# RS-2B: Securing the Control and Navigation Surfaces

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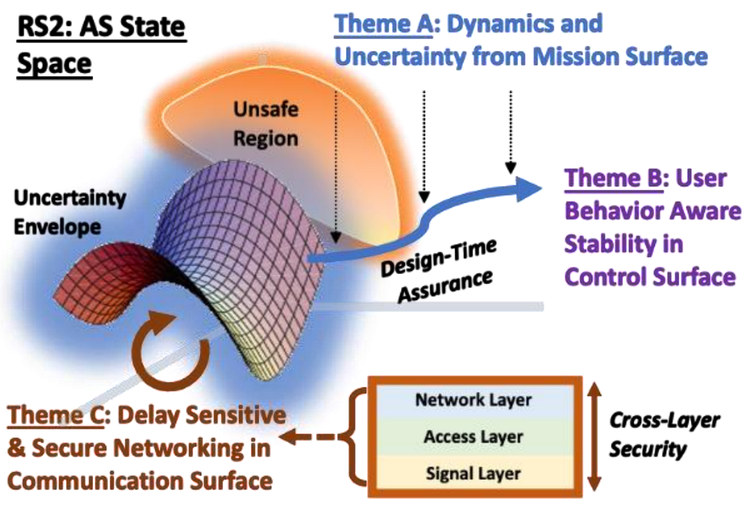
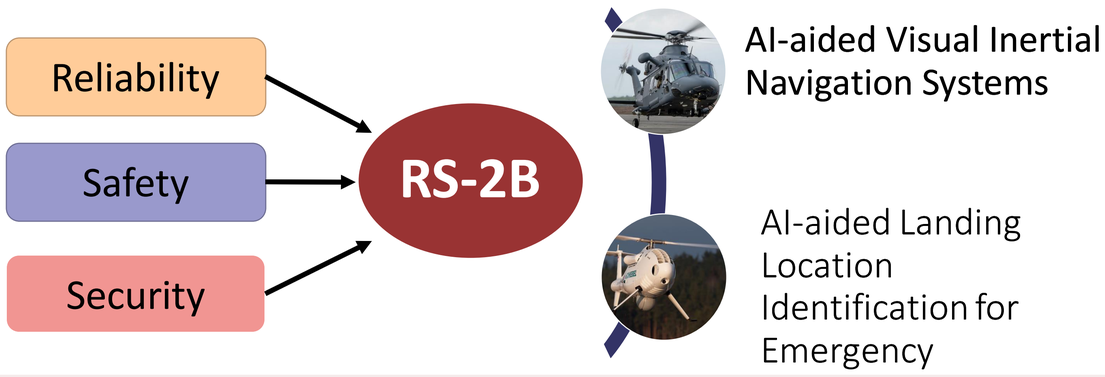
## 1. Role of the RS-2B

