Astronauts onboard the International Space Station (ISS) follow intricate step-by-step instructions and often encounter maintenance challenges when completing procedures. We propose an automated solution: a procedure-tracking system that uses a computer vision model and sensors to validate user progress.

**Background**

The system involves real-time image processing and identification of all elements involved, with specific substeps that must be satisfied before proceeding to the next step.

**Hardware Diagram**

- **MPU-6050 Acc/Gyro**
- **ESP-32S Microcontroller**
- **Econ E-Cam81_CUNX Camera**
- **NVIDIA Jetson Orin Nano**

**Software Flow**

- **Camera Capture**: Transforms raw camera data into a workable live video feed
- **Sensor Capture**: Transforms raw gyro/acc/temp data to usable metrics
- **Detection Phase**: Computes bounding boxes and angular displacement
- **Validation Phase**: Validates detection against ground truth
- **User Display and Input**: Shows bounding boxes and allows for manual override

**Computer Vision**

- **Model and Performance**: Runs YOLOv7-tiny, a real-time object detection model built for edge devices. This smaller model provides faster inference speed and lower system cost due to reduced parameters (6M).
- **Dataset and Training Enhancements**: Training dataset were manually collected and labeled and augmented with CutMix augmentation. Training employed Transfer Learning on top of MS COCO dataset.