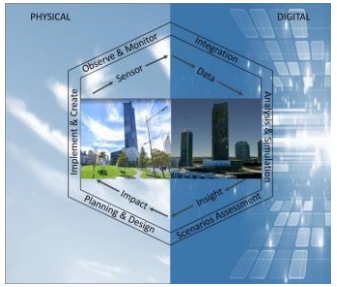
Urban Digital Twins Interoperability Pilot

Open Geospatial Consortium

D101 Deliverable
Camera Imagery Interoperability



Urban Digital Twin Lab

LH 한국토지주택공사

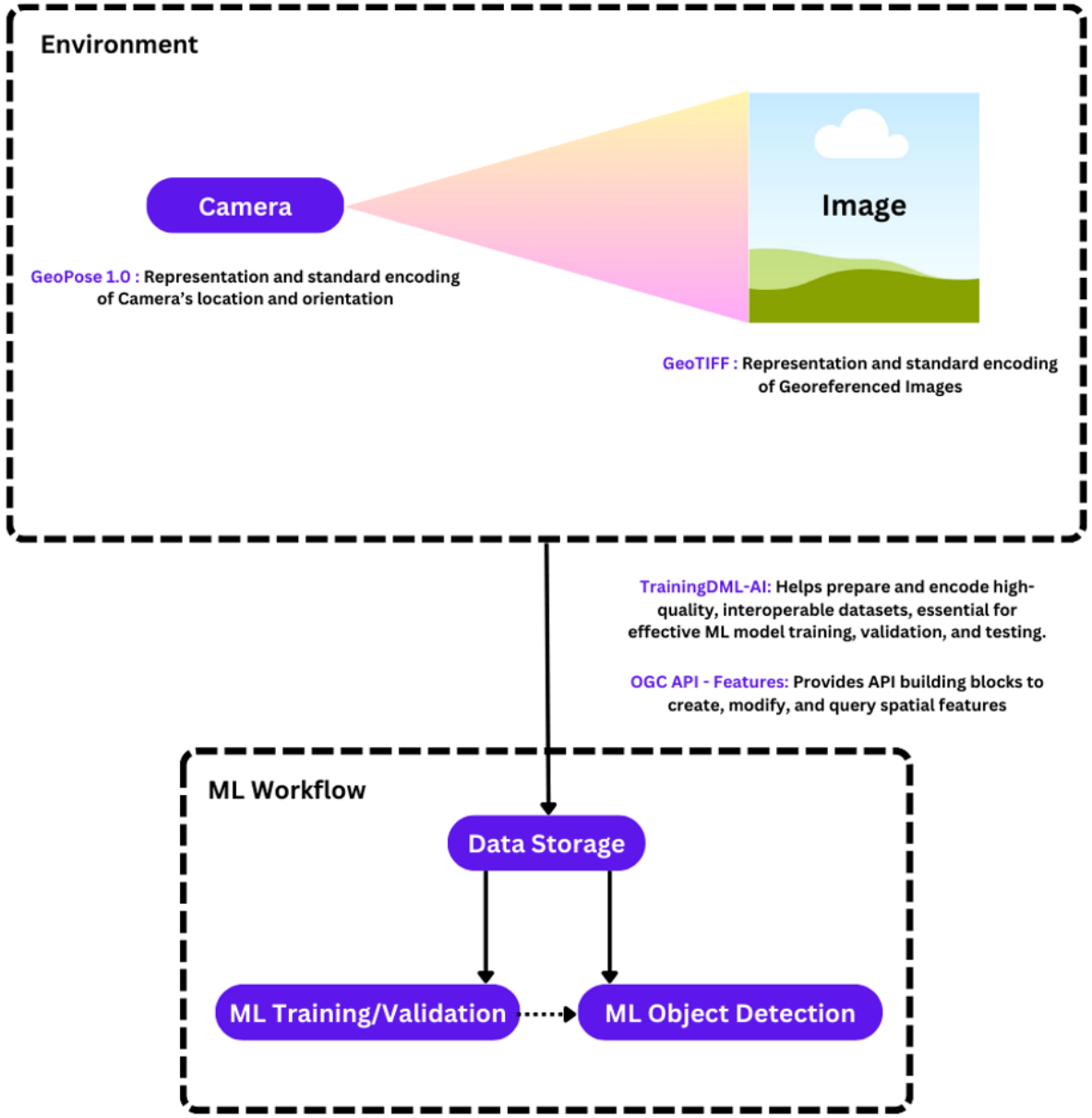
UCF School of Modeling Simulation and Training

Outline

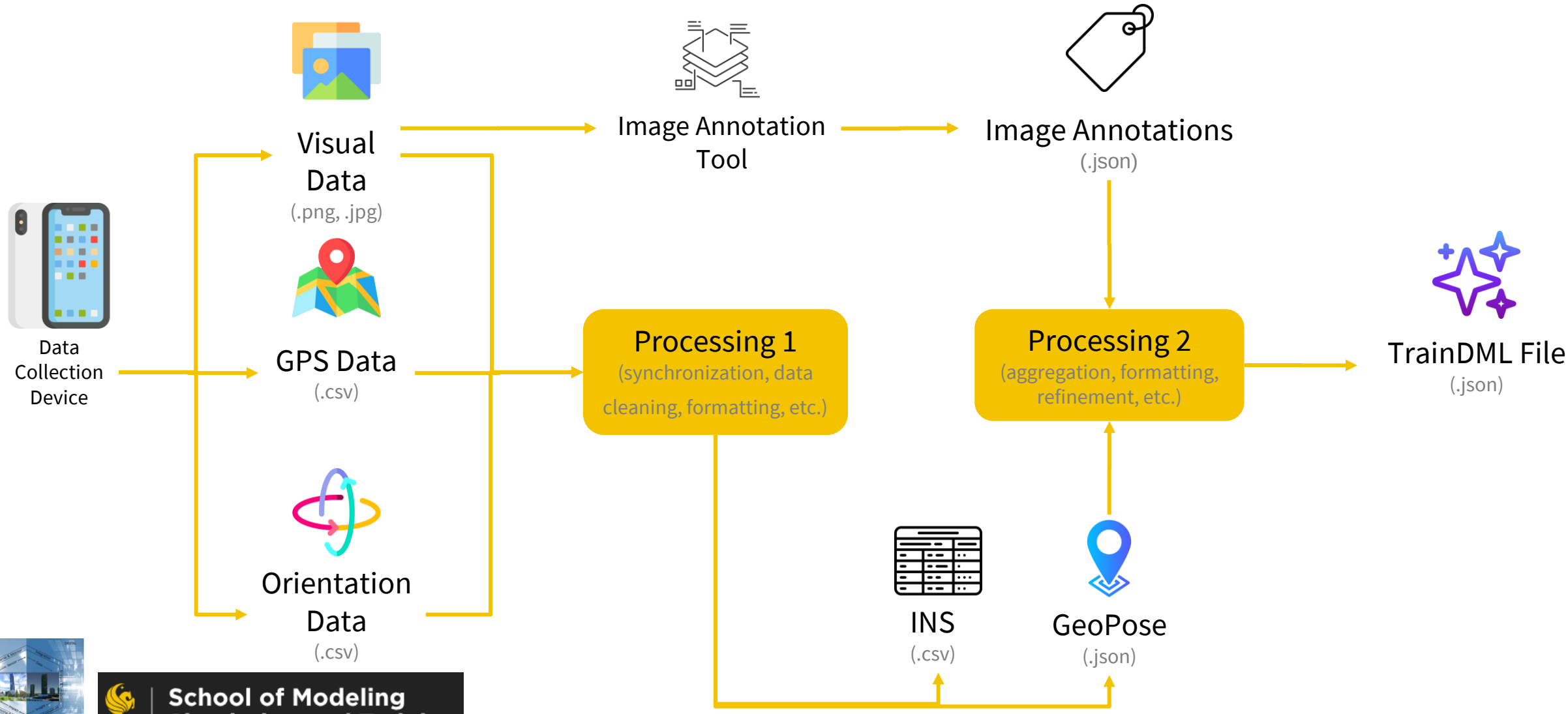
- Project Objectives
- Project Workflow
- Experimental Area Map, Road Condition, and Device Specification
- Data Capturing Guidelines
  - App Installation & Configuration
  - Mounting Setup
  - Recording
- Data pre-processing & GeoPose Generation
- Walkthrough D102: Labeling, Annotation, & TrainDML Generation
- Conclusion

