

# EXPO

engineering ▲ design

## RELOCATION GUIDANCE SYSTEM FOR C-ARM MEDICAL IMAGING

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### OBJECTIVE

Implement a guidance system for efficient, convenient, and accurate C-arm relocation.

### BACKGROUND

- C-arms are mobile fluoroscopic X-ray machines used in surgical and medical procedures
- Operated by single X-ray technician
- Quick, accurate images are essential



C-arm with operator

### THE PROBLEM

- Repeatable C-arm positioning
- Difficult & time consuming
- Excessive X-ray scans
  - ↑ radiation exposure
  - ↑ surgery time

### VALUE PROPOSITION

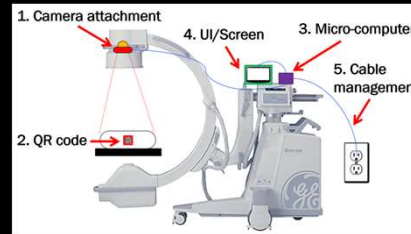
- Decrease surgery time
- Enhance operator convenience
- Decrease radiation exposure

### REQUIREMENTS

- \$1,905 budget
- 1 cm and 1° accuracy
- Sterilizable & detachable
- Provides visual feedback
- User-friendly
- Won't interfere with machine operation

### CONCEPTUAL DESIGN

- A relocation guidance system is retrofitted to the C-arm
- A camera attached to the receiver looks at the surgical site where QR code is placed within FOV
- Coordinates of code are saved and relayed



Major systems breakdown

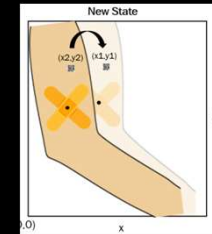
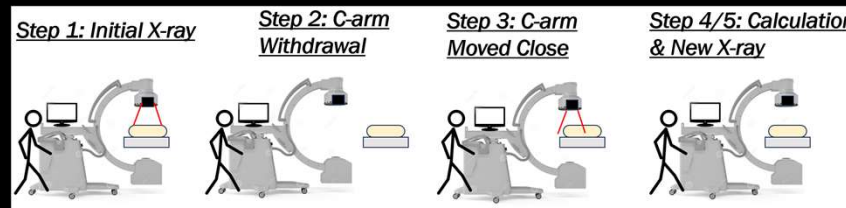
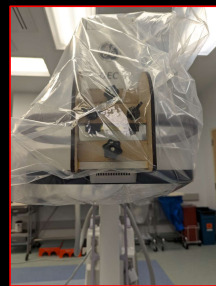


Image detection output

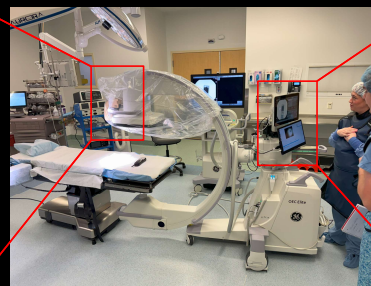


Operator guidance system process flow

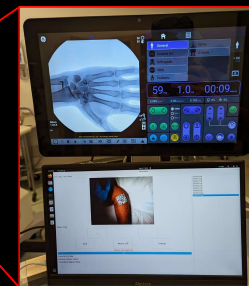
### FINAL DESIGN



Camera bracket



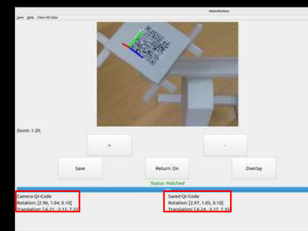
Physical guidance system



UI/Screen

Saved Qr-Code  
Rotation: [2.97, 1.05, 0.10]  
Translation: [-6.24, -3.17, 7.35]  
Saved

Camera Qr-Code  
Rotation: [2.96, 1.04, 0.10]  
Translation: [-6.21, -3.15, 7.32]  
Returned



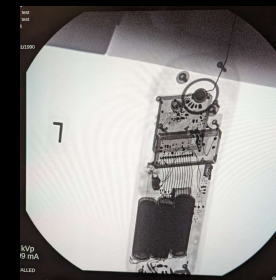
Relocation within 1.27 mm

### OUR TEAM

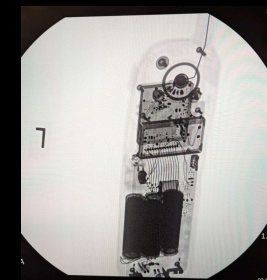


### VALIDATION

- Accuracy determined by difference between saved and returned coordinates
- **Time + accuracy = efficiency**
- User-friendliness determined by technician feedback



Original X-ray



Relocated X-ray

### CONCLUSIONS

- Operators reported enhanced convenience and efficiency
- Guidance system relocates QR code within 1 cm of accuracy
- Compatible with operating room environment

### RECOMMENDATIONS

- Test accuracy of system with difficult relocation scenarios
- Retrofit system to other C-arm models
- Explore other visual image tracking markers
- Develop relocation tests giving quantitative data

### ACKNOWLEDGEMENTS

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