Closed-Loop Anesthesia Delivery System

TinkerHub 24-Hour Hackathon

Jan 31 – Feb 1

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Introduction

- Manual anesthesia delivery depends on clinician experience
- Delayed response can cause patient instability
- Closed-loop systems enable automatic, real-time control

Problem Statement

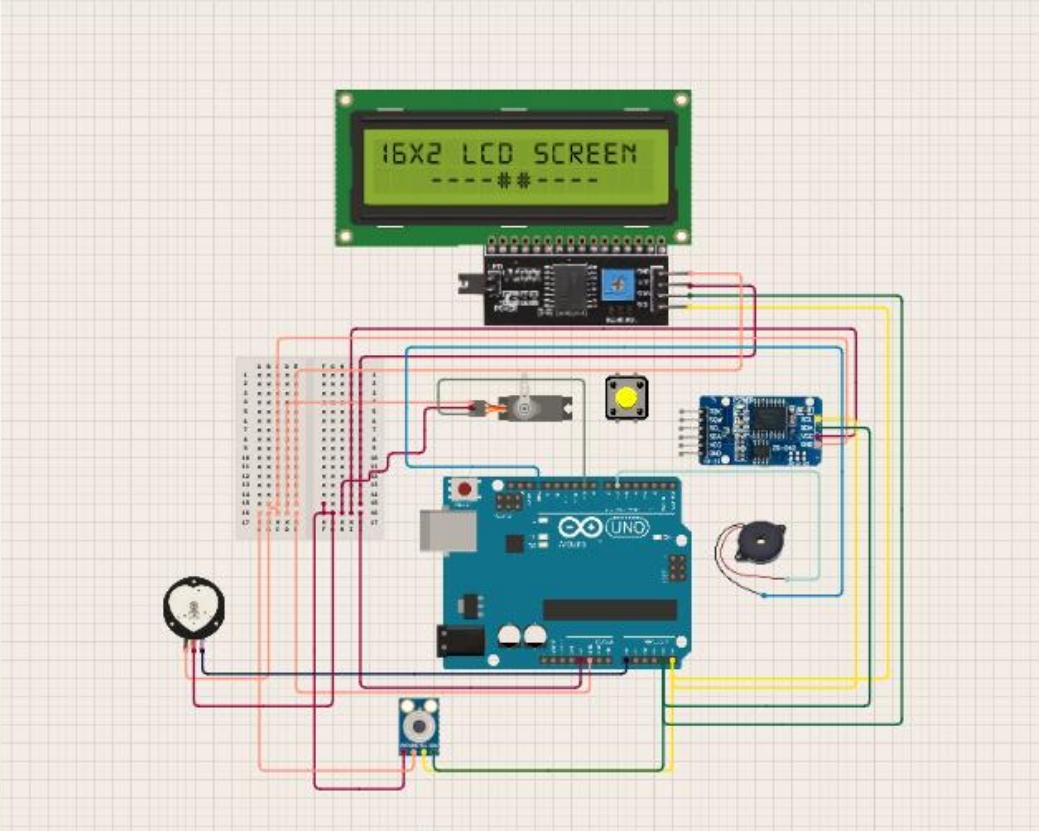
- Manual adjustment of anesthetic drugs
- Intermittent monitoring of vitals
- Need for automated, safer infusion control

Objective

- Monitor HR, MAP, RR, SpO_2
- Implement closed-loop control
- Adjust infusion automatically
- Ensure safety with alarms

System Architecture

Sensors / Simulated Vitals → Microcontroller → Control Algorithm→ Servo Motor → IV Drip Control

