

# Master - Thesis Project



## TRACKING ADD-ON CAMERA SYSTEM FOR GAMMAPROBES AND ULTRASOUND SENSORS

### Required Knowledge (some obviously to be acquired during the course of this work):

Little mechanical engineering, some electronics, small camera systems for tracking, fiduciary/physical markers, tracking algorithms, image registration ...

### Description / expected results:

Tracking and Navigation of instruments / systems and small imaging systems is performed using commercially available systems based on infrared cameras or electromagnetic fields. Both have advantages and drawbacks for use with handheld gammacameras or ultrasound probes. Main disadvantage is that you require a separate system.

It would be advantageous to have a small system ADD-ON that is directly attached to the device that is being tracked.

Based on a patent application and some work that was performed by the Max-Planck-Society in Leipzig (EMOTRAC - motion tracking of head movement with a small camera system) it is proposed to use one to three small cameras in a separate small system to be attached to the device to be tracked. These cameras track the motion of the device with respect to one to three markers (barcode, geometric forms, ...) that are attached to the human body.

The project work expects that a small, rudimentary prototype is build including the tracking software and data sets that are required for accurate tracking and image stitching or image fusion. Accuracy of 1mm in all three dimensions is required in a real-time setup.

Expenses are being paid by the work group of Michael Friebe and a small "work fee" can be negotiated!

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**emMotRac**  
Embedded Motion Tracking for MR

Thomas Siegert & Jessica Schulz

**Problem**

- Magnetresonanztomografie (MRT): teure medizinische Bildgebung mit hoher räumlicher Auflösung, gutem Gewebekontrast (insbesondere Weichteile) und Möglichkeit zur funktionalen Bildgebung (fMRT)
- Lange Aufnahmezeiten (meist ~Minuten)
- Bewegungsartefakte beeinträchtigen häufig die Bildqualität und damit die diagnostische Beurteilung bis hin zur kompletten Wiederholung der Untersuchung (sehr hohe Kosten pro Patient)
- Besonders häufig bei
  - Unkooperativen Patienten
  - Patienten mit krankheitsbedingten Bewegungen
  - Kindern
  - Hochaufgelösten Scans ( $\leq 0.5 \text{ mm}$ )
  - fMRT mit Bewegungsaufgaben

**Lösung**

- Adaptive Bewegungskorrektur: Die Bewegung wird gemessen (optische Lösung mit emMotRac) und die Messparameter in Echtzeit an die Bewegungs angepasst
- Kopfbewegung = rigide Bewegung mit 6 Freiheitsgraden (Rotationen und Translationen)

uncorrected      corrected

**PATENT APPLICATION:**  
DE 10 2013 109486 -- "Navigation Add-On"

$(x, y, z, t)$

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