

CradleWatch



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Some logos



01

Introduction



The Problem: Simplistic Baby Monitors



Typical baby monitors:

- Camera
- Connects to a home-screen
- **Detect:**
 - Loud sounds
 - Crying

The Problem: Simplistic Baby Monitors

A baby's facial expression/colour can indicate:

*For infants, facial expressions serve as key indicators of pain-related distress.



Positional Asphyxia

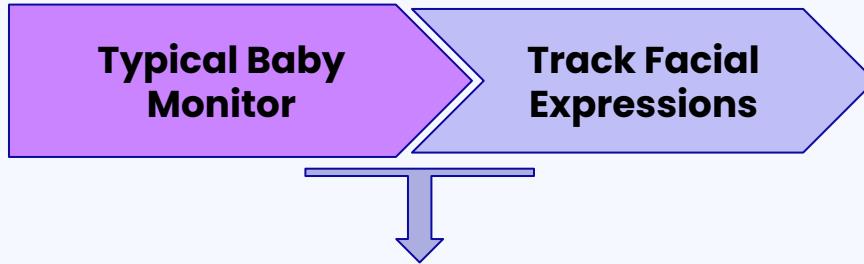


Cyanosis



Sleep Apnea

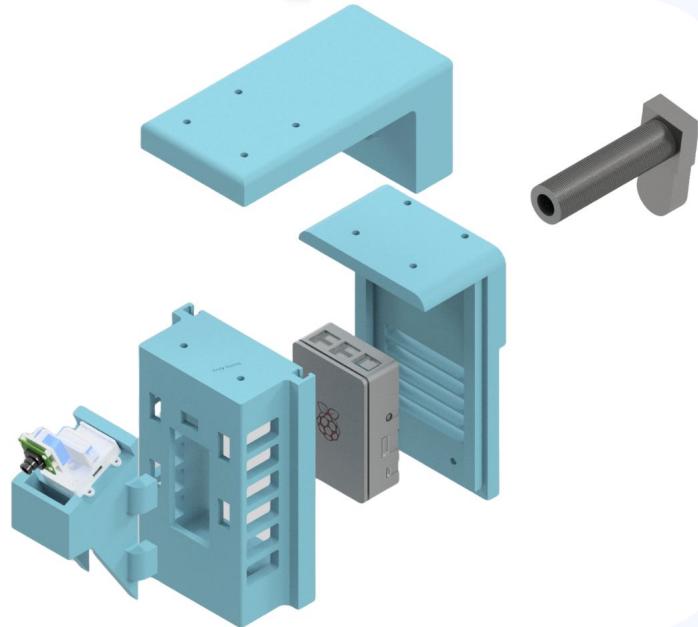
Need Statement



A smart baby monitor that can track facial expressions.

CradleWatch

- **Pan-Tilt camera** for face detection
- **Clamps** onto existing cribs
- Sends notifications about potential dangers through the **Twilio App**



Current Market Analysis

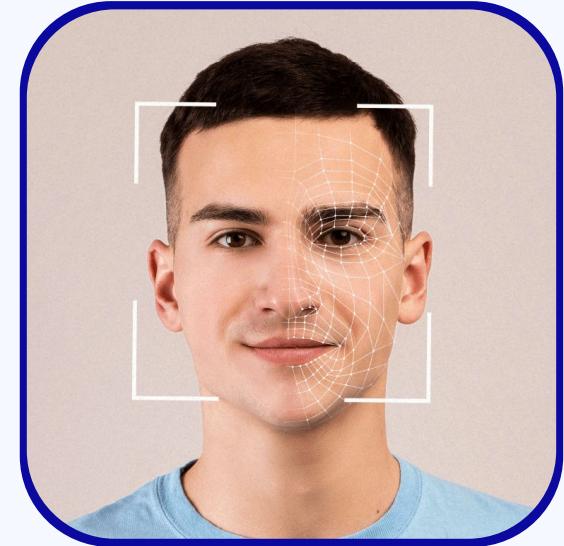
Competitor: Cubo-Ai



- Notifies parents of **covered faces, rollovers, cries, or coughs.**
- **Lacks facial recognition**
- **Retails for \$500 per unit**
 - *CradleWatch* has an estimated price of \$75-100 per unit.

