# GNSS Tracker with PhyCV-Enhanced Video Streaming on JetBot

## Goal

The goal of this project is to build basic components of a GNSS tracker with real-time PhyCV-enhanced video streaming on an NVIDIA JetBot. The JetBot is controlled by a Jetson Nano equipped with a camera and a GNSS module. It will acquire GNSS coordinates and videos and transmit them wirelessly to a remote node, the video is enhanced by PhyCV algorithms.

## Introduction

Global Navigation Satellite System (GNSS) trackers harness the power of satellite signals to accurately pinpoint locations, providing real-time positioning information with remarkable precision. In parallel, the NVIDIA JetBot has emerged as a versatile platform for various robotics and artificial intelligence projects. Powered by the Jetson Nano, the JetBot can capture real-time videos and GNSS coordinates by its camera and a GNSS module, making it an ideal candidate for the integration of advanced tracking and streaming functionalities. This project combines GNSS technology and the JetBot to create a hardware kernel for precise tracking and real-time video streaming enhanced by PhyCV algorithms. Additionally, it facilitates wireless communication for transmitting acquired information to a remote node.

## Task 1: System block diagram Design

Design the system block diagram with component specifications and SWaP (Size, Weight, and Power) analysis. Familiarize yourself with the core components of systems (see the Reference for more details).

## Task 2: Setup a GNSS module on the Jetson Nano for real-time location acquisition

Connect a GNSS module to the Jetson Nano and test its functionality to acquire real-time location coordinates. See the product info of the module [here](https://www.waveshare.com/sim7600g-h-4g-for-jetson-nano.htm). Explore the module’s API to extract coordinates.

## Task 3: Setup the wireless communication between the Jetson Nano and a remote node

With real-time location data acquisition in place, utilize the GNSS module's 4G communication capability (you can use a one-time SIM card) to wirelessly transmit acquired information to a remote node (could be your smartphone or laptop). Also investigate other wireless communication options such as Bluetooth, Wi-Fi, and direct satellite communication with Star Link or other options (for situations when there is no cellular network).

## Task 4: Setup the JetBot with the Jetson Nano

Configure the JetBot and establish control through the Jetson Nano. See the product info of the JetBot [here](https://www.amazon.com/Accessories-Wireless-Bluetooth-Recognition-XYGStudy/dp/B07WMZ3KLY/ref=sr_1_2?crid=1X2WHQVBBYL2P&keywords=jetbot&qid=1696531651&s=electronics&sprefix=jetbot%2Celectronics%2C152&sr=1-2).

## Task 5: Setup a camera on the Jetson Nano for real-time PhyCV processing

Connect a camera to the Jetson Nano to acquire real-time video stream. Subsequently, run PhyCV for video processing. Test both Python and C++ versions of PhyCV algorithms. Wirelessly transmit the real-time video to a remote node as well. Develop a unified program that encompasses the functionalities from tasks 2, 3, 4, and 5.

## Task 6: Assemble and test the entire system

Integrate all components and test the entire system. Ideally, the JetBot should operate within a specific location (e.g., on the campus), providing real-time location coordinates and video feeds enhanced by PhyCV algorithms to the remote user's end.

## Deliverables

PowerPoint slides, final presentation, YouTube video, and GitHub repository.

## Reference

* Jetson Nano Developer Kit: <https://developer.nvidia.com/embedded/jetson-nano-developer-kit>
* GNSS module for Jetson Nano: <https://www.waveshare.com/sim7600g-h-4g-for-jetson-nano.htm>
* JetBot:<https://www.amazon.com/Accessories-Wireless-Bluetooth-Recognition-XYGStudy/dp/B07WMZ3KLY/ref=sr_1_2?crid=1X2WHQVBBYL2P&keywords=jetbot&qid=1696531651&s=electronics&sprefix=jetbot%2Celectronics%2C152&sr=1-2&th=1>

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