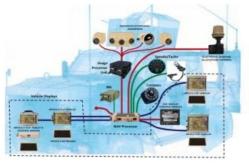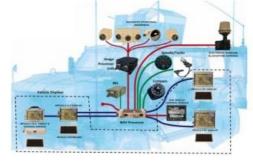# UCF Researchers to Develop Non-GPS Location Finder

The University of Central Florida has been awarded a US$4.5 million grant to develop a smart, computer vision-based navigation system for when GPS is unavailable or jammed. The grant comes from the US Army's corporate research laboratory.

The system will be like a cyber co-pilot that supports navigation of ground vehicles by using artificial intelligence and machine learning to assess computer imaging of terrain captured by the vehicle and by unmanned aerial vehicles (UAVs). It will help drivers determine where they are and how to get to where they are going in complex terrain.

Geospatial databases to identify landmarks

"For the US Army, this is all about navigating in GPS-denied environments wherein adversaries can jam or spoof GPS signals, and it's also about supporting ground vehicles with off-board sensors on UAVs that can provide additional perspectives for awareness and threat detection in complex, typically urban, scenarios," said Kyle Renshaw, the project's principal investigator and an assistant professor in UCF's College of Optics and Photonics (also known as CREOL).

The system will use geospatial databases to identify landmarks for correlation to imagery and will track object movements through video to estimate motion.

Renshaw said that although positioning by triangulation and relative motion are not new concepts, the researchers are combining them using artificial intelligence to do this precisely and autonomously.

Members of UCF faculties working on the project also include Mubarak Shah, a UCF Trustee Chair Professor of Computer Science and director of UCF's Center for Research in Computer Vision; Abhijit Mahalanobis, an associate professor with UCF's Department of Computer Science and Center for Research in Computer Vision; and Robert Crabbs, a senior research scientist with UCF's College of Optics and Photonics.

Automatic geodata analysis

UCF's Center for Research in Computer Vision is one of the top-ranked computer vision programmes in the country and, along with Carnegie Mellon University, is one of only two institutions in the nation to offer a master's degree programme in computer vision.

"Researchers at CREOL are experts in sensors and optics and data collection and integration, and CRCV is a world leader in computer vision and machine learning," Shah said. "CRCV researchers will develop algorithms to automatically analyse the data collected by the CREOL team to extract relevant features from mission imagery in order to match with geo-tagged reference imagery for GPS-denied combat navigation."

Shah has been working on geospatial localization for about two decades and says this is a great time to push the scientific boundaries since performance of new deep learning-inspired computer vision methods has significantly improved.

"And with availability of large amounts of data and great computing power, we can make a big difference," he added.

Infrared imaging

The team will also partner with researchers Ron Driggers from the University of Arizona, who has extensive experience in infrared imaging systems, and Eddie Jacobs from the University of Memphis, who brings expertise in unmanned aerial vehicles.

"I'm looking forward to working with ARL and the world-class team we've pulled together to address some real, significant and immediate problems for the Army," Renshaw says of the award. "Of course, the technologies and solutions we're working on can also translate to a wide range of problems, from autonomous driving to border security to disaster response."

The project award is for four years, with two years awarded now and a two-year option for the Army Research Lab to continue funding the

work.

This image shows the concept of a smart, computer vision-based navigation system using multi-sensor inputs and geospatial databases to determine vehicle position. (Image courtesy: University of Central Florida)