Project Objectives

1. Capture low-cost camera imagery and INS metadata
2. Perform data pre-processing
   - Data sampling to eliminate inconsistencies
   - Frame synchronization for fine-tuning the dataset frequencies
3. Generate GeoPose
4. Perform labeling, annotation, and TrainDML extraction
5. Provide guidelines for UN Mission Team



OGC Camera Imagery Data Collection and Geo AI



Digital Twin Lab

UCF School of Modeling Simulation and Training

Experimentation Area Map

● *RECORDING*

Location: UCF Main Campus, Orlando, FL, USA

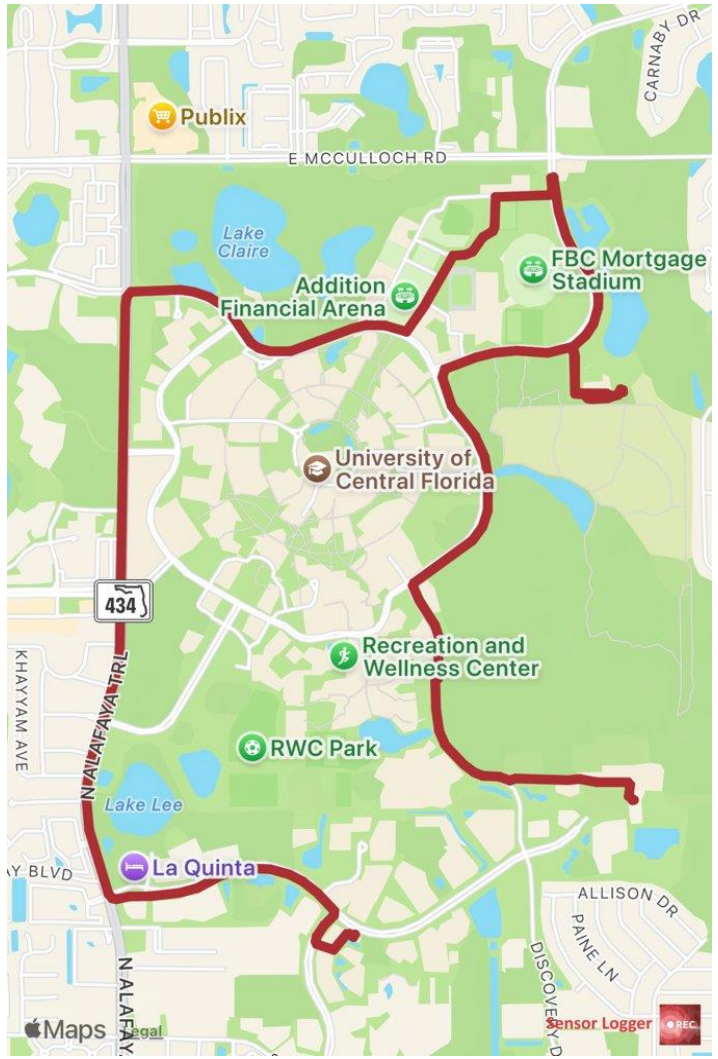
Date: 9/13/2024 (mm/dd/yyyy)

