The overhead in designing unmanned aerial vehicles can run a high cost in time and money during the prototyping phase. We propose Project Dragonfly, a modular and cost-effective way of providing state estimation, reducing the individual sensor configuration workload for drone manufacturers and hobbyists.

### Overview
Project Dragonfly serves to consolidate several low-profile sensors into a single, peripheral device ready-to-use with open-source software and user manuals.
- L: 3” x W: 1.5” x H: 1”
- USB-A 2.0 connector
- ROS State Estimation Software
- Datasheet/User Manual

### Key Hardware Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
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<tbody>
<tr>
<td>Microcontroller - STM32L412RBT6</td>
<td>Performs reads of sensors and packages data</td>
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<tr>
<td>Inertial Meas. Unit (IMU) – BMI088</td>
<td>Provides translational and rotational measurements</td>
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<tr>
<td>Magnetometer – STEVAL-MKI185V1</td>
<td>Provides 3 axis orientation data</td>
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<tr>
<td>GPS – NEO-6M</td>
<td>Provides Latitude and Longitude</td>
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<td>Barometer – DPS310XTSA1</td>
<td>Provides current altitude</td>
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<tr>
<td>Air Speed – 45525DO</td>
<td>Provides speed relative to air</td>
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### Firmware

**Main Loop**
- ISRs
- IMU Handler
- Mag Handler
- Bar Handler
- Air Handler
- Barometer Data
- Air Speed Data
- Air Speed
- GPS Data

**Diagram Key**
- MCU Process
- Locally Stored Data
- ROS Output
- Interrupt Service

Sensors generate data ready interrupts triggering a read from the MCU. This data is timestamped, turned into a packet, and transmitted over USB. The packet contains all fields simultaneously and indicates validity using stale bits.

### Visualization & State Estimation
ROS Melodic will be used on Jetson Nano. Data packet reaches Nano and from here publisher nodes publish a topic for each sensors data. Subscriber nodes subscribe to a topic and this data is then used for a virtual demo visualization as well as state estimation via ROS packages and plugins.

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