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# Integrating Ranging Sensors into Finken Robots

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FAKULTÄT FÜR  
INFORMATIK

Some Department

Bachelor Thesis

# Integrating Ranging Sensors into Finken Robots

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**Sebastian Mai:** *Integrating Ranging Sensors into Finken Robots*  
Bachelor Thesis, Otto-von-Guericke-Universität  
Magdeburg, The Year.  
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# Contents

<b>1</b>	<b>Prior Art</b>	<b>1</b>
1.1	Finken Robots . . . . .	2
1.2	Evaluation of Existing Ranging Solutions . . . . .	2
1.2.1	Indoor GPS . . . . .	3
1.2.2	Cricket / Active Bat . . . . .	3
1.2.3	External Tracking . . . . .	3
1.2.4	Atmel RTB, Dresden Elektronik, Meterionic . . . . .	3
<b>2</b>	<b>Implementation</b>	<b>5</b>
<b>3</b>	<b>Evaluation</b>	<b>7</b>
<b>4</b>	<b>Future Work</b>	<b>9</b>





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# 1 Prior Art

## 1.1 Finken Robots

The Finken project aims to create a swarm of autonomously flying quadcopters to research swarm intelligence behaviour on robots. Many algorithms in swarm intelligence are based on distance-values. For this reason it is reasonable to search for a sensor that is capable to measure distances and integrate it into the Finken robots.

source

The Finken robots are already existing and of course it is necessary to know which kind of hardware on the robots could interfere with the ranging sensors that shall be integrated into those robots.

IMU Inertial Measurement Unit with accelerometer, magnetometer and barometer

Sonar Sensors Sonar sensors to measure distances of the nearest object in four directions (front, back, left, right)

IR-Sensor Sensor to measure distance to ground with high frequency

Optical Flow Optical flow sensor, that can be integrated to measure x-y-velocity over ground

Motors Four brushless motors that may cause RF-interference and noise

Telemetry BTLE-/Zigbee modules to exchange data with the ground station

RC-Control 2.4GHz based Radio Control to manually control the robots

fink3? Supply Lithium polymer batteries with nominally 6.6V output voltage that is converted to 5V and 3.3V by the power distribution hardware

weight Payload The overall weight of the copter in the current configuration is about g with about g headroom for additional equipment

payload

Size The copter has a rotor to rotor distance of 10cm, and a sensor tower that is about 4cm by 4cm wide to use the existing mounting holes would be favourable

## 1.2 Evaluation of Existing Ranging Solutions

There are some technologies that can be used for ranging, however the usual application for most of those technologies in research is positioning. For that reason it is interesting to search for positioning applications that use range

measurements, however many of those positioning technologies are base on other principles than multilateration<sup>1</sup>.

The usual technologies used for ranging are based on time of flight measurements, signal strength, optical tracking, and phase difference measurements in signals.

### 1.2.1 Indoor GPS

[?]

### 1.2.2 Cricket / Active Bat

### 1.2.3 External Tracking

### 1.2.4 Atmel RTB, Dresden Elektronik, Meterionic

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<sup>1</sup>The usual methods for positioning are: *multilateral*—which is what we are interested in because only ranging measurements are used, *multiangular*—which is no use to us, because angle measurements are used and by *orientating in a map* with different factors like beacon-positions—which is also no use to us.



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## 2 Implementation



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## 3 Evaluation





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## 4 Future Work