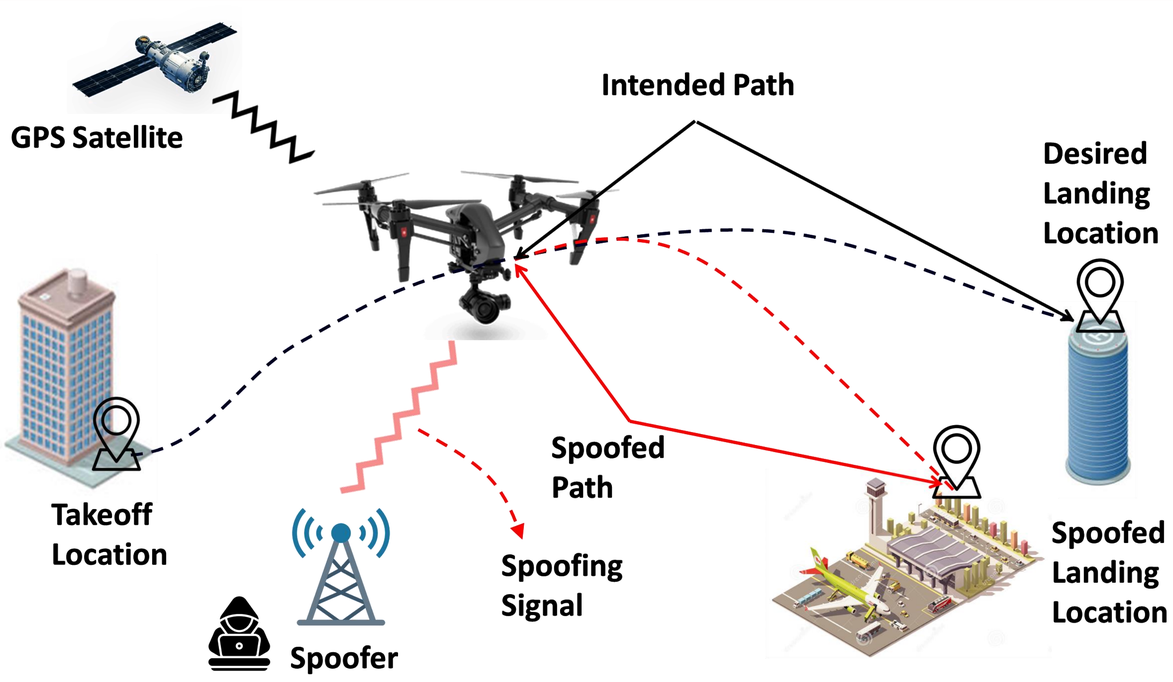



**Ability of runtime adaptations of control and navigation systems over attacks or "perceived" attacks:**

- Adversaries
- Environment uncertainties
- Degraded performance




## 2. AI-aided Visual Inertial Navigation (VIN) for GPS-denied Environments and GPS Spoofing Detection



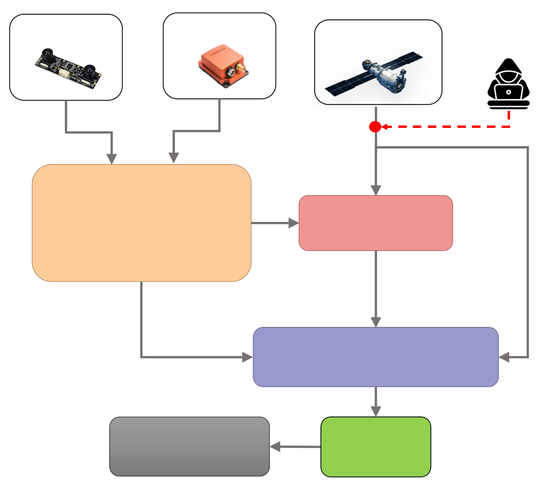

### Operations in Urban Airspace

- GNSS is one of the most vulnerable system against cyber-attacks such as jamming and spoofing. These attacks are harmful and difficult to detect
- GNSS system should be supported by utilising multi-sensor pose estimation algorithms not only to detect the attacks but also to provide safety for the vehicle.

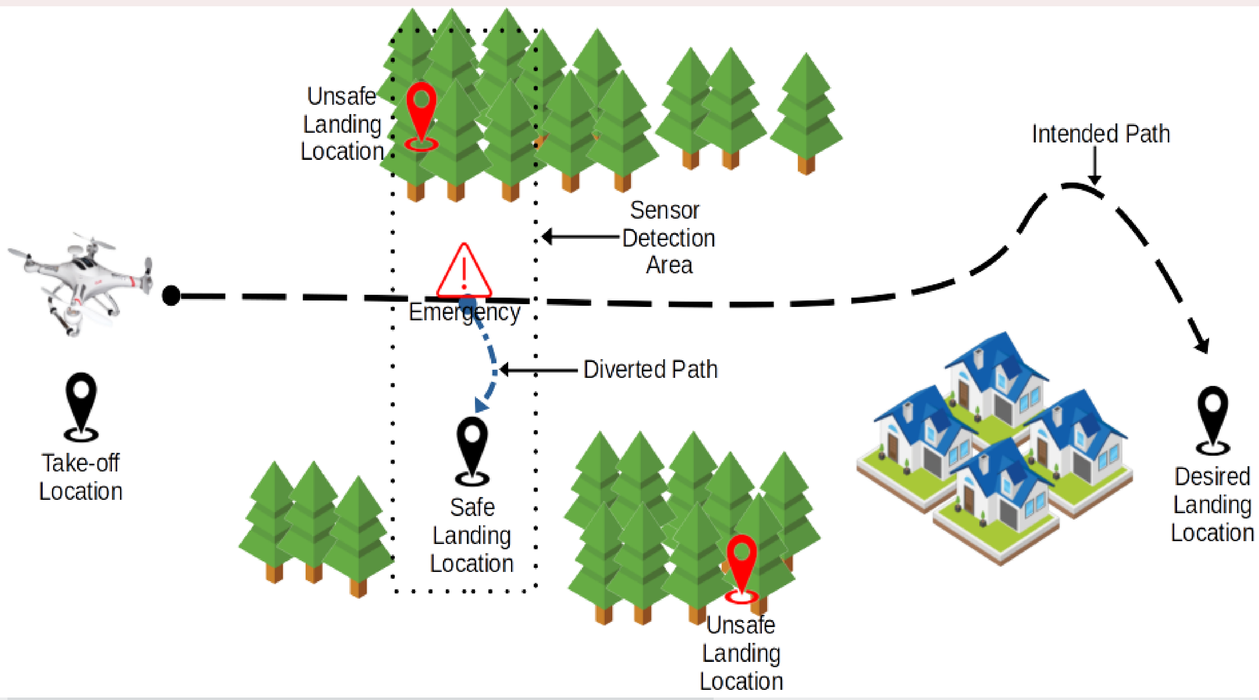
### Research Proposal

- Designing AI-aided Visual-Inertial navigation system to support the GNSS in the presence of spoofing attacks.
- Combining the AI-based solutions with classical filter-based approach
- Improving pose estimation performance in austere environments