Start Time: 13:40:34

End Time: 14:10:45

Total Time: 30 minutes, and 11 seconds

Total Distance: 9.8 km



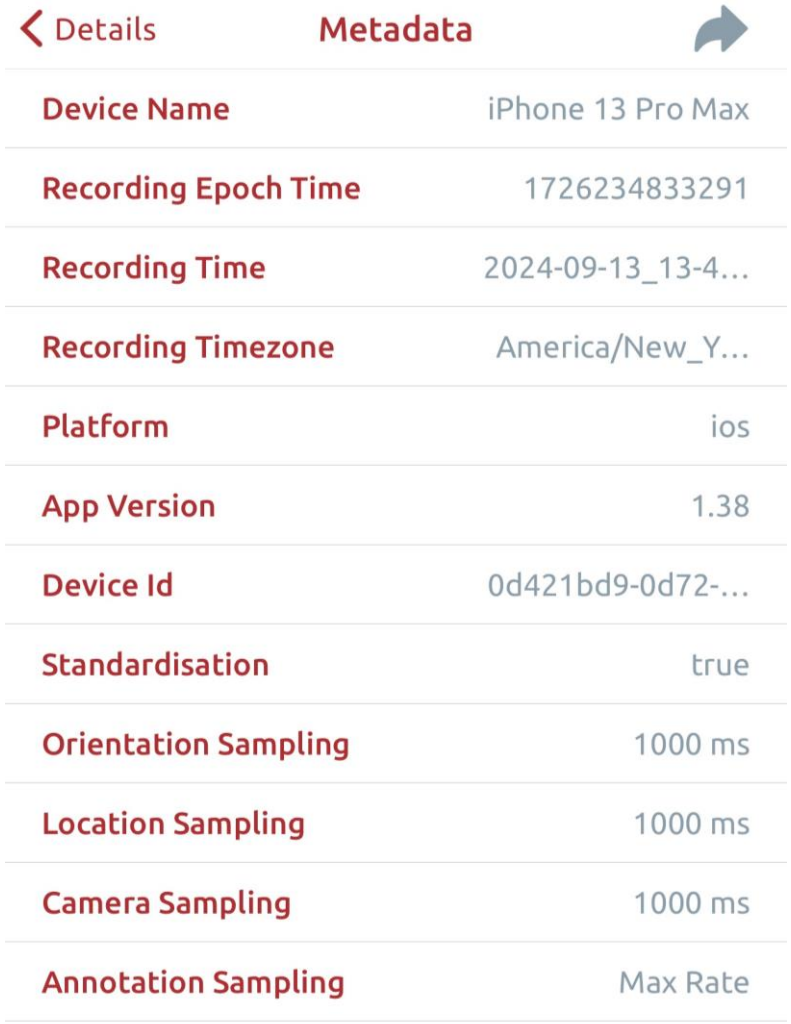
Digital Twin Lab

UCF School of Modeling Simulation and Training

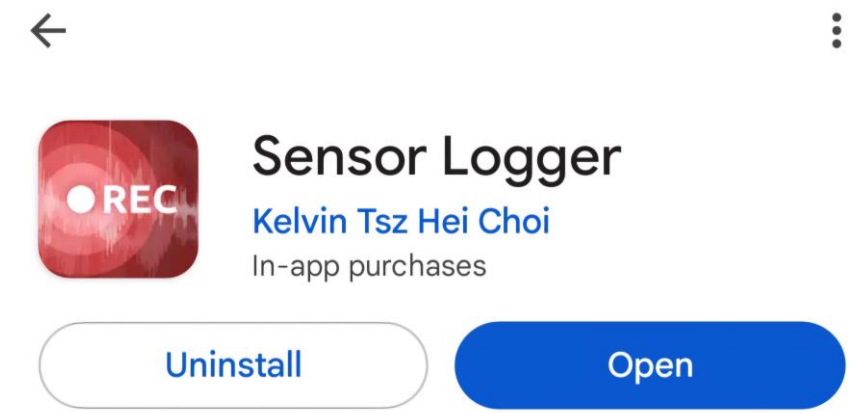
Area Road Conditions

1. Mix of different road covers
2. Mix of different road qualities

Mobile Type & Specifications

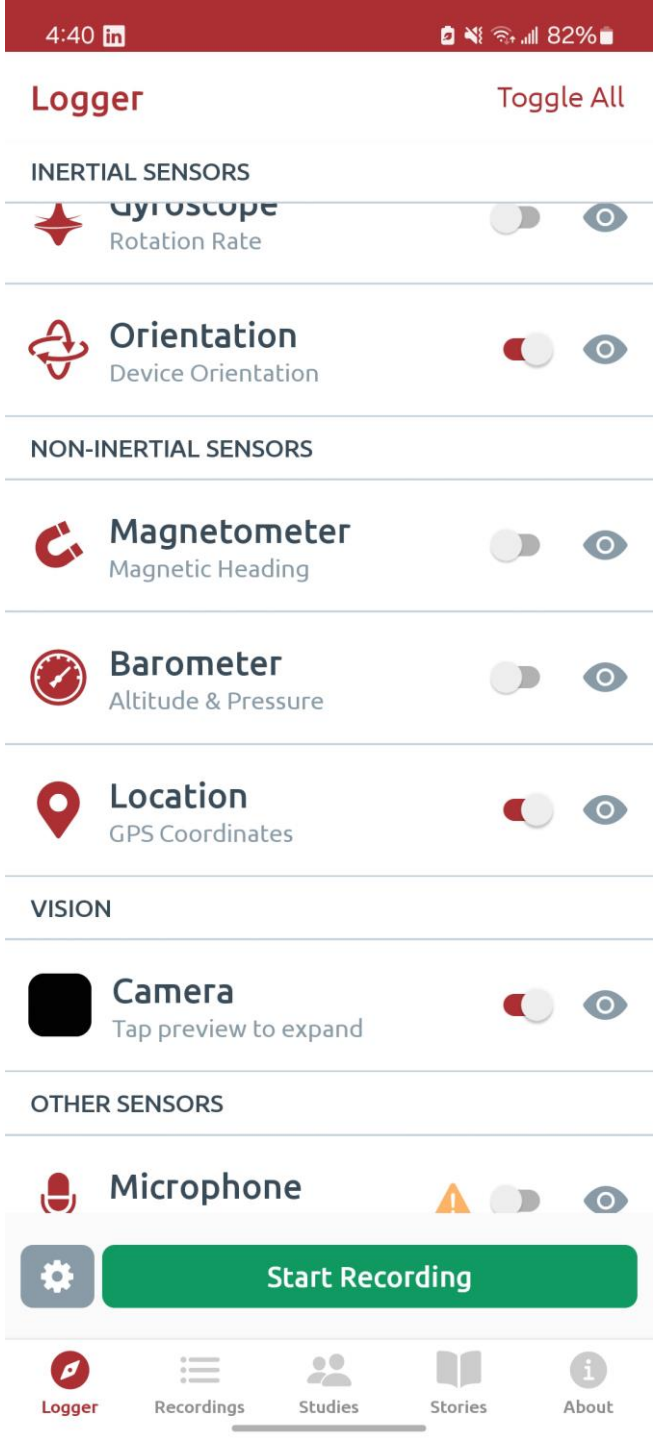


Sensor Logger



Toggle ON

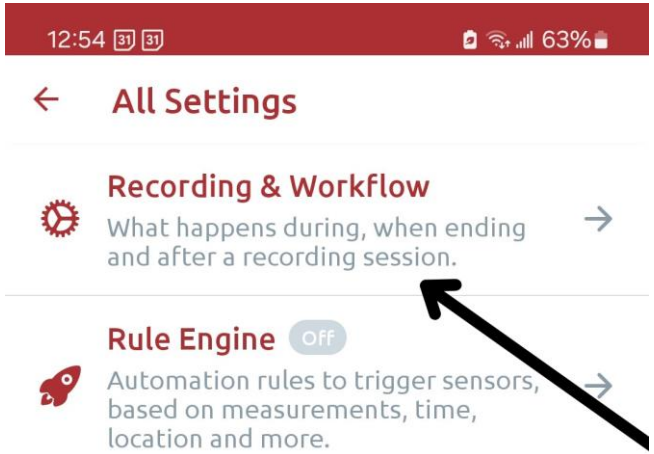
- Location
- Orientation
- Camera



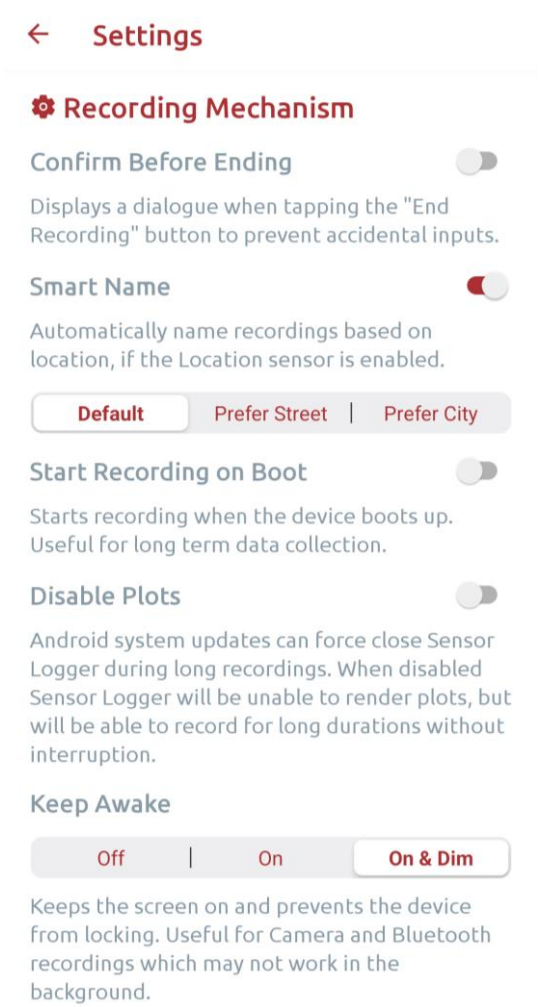
Digital Twin Lab

School of Modeling Simulation and Training

Settings