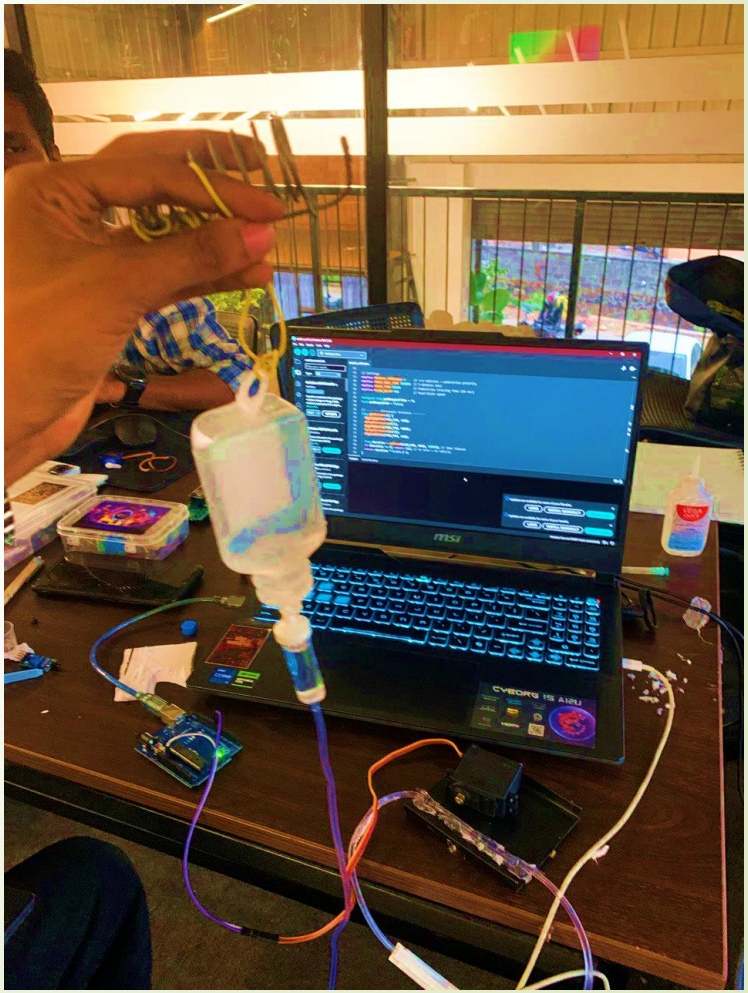


Control Algorithm

- Set-point based control
- Normalized error calculation
- Weighted control signal
- Safety override logic

Servo & Infusion Logic

- ✓ Flow (mL/min) × 20 = Drops/min
- ✓ Servo angle mapped to flow
- ✓ Physical drip control using servo

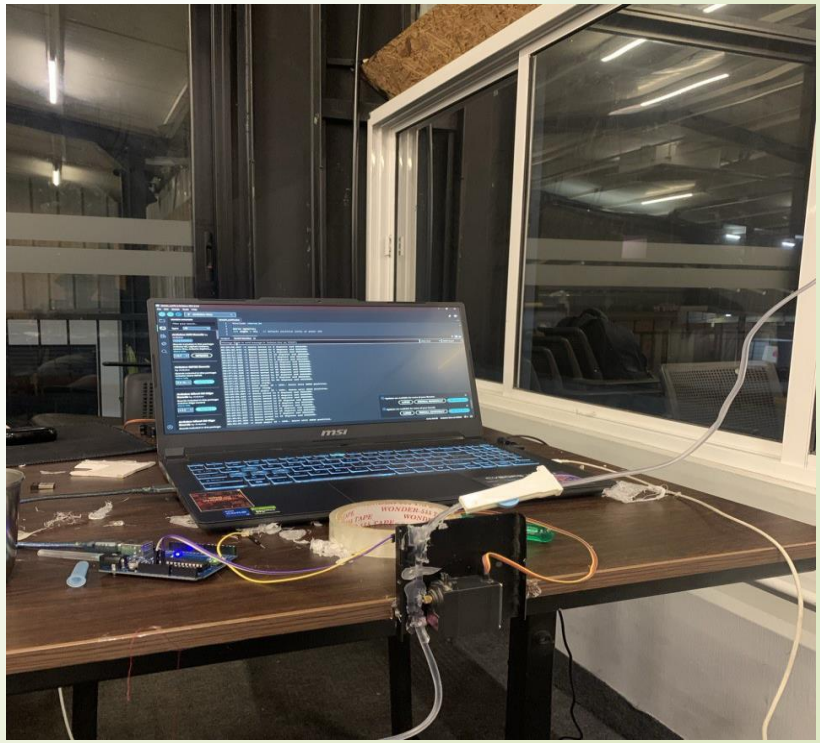


Safety Mechanism

- $SpO_2 < 92\% \rightarrow$ Emergency alarm
- MAP < 60 mmHg → Warning alarm
- Buzzer + OLED display

Results

- Normal → Servo 65°, Buzzer OFF
- Low BP → Servo 55°, Buzzer Beep
- Low SpO_2 → Servo 47°, Continuous Alarm



Conclusion & Future Scope

- Demonstrated closed-loop control
- Stable and safe operation
- Future: Real sensors, PID, AI models

Thank you