J.M. van Willigen

Problem sketch & Goal Problem sketch Goal

Approach

Challenges -Solutions Elaboration

Data analysis

Kinect Omnivisio

Implementation

Verification Ball laying still Shot/Pass

Conclusions & Recommendations

Questions

Bachelor end project Online mounting calibration around the vertical axis of the Kinect sensor

J.M. van Willigen

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July 6, 2017

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Challenges -

Kinect

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3 Data analysis Kinect Omnivision

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6 Conclusions & Recommendations

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Problem sketch

- TURTLE & frame
- Kinect unused
- Online mounting calibration
 - Horizontal axes
 - Vertical axis



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Goal

• Develop an online mounting calibration around the vertical axis of the Kinect.

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- Robot coordinate frame
- Kinect coordinate frame
- Omnivision coordinate frame

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• Use ball position

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sketch & Goal

Challenges -Solutions

Kinect

Ball laying still

Approach **Challenges - Solutions**

Challenge	Solution
Delay	Constant θ
	 RefBox task
	 Shot/Pass
Offset Kinect and	Goniometry
Omnivision	
Inaccuracy	Kalman filter
Dislocations due to	Collision detection
collisions	Filter reset
False-positives	Compare Kinect and
	Omnivision ball
Ball not in measurement	Greenfield analysis
space	

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Approach Elaboration: Goniometry



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Approach Elaboration: Kalman filter

• The system:

$$x_k = Ax_{k-1} + w_k$$
$$z_k = Cx_{k-1} + v_k$$

•
$$x_k = \hat{\theta}_d$$
, $z_k = \theta_d$, $A = 1$, $C = 1$, $w_k = 0$

• v_k to be determined



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Approach Elaboration: Collision detection

Threshold: 160 m/s^2



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Standard deviation: 0.014 Variance: $2.0 * 10^{-4} \text{ rad}^2$

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Standard deviation: 0.018 Variance: $3.2 * 10^{-4} rad^2$

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Implementation

- 1 Collision detection
- 2 RefBox check
- 8 Ball selection
- **4** Goniometry to calculate θ_d

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- 6 Kalman filter
- 6 Correction

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Two cases:

1 Ball laying still with collision

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2 Shot/Pass

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Ball laying still with collision



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Shot: too little measurements

Pass: still an offset

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Conclusions

- Ball laying still: Works
- Shot: Does not work
- Pass: Needs improvement
- Algorithm deals well with collisions
- Greenfield analysis

Recommendations

- Test in game
- Optionally adjust algorithm for Passes to work
- Combine with mounting calibration horizontal axes

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Questions?

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