAL LOCALIZATION

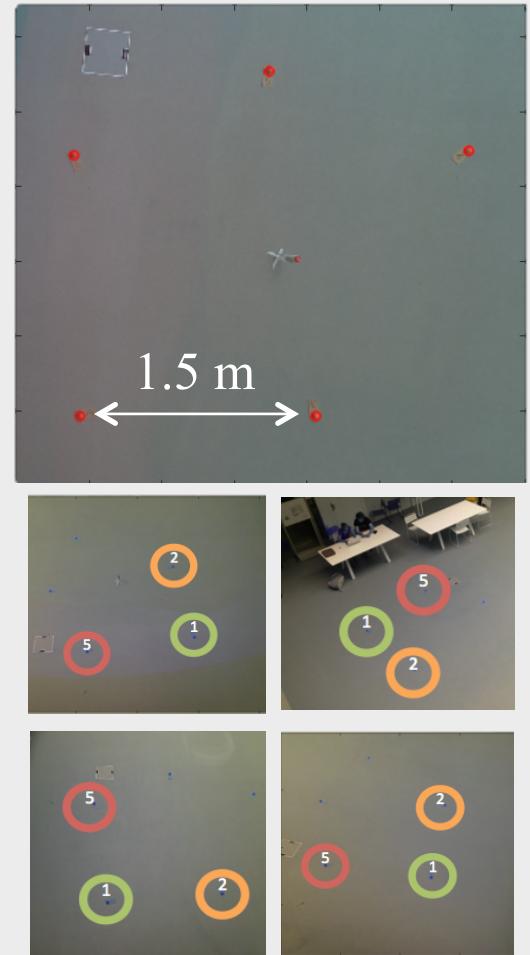
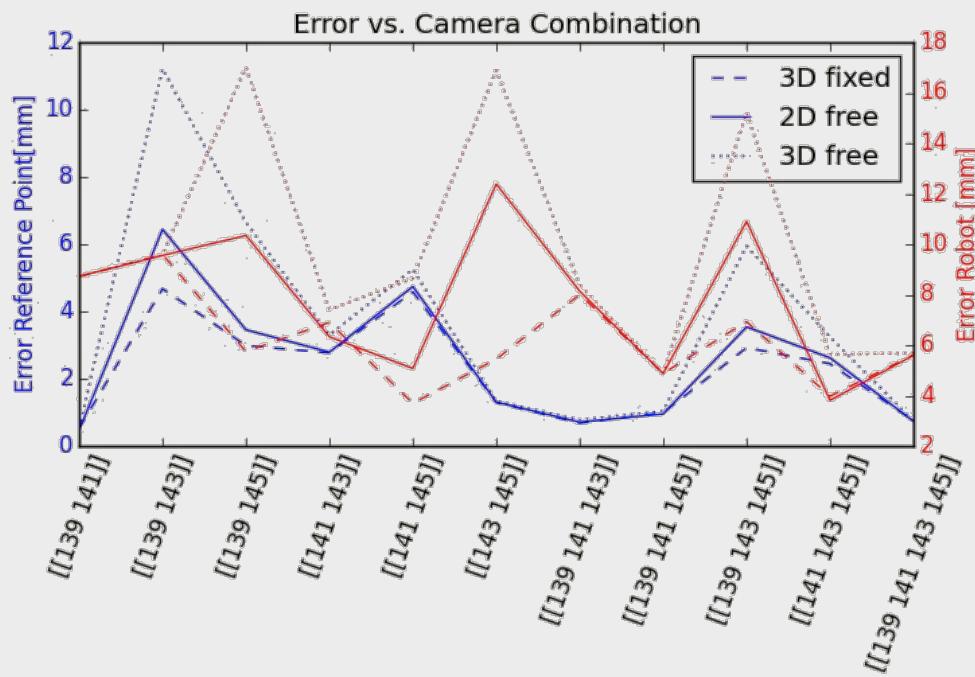
EXPERIMENTAL RESULTS

- ◆ Good accuracy in 2D (<3 cm) and height (<2 cm) for **some** camera combinations
- ◆ Very big variance between and within 4 cameras
needs more investigation



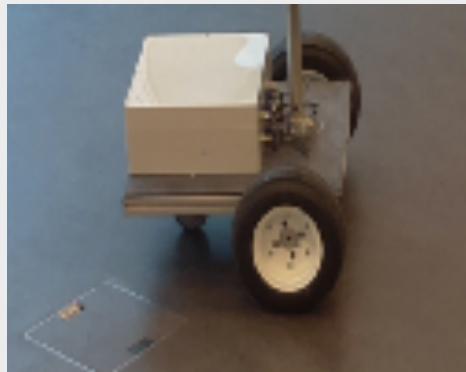
VISUAL LOCALIZATION COMPARISON ATRIUM

- Very good accuracy in 2D (<1 cm) and height (<5mm) for **all** camera combinations



ODOMETRY

EXPERIMENTAL RESULTS



Parameters:

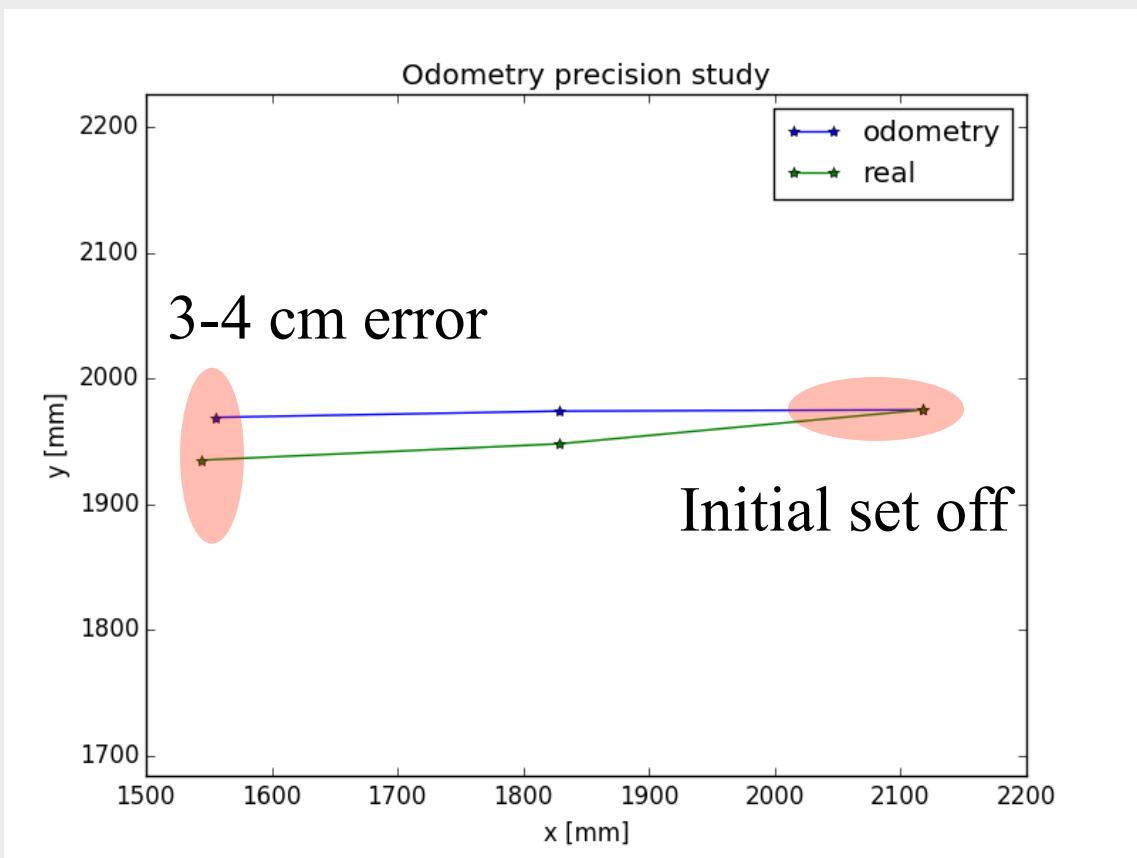
R=15cm

D=71cm

N=512x47 counts/rev

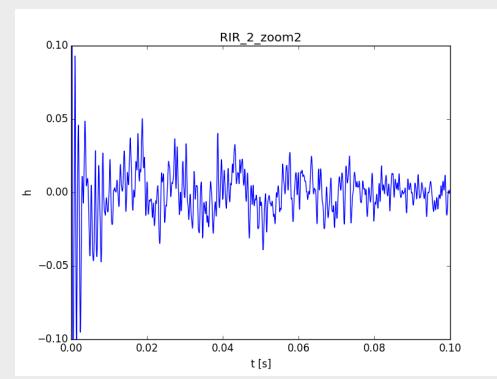
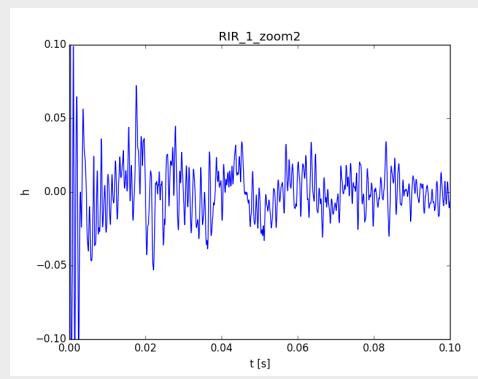
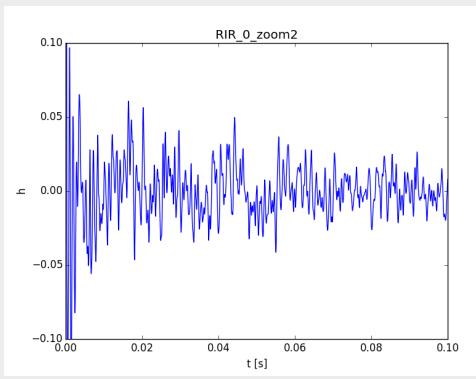
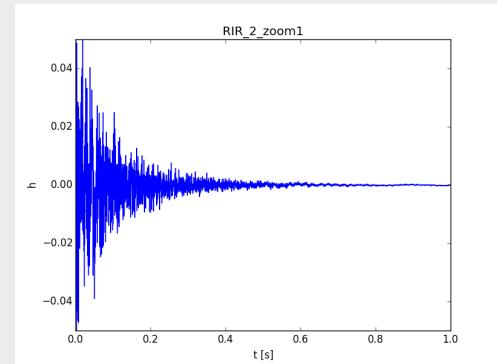
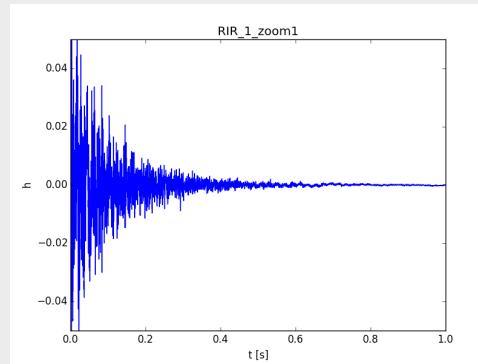
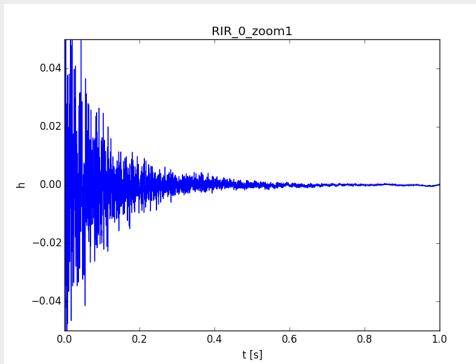
(x_0, y_0, θ_0)