02

Face Tracking & Expression Analysis



The Pan-Tilt Platform



- 180 degree pan and tilt motion
- Allows for tracking baby's face
- Integration with Raspberry Pi + Raspberry Pi camera module 3

Camera Module



12 Megapixel resolution + autofocus

Software

Face Emotion Detection Techniques & Libraries

Libraries Used

- Transformers (HuggingFace): `AutoModelForImageClassification`, `AutoFeatureExtractor` for emotion detection
- MediaPipe: Real-time facial landmarks extraction (Face Mesh).
- OpenCV (cv2) and Pillow (PIL): Image processing and frame rendering.
- SciPy (distance): Calculation of Eye Aspect Ratio (EAR) & Mouth Aspect Ratio (MAR) to detect facial expressions.

Techniques

- Facial Landmarks (EAR/MAR): Used to detect eyes and mouth status (open, closed, distressed).
- Vision Transformer (ViT) Model: Classifies facial expressions (happy, sad, fear, etc.).
- Distress Detection Logic: Combines emotion classification with facial feature ratios (EAR/MAR) to identify distress states.

Software

Raspberry Pi Integration & Notification System

Hardware Integration

- Picamera2: Real-time video capture optimized for Raspberry Pi
- Adafruit PCA9685 PWM Driver: Servo control (pan & tilt) for camera tracking based on detected face position.
- I²C (board & busio libraries): Communication protocol between Pi and PCA9685 hardware.

