

MIGHTY: A comprehensive platform for the development of medical image-guided holographic therapy

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INTRODUCTION

Problem. Lack of interoperability between all the devices that interact in the operating room (OR).

Aim. To develop a novel comprehensive platform for surgical applications providing the integration across multiple OR systems and supporting modern AR hardware, real-time imaging and collaborative robotics.

Use case. AR-Guided Abdominal Biopsy.

METHODS

ARCHITECTURE

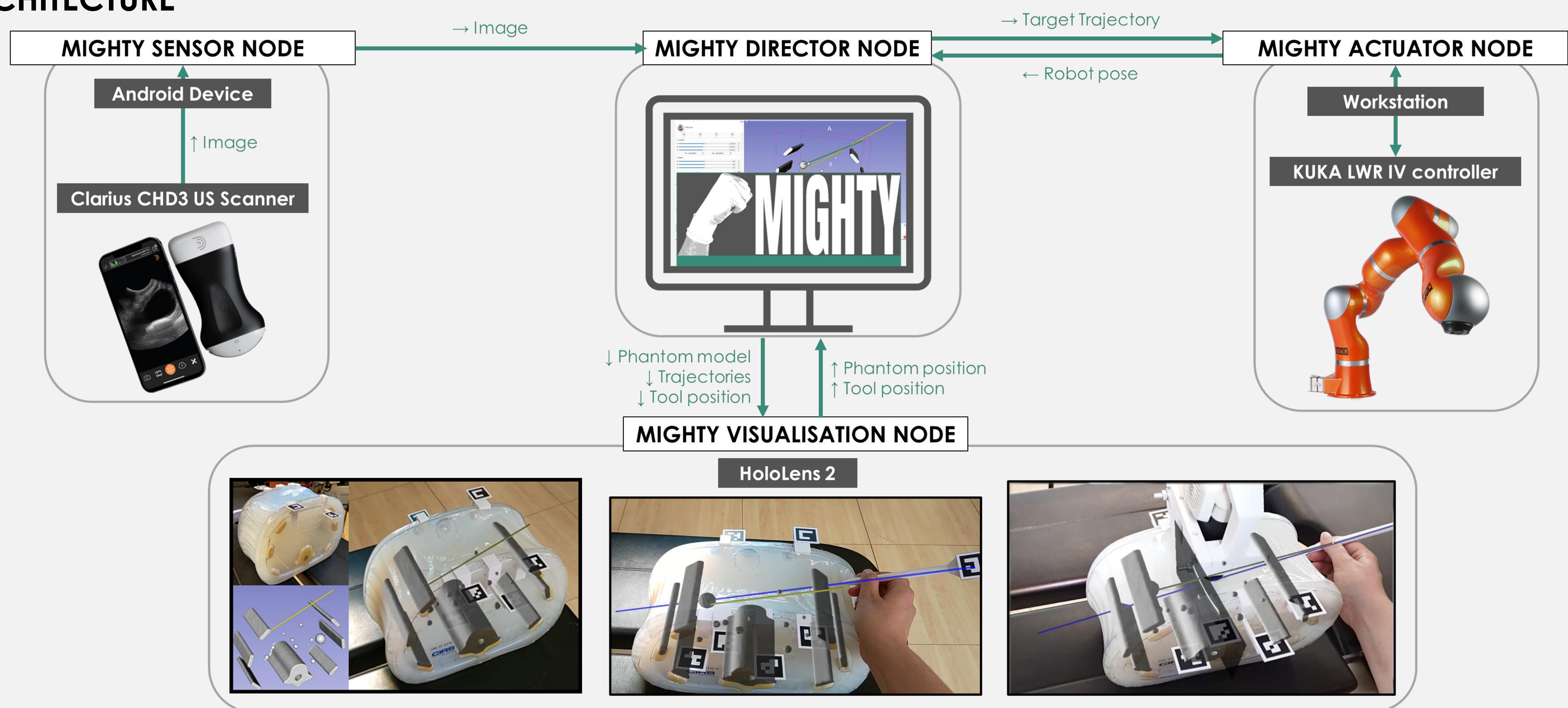


Figure 1. Schematics of MIGHTY architecture and AR-Guided Abdominal Biopsy use case.

QUANTITATIVE ASSESSMENT

Throughput. Frame rate on the holographic display (biopsy scenario with and without real-time imaging).

Scene tracking. Marker-based tracking evaluated for registration procedure:

- *Patient tracking:* back-projected error calculated in mm (repeating series of sweeps around the phantom).
- *Tool tracking:* coordinate system measured one with respect to the other (3D printed scaffold with two cubes placed in parallel on the X and Z axes).

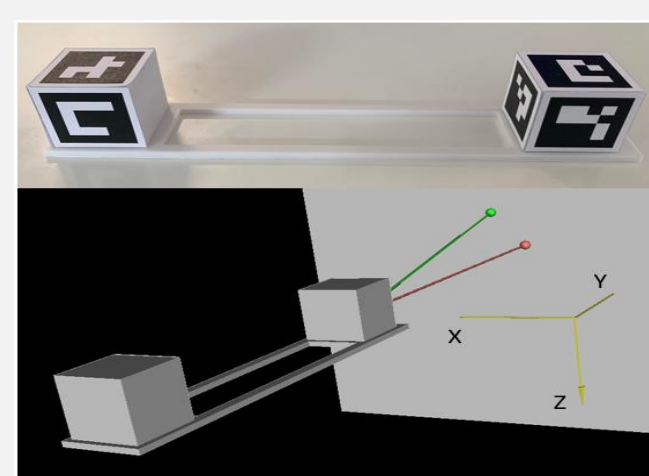


Figure 2. Scaffold for tool tracking experiment

RESULTS

Table 1. Results for throughput experiment

Scenario	Mean (fps)	Std. (fps)
Without US	50.75	9.75
With US	54.79	8.20

Table 2. Results for patient registration experiment

Sample	Mean (mm)	Std. (mm)
1209	1.42	0.69

Table 3. Results for tool tracking experiment

Axis	Median (mm)	IQR (mm)
X	0.90	5.50
Z	3.93	60.85

DISCUSSION

- MIGHTY successfully integrates the use of AR, robotics, real-time imaging and computer-assisted planning in a coordinated manner for surgical interventions.
- Throughput results ensure a good real-time performance.
- In terms of marker tracking, MIGHTY solves properly the registration algorithm. However, it encounters some limitations related to depth-perception directly related to the use of monocular camera tracking.

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