Keep Awake: On & Dim

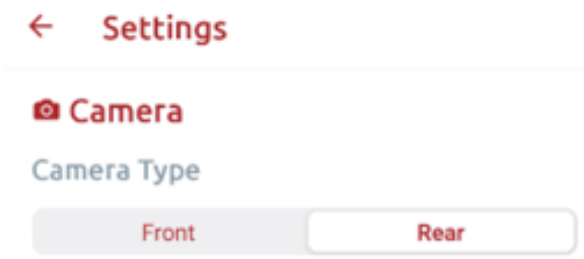


Digital Twin Lab

UCF School of Modeling Simulation and Training

Settings

Camera Type: Rear

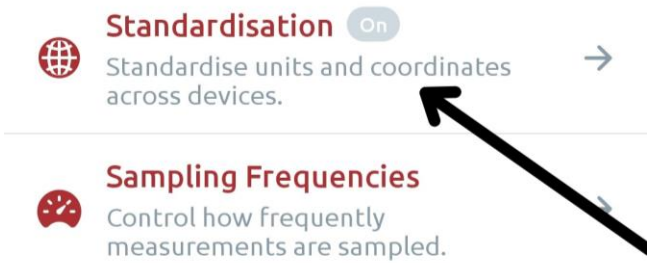


Location: Precise

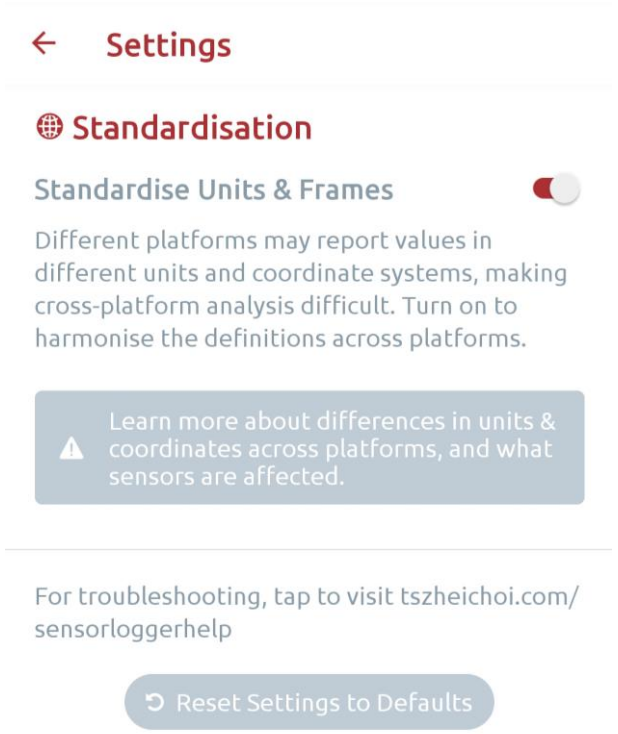
Digital Twin Lab

UCF School of Modeling Simulation and Training

Settings

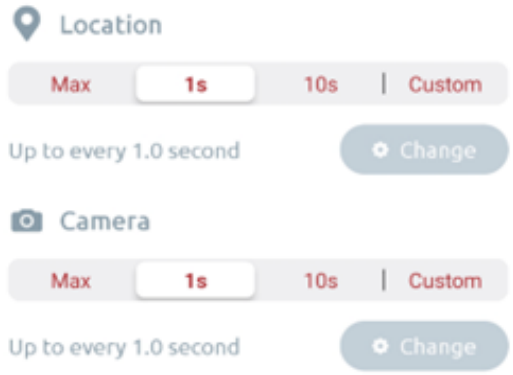


Standardise Units & Frames: ON

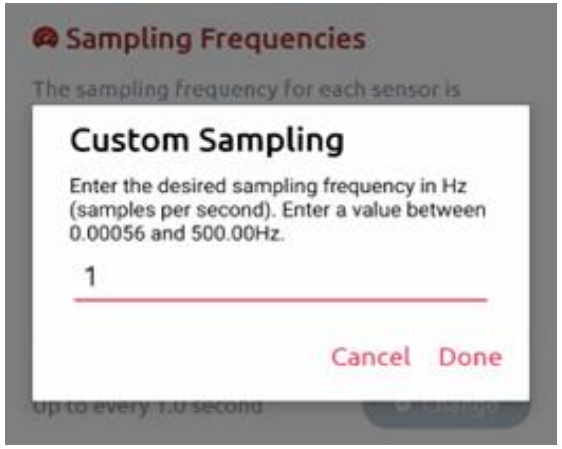


Settings

Location: 1s
Camera: 1s



Accelerometer, Gravity, Gyroscope, Orientation & Magnetometer: Custom

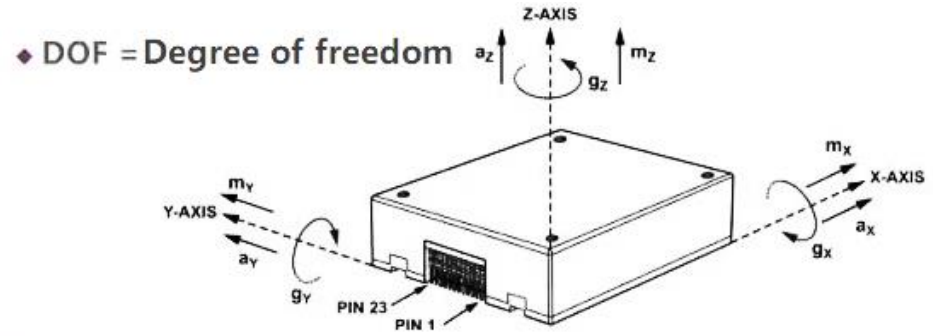


Mounting & Setup

Street Drone (Car)