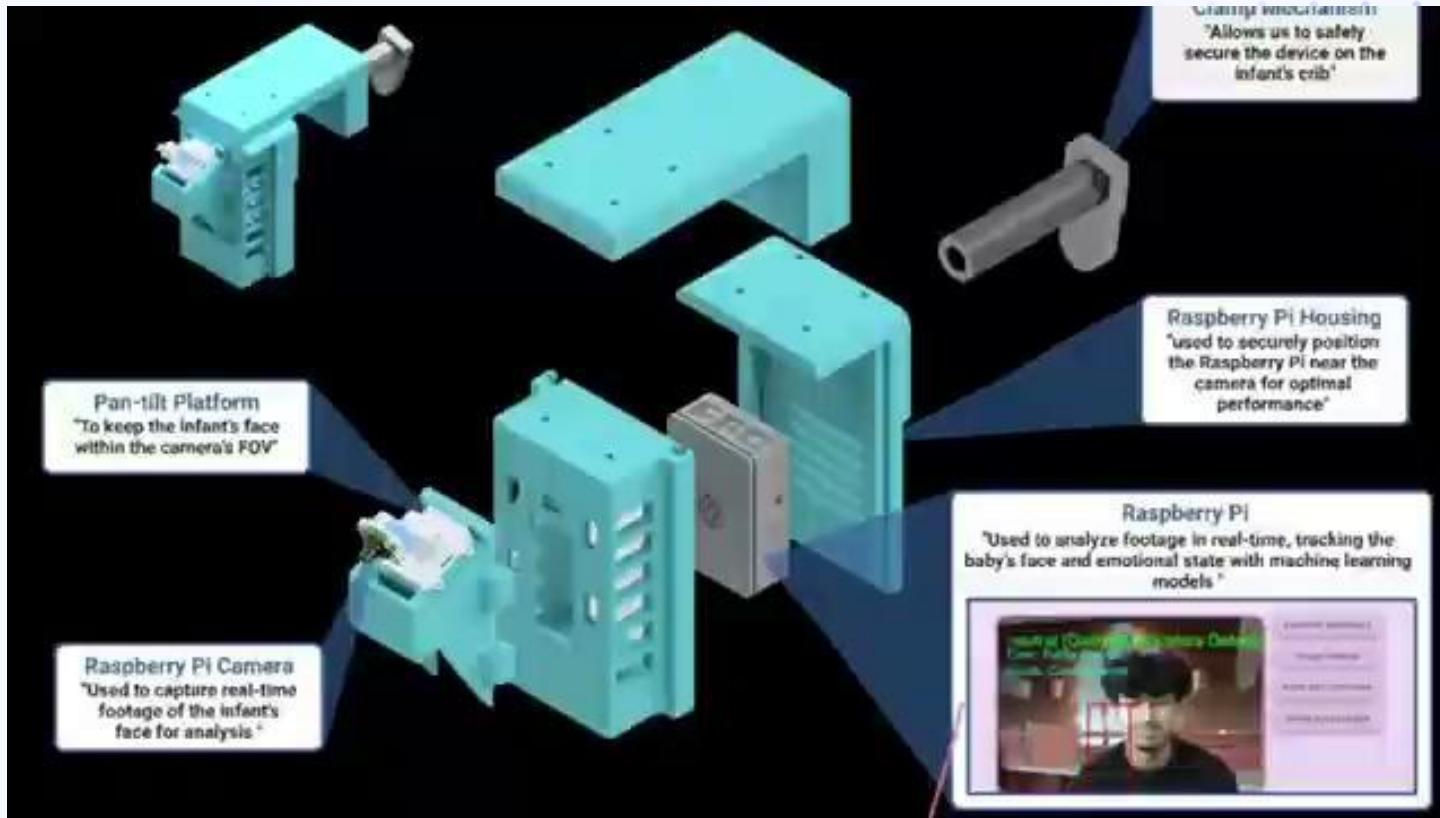
Servo Functionality

- Dynamically adjusts camera position to center detected face.
- Controlled by calculated angles based on facial landmark coordinates.

Notification System

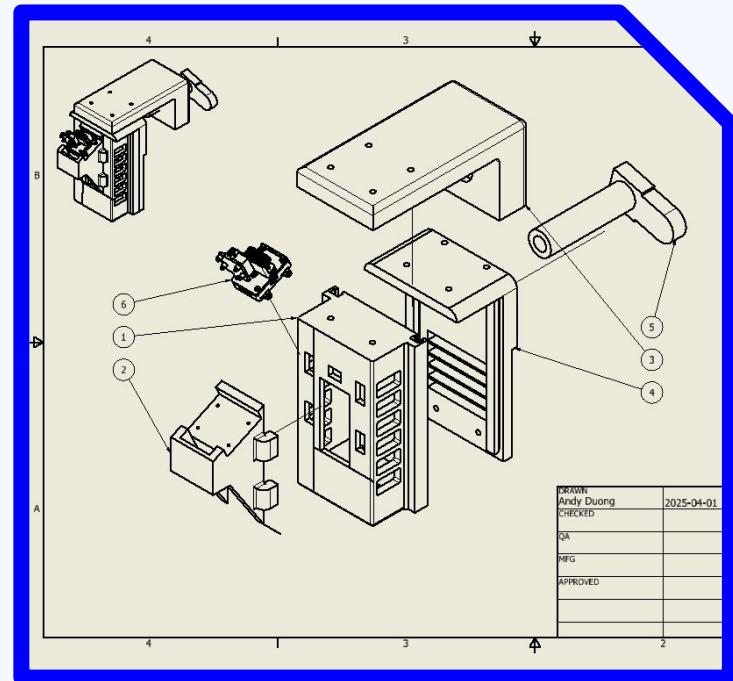
- Twilio API: Sends SMS notifications when distress is detected (e.g., prolonged eye closure, wide-open mouth indicating potential distress).

Video of Functionality



03

Mechanical Assembly





3 Design Considerations:

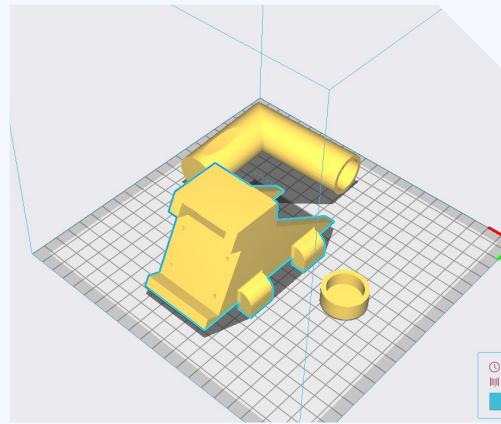
Feasibility, Assembly, Usability





Design for feasibility

Design for feasibility



Catalogue

Apply existing components to decrease manufacturing

3D printed

Anything from scratch, was rapidly prototyped using 3D printers and modeled in **AutoCAD inventor**.