$\Delta_{\text{left},k}, \Delta_{\text{right},k}$ ($k=0, \dots$)



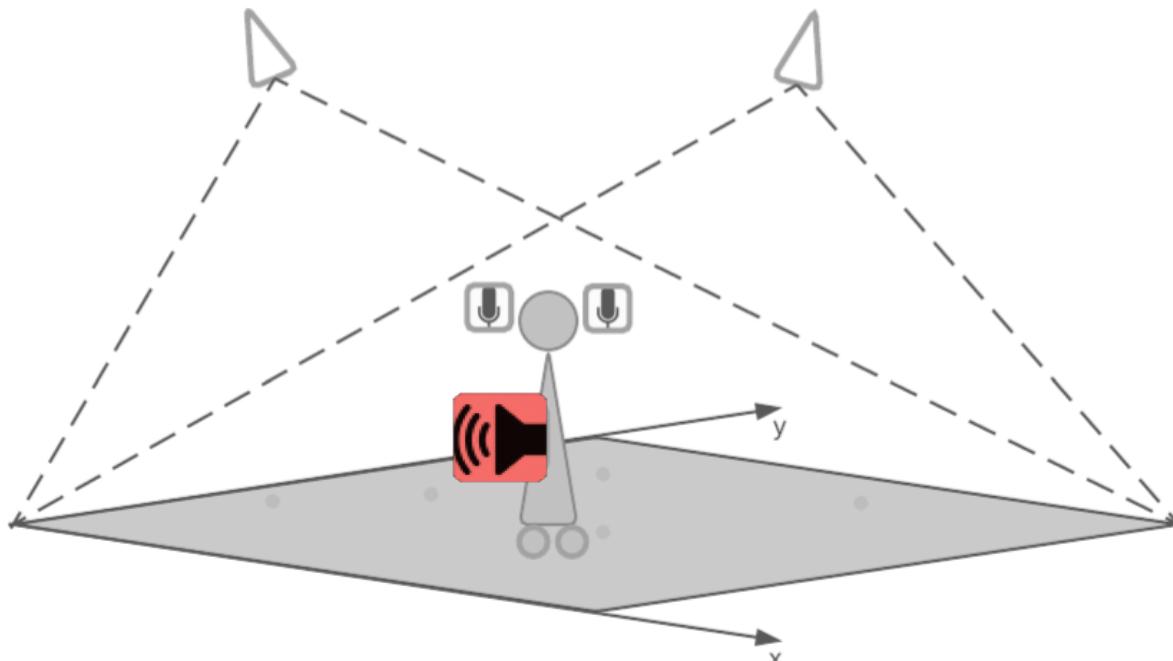
ACOUSTICS

EXPERIMENTAL RESULTS



SUMMARY AND OUTLOOK

Physical setup



Algorithms

Visual localization
ground truth

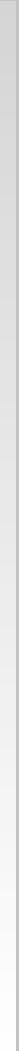
Odometry
position guess

Sound processing
new algorithm

+ Finalization Instructions online

REFERENCES

- [1] <http://www.trailblazercoaching.com/2156/blind-batman/>
- [2] William Kremer: *Human echolocation: Using tongue-clicks to navigate the world.* 12.09.2012. www.bbc.com/news/magazine-19524962
- [3] *The boy who sees without eyes,* 30.05.2012
<https://www.youtube.com/watch?v=TeFRkAYb1uk>



THANK YOU