Delkin Devices Fat Gecko Stealth suction mount

KDD Cell Phone Tripod Mount Adapter



- 3-axis accelerometer (linear)
- 3-axis gyroscope (rotation rate)

6DOF

- 3-axis magnetometer (magnetic field)

9DOF

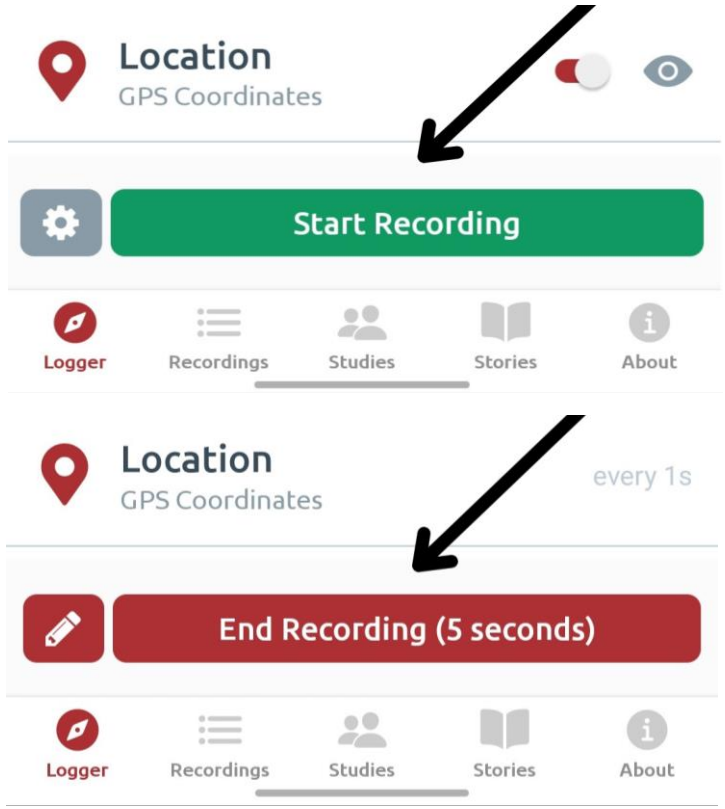
- Barometer (altitude)