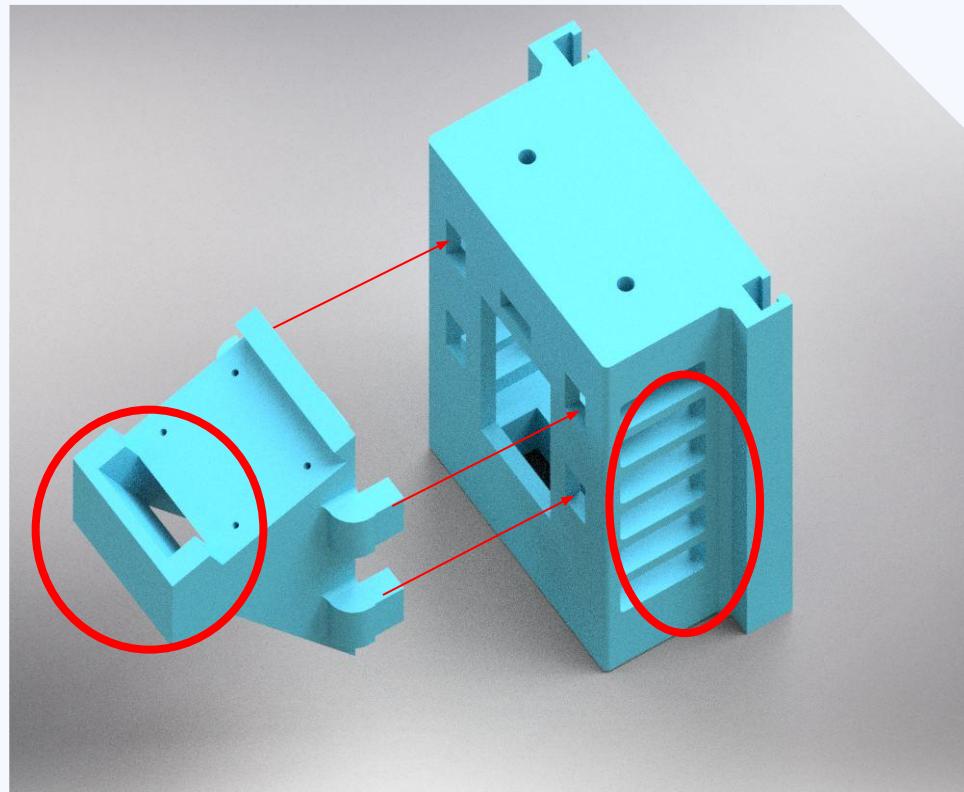


Design for assembly

Design for assembly

JigSaw assembly

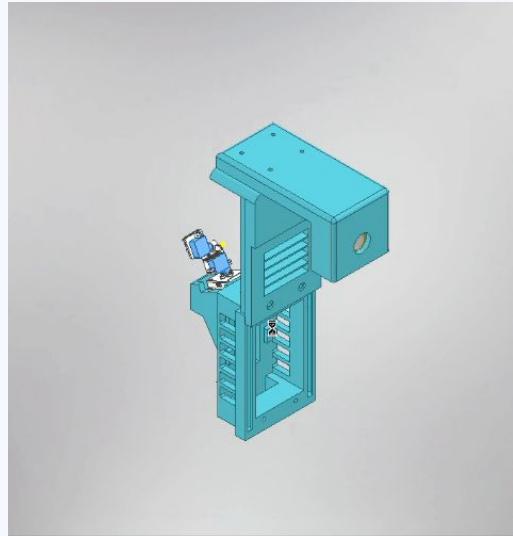
Auto-Locating
Ease-of-assembly



Design for assembly

Slide Lid

Auto-Locating
Ease-of-use

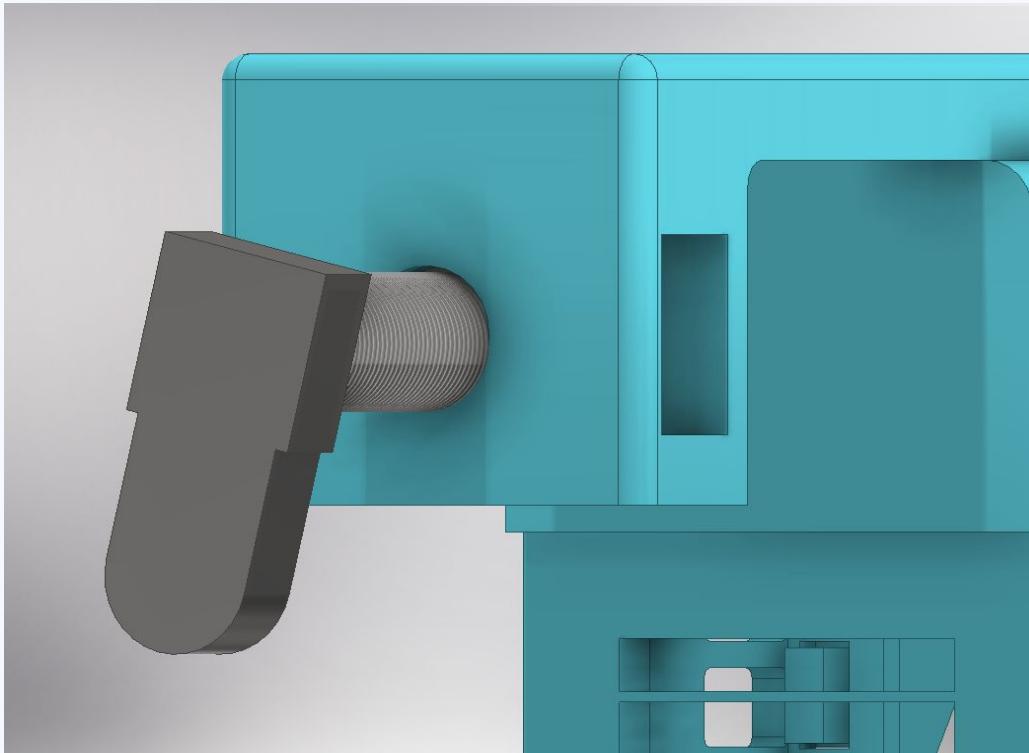


