Evaluation Results

Positioning Accuracy and Stability of MPS

The experiment results show that the MPS system can achieve accurate indoor positioning at a median error of 5 cm, and the standard deviation of 2〔Fig. **12** & **13**〕.

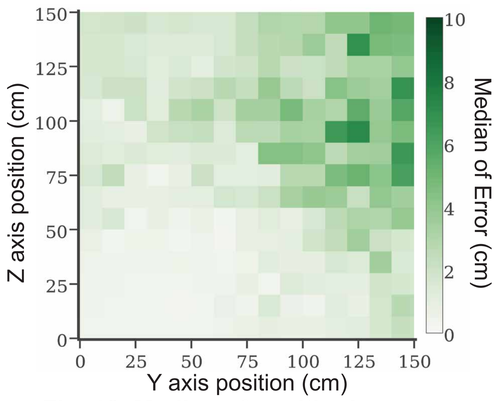

Fig. 12. Median of positioning error

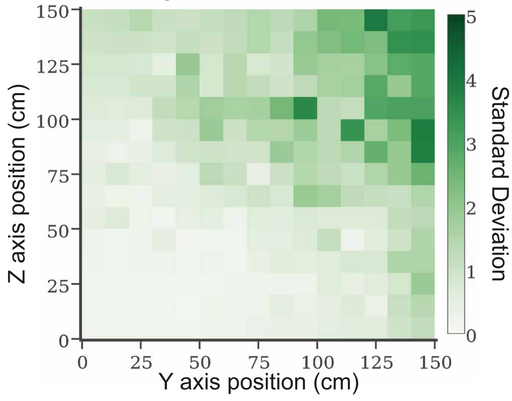

Fig. 13. Standard deviation of positioning error

Positioning Accuracy with Obstructions in Different Zones

1. The positioning accuracy was evaluated with different obstructions in the three zones within a 3D space〔Fig. **14**〕.
2. The results show that wooden obstructions have little to no effect on positioning, while metal obstructions do produce slight errors due to the induction fields; however, they are negligible〔Fig. **15**〕.

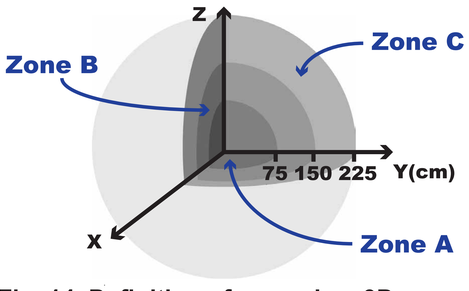

Fig. 14. Definition of zones in a 3D space

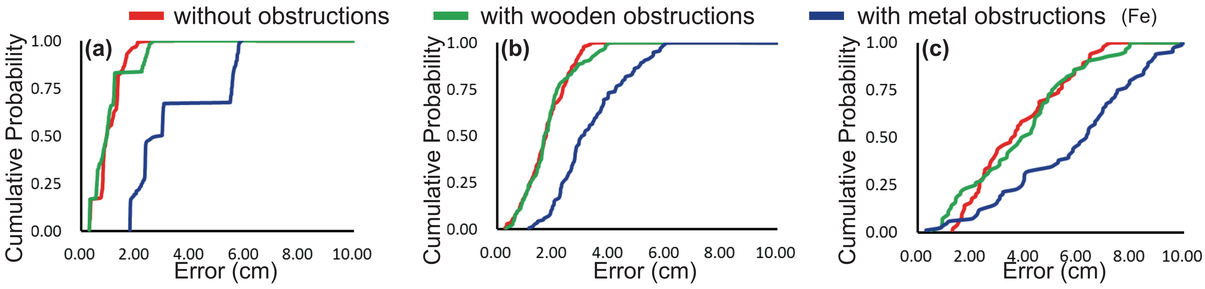

Fig. 15. Cumulative Distribution Function for positioning error with and without obstructions

(a) Error of positioning in **Zone A** (b) Error of positioning in **Zone B** (c) Error of positioning in **Zone C**

Coverage of MPS

1. The magnetic field strength is determined by the value of **NI_0A**, which considers the number of turns of coil; electric current flow (Amperes); and the area of coil (m^2), as illustrated in formula ***(3)*** 〔Table **1(a)**〕.
2. The achieved range of MPS is sensitive to the granularity supported by Analog to Digital Converter (ADC) and the amplification gain of the magnetometer〔Table **1(b)**〕.

Table 1. Coverage of MPS under different conditions

(a) MPS with different NI_0A

NI_0A	Measured range (m)	Ideal range (m)
1.15	1.46	2.64
2.89	1.88	3.59
5.39	2.51	4.57
8.32	2.68	5.12
62.83	5.32	10.15
353.43	N/A	18.06
1963.49	N/A	31.99
3848.45	N/A	40.03

(b) Objects with different sensitivities

NI_0A	Bits of ADC	Gain of sensors	Measured Range (m)
2.89	12 bits	212.77	1.88
		638.30	2.21
	16 bits	212.77	1.95
		638.30	2.29
8.32	12 bits	212.77	2.68
		638.30	3.17
	16 bits	212.77	2.76
		638.30	3.19

Conclusions and Future Applications

1. A novel system, called **Magnetic Positioning Sphere**, is presented as an accurate and single source indoor positioning.
2. The MPS can locate an object is less than 10 ms, and it is resilient against radio interference and obstructions.
3. Compared with current positioning systems, the MPS system does not require a site survey and can be installed instantly with minimal deployment cost.
4. Future applications of the MPS system may include applications which demand an **instant setup** positioning system. For example, it can be installed in seconds and provide positioning of firefighters, robots, or UAVs in rescue situations.

References

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