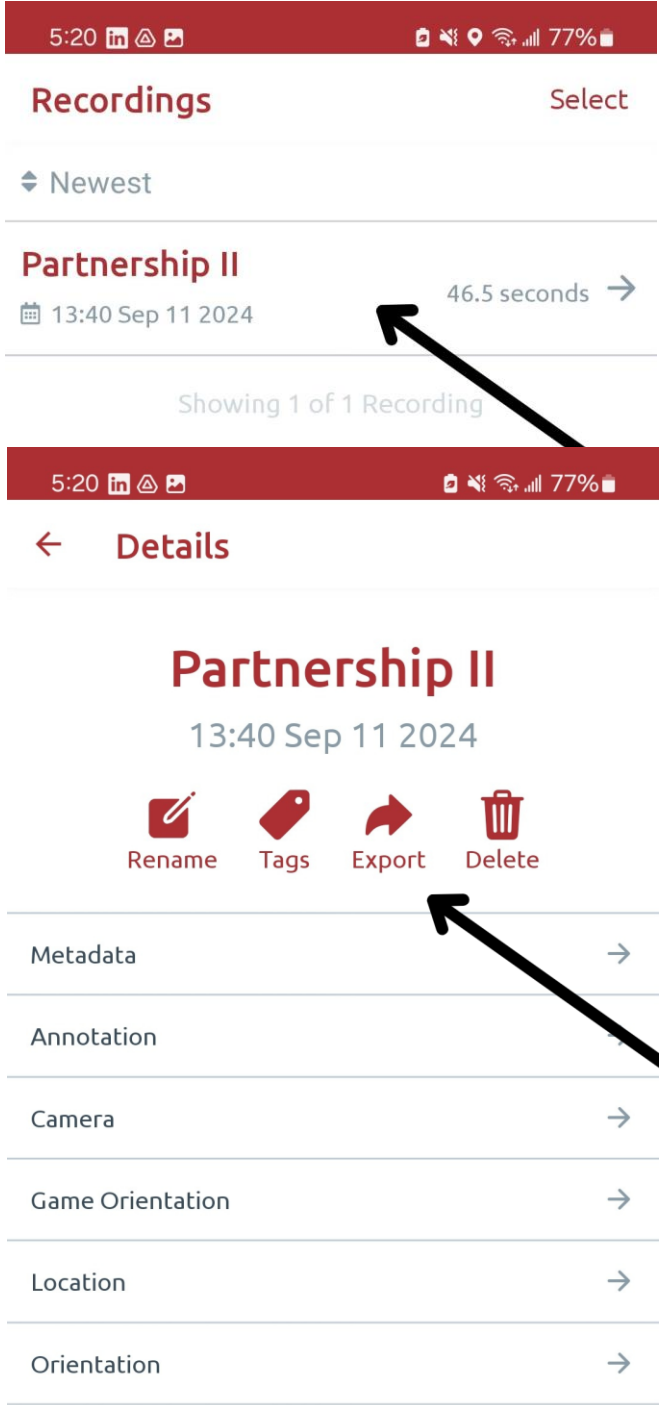
10DOF

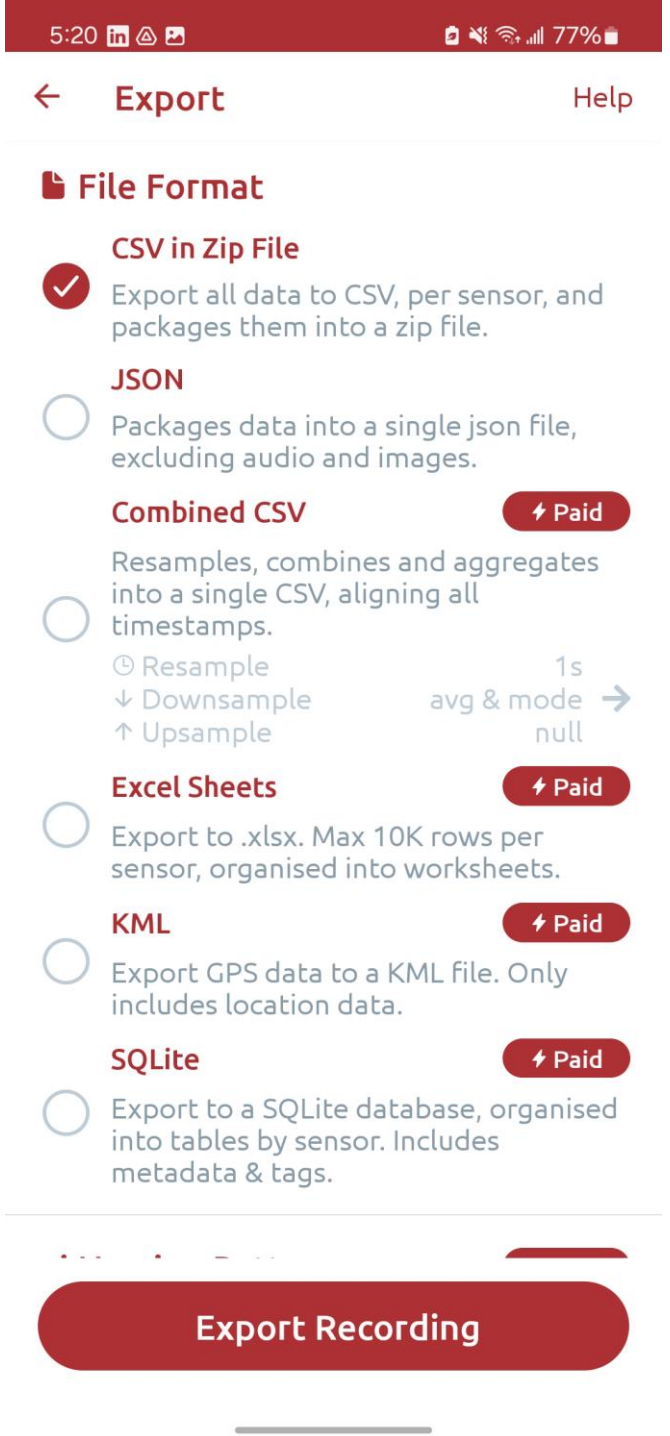
Digital Twin Lab

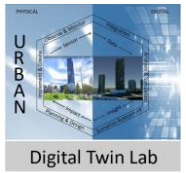
School of Modeling Simulation and Training