Design for assembly

Built in Hex Nut cutout

Ensures Hex Nut stays tight

Doesn't move during
operation





Design for Usability

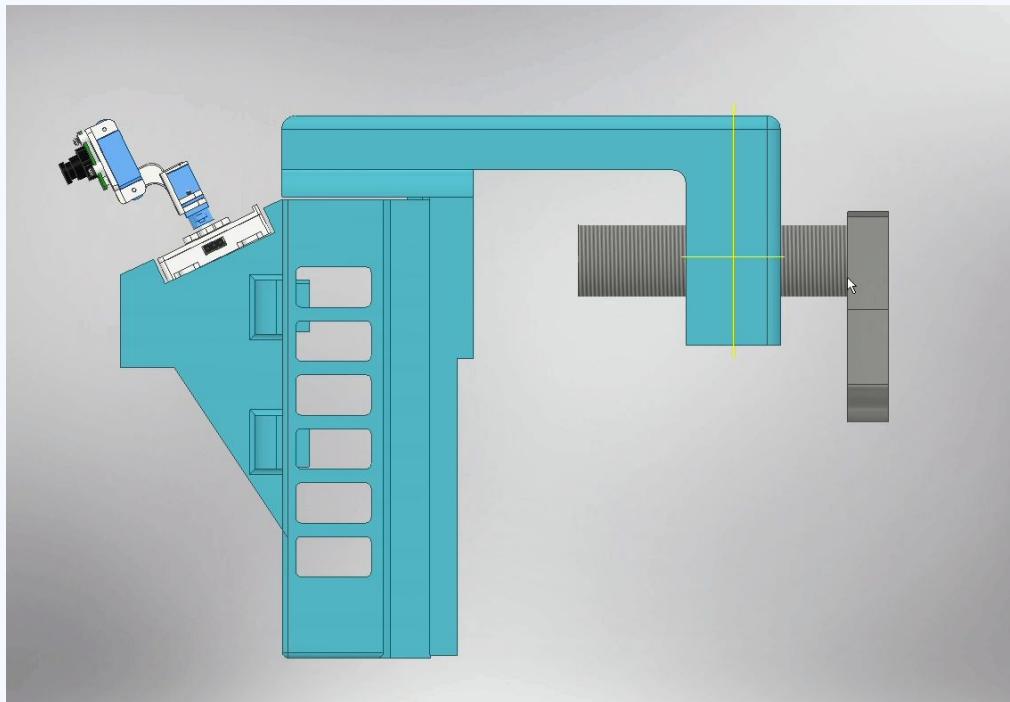
Design for Usability

Screw Clamp

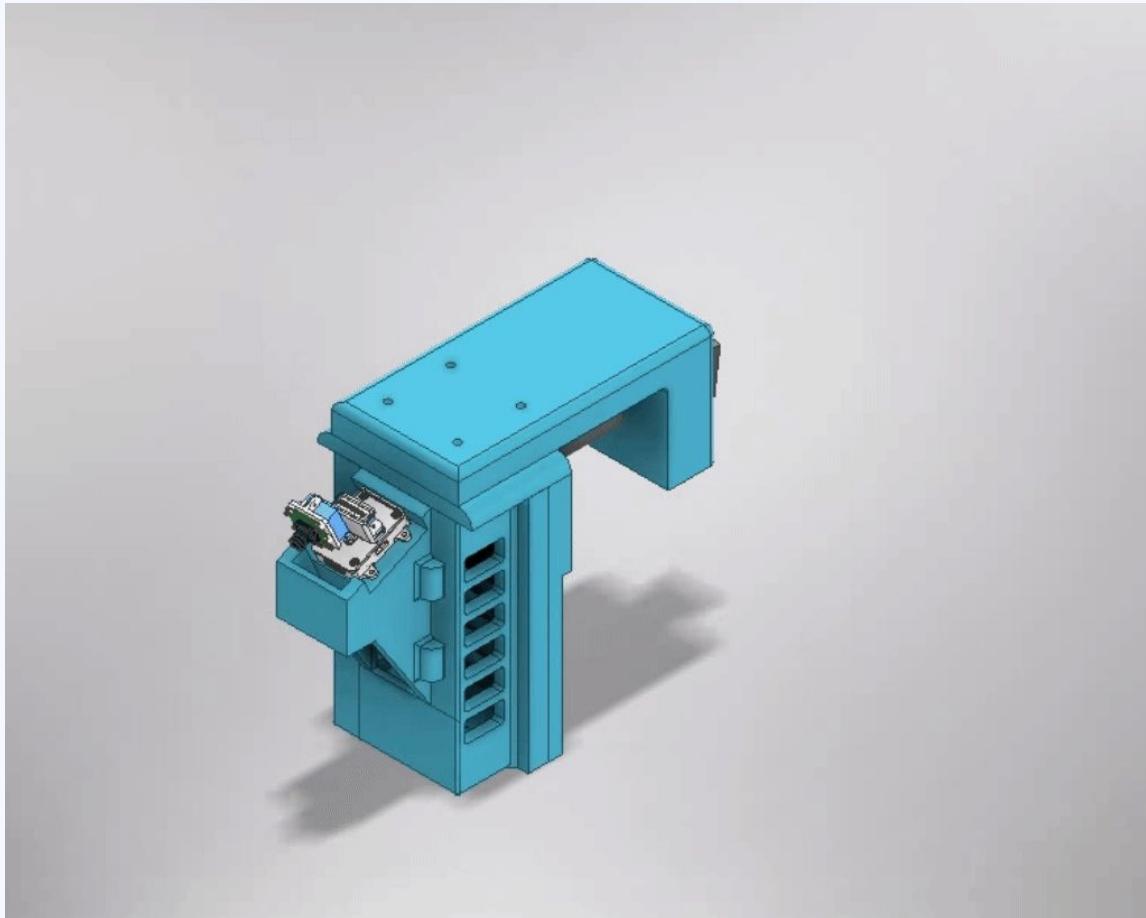
Easy to Use

Simple to implement