### AI-aided VIN System and GPS-Spoofing Detection Overview

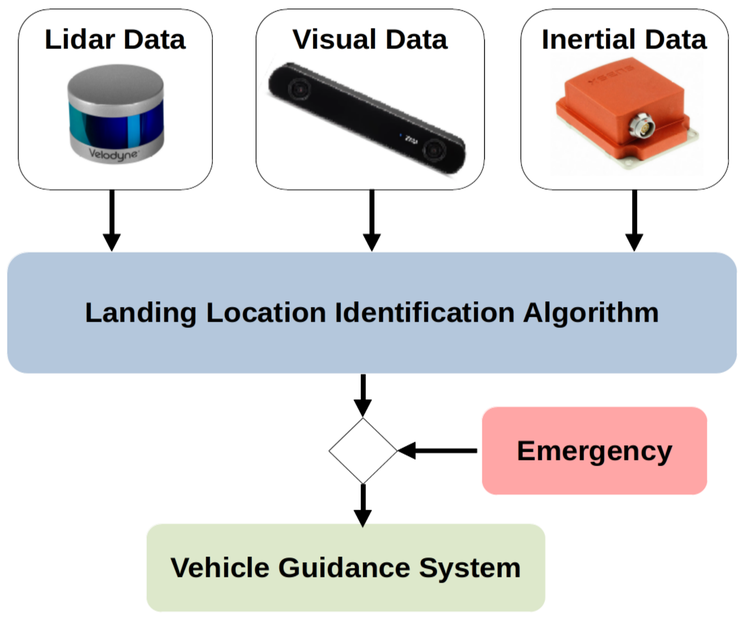


## 3. AI-aided Landing Location Identification for Emergency Situations and GPS-Spoofing




### Operations in Urban and Rural Airspace

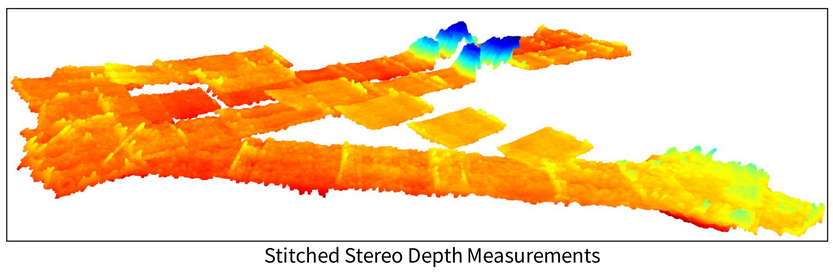
- Thousands of drone are envisioned to fly over urban and rural area with austere environments.
- They can experience multiple emergency like low battery, loss of trust and GNSS spoofing.
- Even the ones equipped with visual inertial navigation capability need to find safe landing location autonomously.



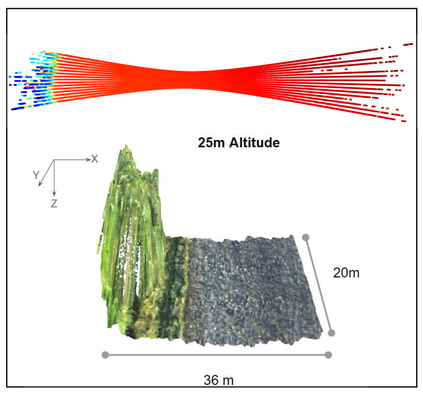

### Research Proposal

- Develop an AI-aided landing location identification system for safe emergency landings.
- Support VIN system to enhance overall system trustworthiness, utilizing vision sensor capabilities.
- Improve system safety in urban and austere environments.

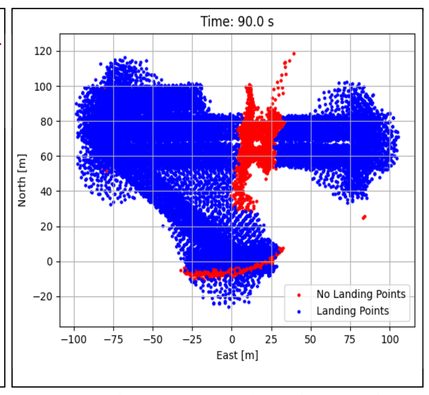
On Ground and In-Flight Drone Pictures



Stitched Stereo Depth Measurements




Single Lidar and Stereo Depth Measurement




Landing Location Algorithm Results

## 4. Conclusions

**AI-aided Visual-Inertial Navigation System Design**

We have developed AI aided visual inertial navigation algorithms providing robust navigation solution accuracy in austere environments subject to both the loss of GNSS and GNSS spoofing. The results demonstrate robust spoofing detection and autonomous navigation in challenging environments, providing a cornerstone capability towards trustworthy autonomous systems.

**AI-aided Landing Location Identification for Emergency Situations and GPS-Spoofing**

We have developed and demonstrated an AI-aided landing location identification system to enhance system trustworthiness, particularly supporting Visual Inertial Navigation (VIN) and improving overall safety in diverse environments. This capability is integral in urban and rural airspace operations in which reliability and safety while demonstrating a trustworthy autonomous system.

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