Recording



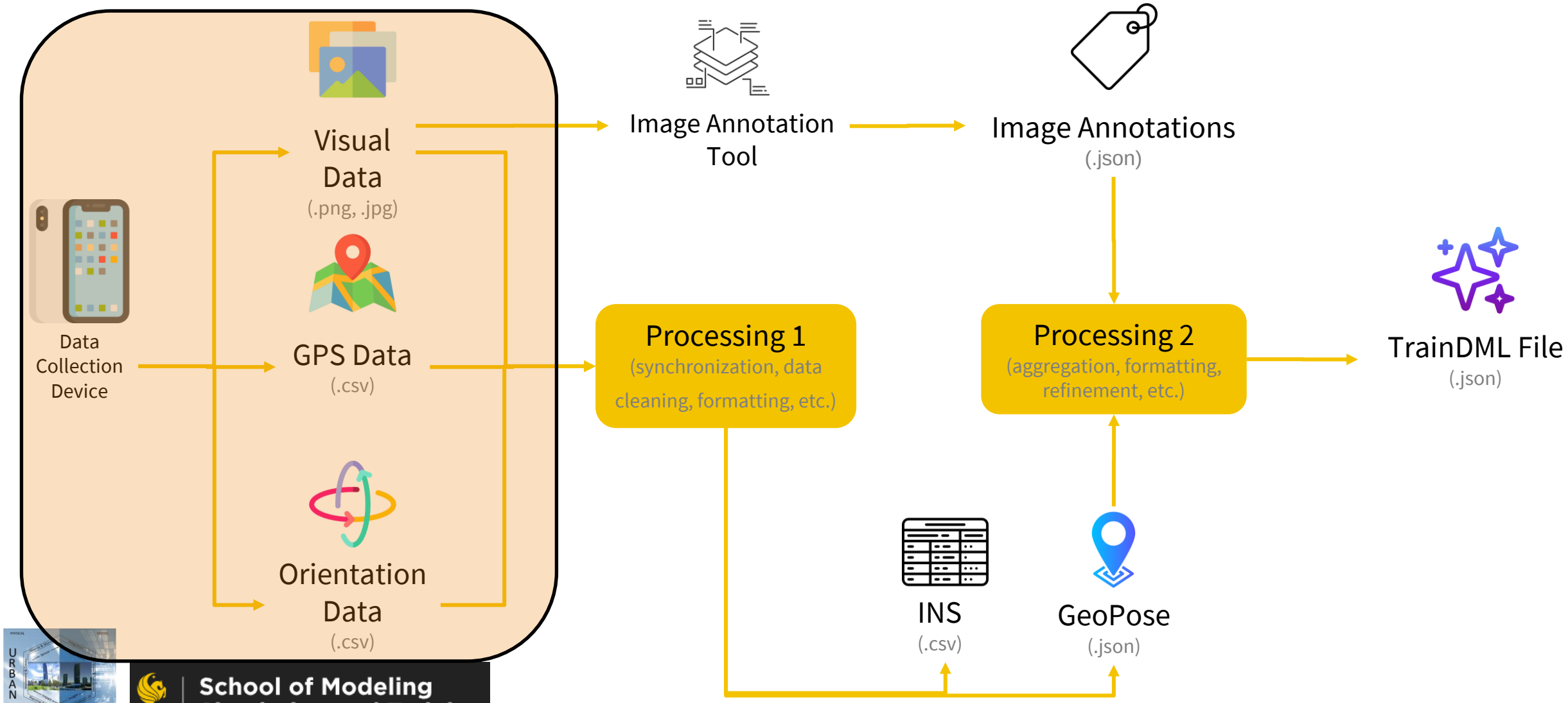






UCF School of Modeling Simulation and Training

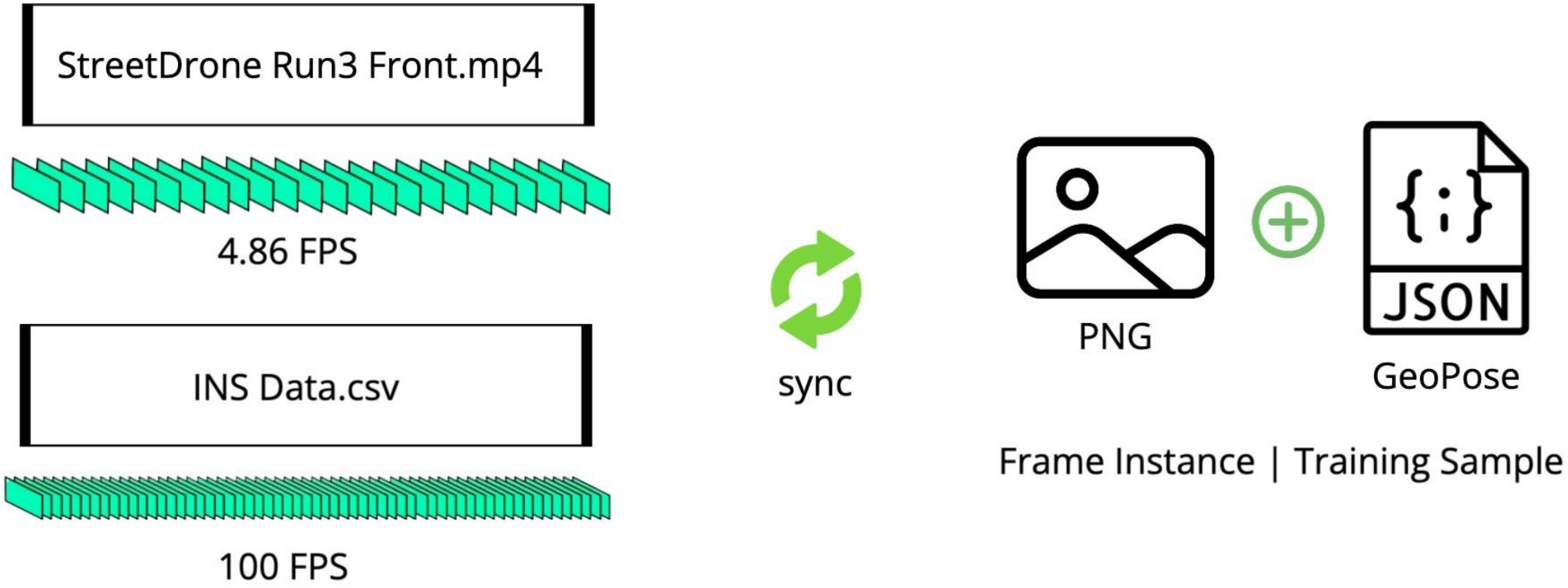
OGC Camera Imagery Data Collection and Geo AI