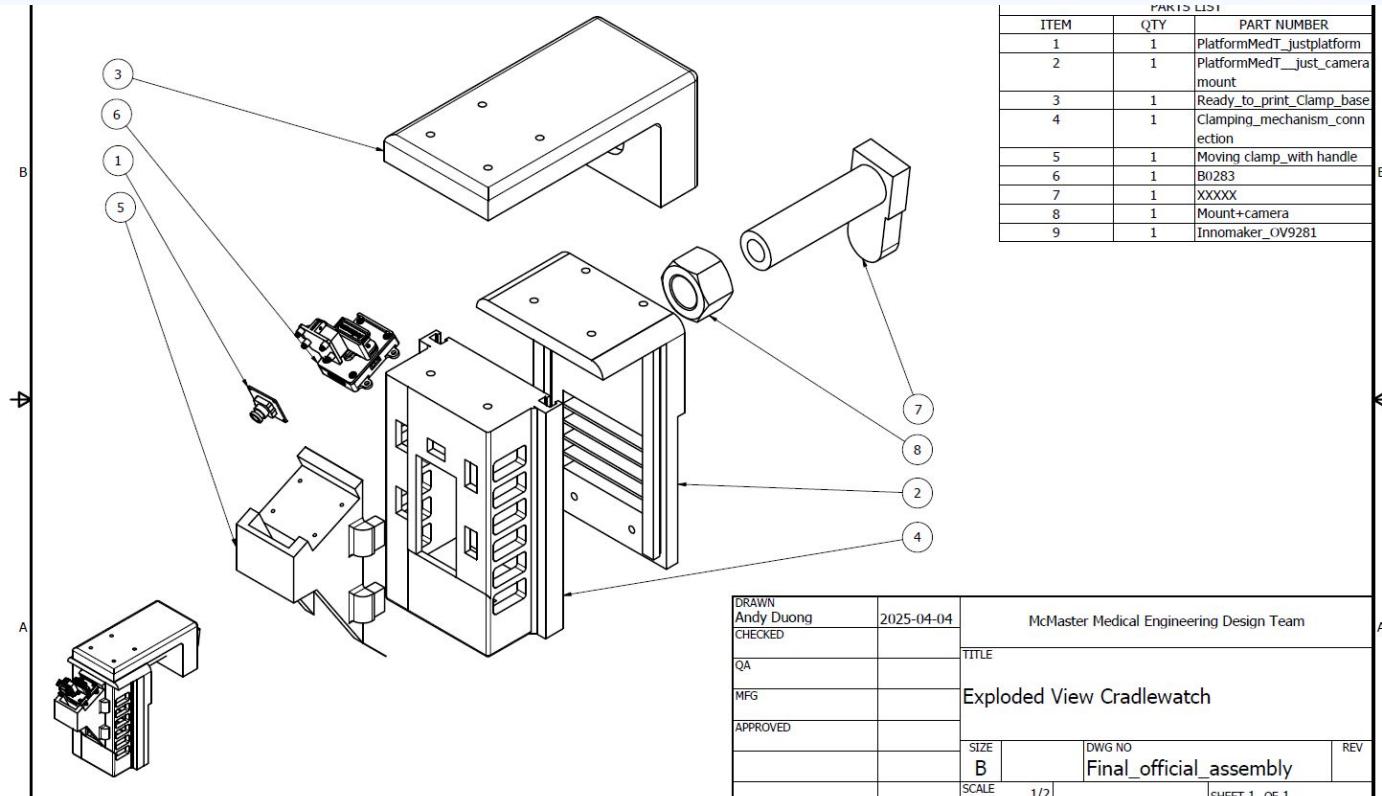
Applicable to many surfaces



Assembly



Assembly



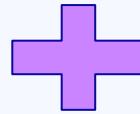
Future Applications: The neonatal intensive care unit (NICU)



Premature infants with congenital conditions require **continuous monitoring from NICU staff or contact-based sensors**.

Future Applications: The neonatal intensive care unit (NICU)

CradleWatch provides a **non-invasive alternative** to enhancing baby monitoring



Detects early warning signs of respiratory distress, pain, or neurological conditions.



Thank You