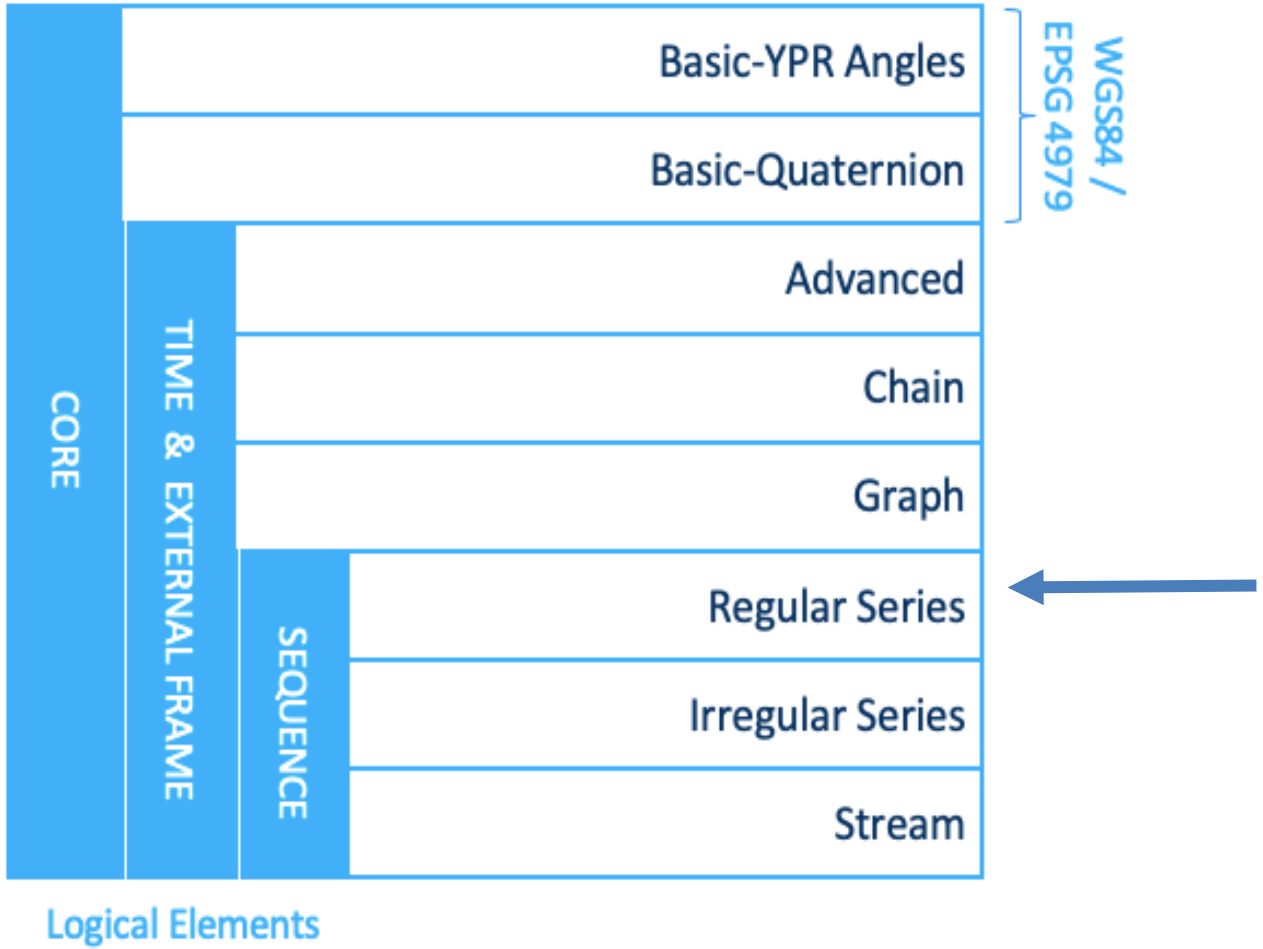
Digital Twin Lab

UCF School of Modeling Simulation and Training

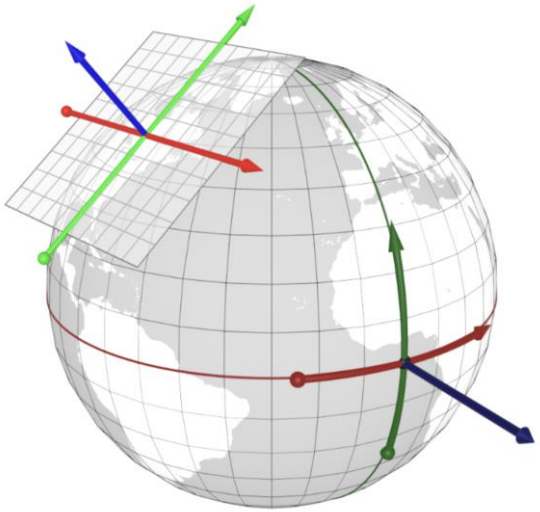
Data Sampling & Frame Synchronization



GeoPose 1.0 : Standardization Targets



GeoPose 1.0



D101 Pipeline: [Jupyter Notebook]

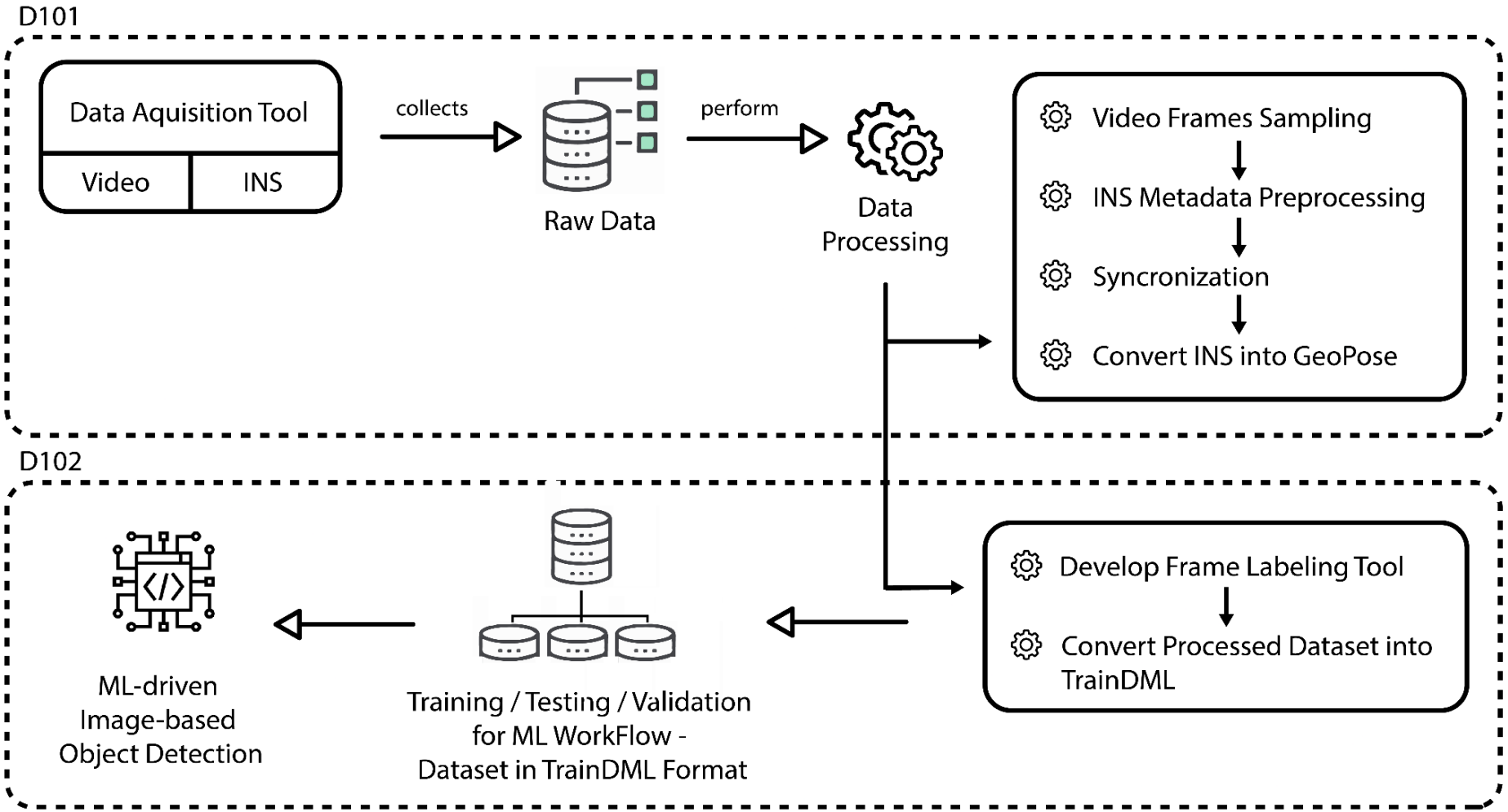
GeoPose_SensorLog...


```
{
    "header": {
        "poseCount": 101,
        "integrityCheck": "{\"SHA256\":
\"8f93dd8f48962696552efc304122a0511eccfa44c58e
fba253c0db69eab99b47\"}",
        "startInstant": 1409936222,
        "stopInstant": 1409936324,
        "transitionModel": {
            "authority": "/geopose/1.0",
            "id": "none",
            "parameters": ""
        }
    },
    "interPoseDuration": 1,
    "outerFrame": {
        "authority": "/geopose/1.0",
        "id": "LTP-ENU",
        "parameters":
"longitude=-81.51741682697994&latitude=28.5874
1621526089&height=16.08392333984375"
    },
    "innerFrameSeries": [
        {
            "authority": "/geopose/1.0",
            "id": "RotateTranslate",
            "parameters": "translation=
```


Digital Twin Lab

School of Modeling Simulation and Training

Workflow


D101
Data Aquisition Tool
Video
INS
collects
Raw Data
perform
Data Processing
Video Frames Sampling
INS Metadata Preprocessing
Syncronization
Convert INS into GeoPose
D102
ML-driven Image-based Object Detection
Training / Testing / Validation for ML WorkFlow - Dataset in TrainDML Format
Develop Frame Labeling Tool
Convert Processed Dataset into TrainDML


GRASS 2 (MANUAL)
DIRT 1 (MANUAL)

Thank You

Contact

Urban Digital Twin Lab
School of Modeling Simulation and Training
University Central Florida, FL, USA
Email: *soheil.sabri@ucf.edu*