

I'm currently working on the software for an intelligent fire control system for point-defense laser weapons. This is basically an engineering problem, but it includes a number of interesting research-related technological challenges.

Description:

Image-based software for point-and-click weapon control.

- The base system processing departs from a visible-light image obtained from a wide-field HD camera.
- From this image feed, the system does real-time object detection, identification and tracking.
- The system warns the operator of the detection of new objects, and he can confirm or alter the object classification proposed by the system.
- The operator can select an object to engage, by clicking on it in the wide-field image.
- The system then points the weapon to the object (deciding by itself the best exact point of the object to target) and shows the target to the operator in a second (highly zoomed) image, obtained from a camera that is (basically) coaxial with the laser weapon beam.
- The operator can then, if he so decides, click to fire the weapon at the targeted object.
- In specific scenarios, the system can use some pre-defined rule-based decision criteria for automated firing against objects that comply with some restrictive conditions (such as arc-of-engagement, distance, size, velocity, visual signature, etc.).
- In the future the system should be able to combine additional inputs (beyond visual analysis of visible or IR images), such as laser rangefinding, sound detection and analysis, GPS info, IFF info, etc.. In the future, the aim is also to allow the system to receive and integrate information from outside sources, and to communicate the information it produces to other tactical information systems.
- Another future development may include the development of an alternative map-based interface for the operator (instead of the typical "observation camera" image-based interface).

Laser weapon system:

The full laser weapon system will combine a number of commercial diode laser fiber-coupled modules to create a beam of 5kW to 10kW. It will be useful for defense against drones and other aerial targets, and will also be able to engage land-based (or water-based) targets – including soft targets and the optical systems of hard targets.

This system will typically have an effective range of several km, but it will depend on atmospheric conditions.

I believe that, using state-of-the-art commercially available components, a complete system with these characteristics can be built so as to fit in many modern light military tactical vehicles – both in terms of weight and size.

Security potential of the software component:

With very limited adaptations, the image-based software component of this system has the potential for employment in security applications that involve detecting, identifying and tracking objects but do not require the direct connection of a weapon system.

I'm looking for Master and PhD students interested in this area of research, and also for industrial partners.

I'm also looking for partners interested in cooperating in the creation of a startup company to complete the development of the full weapon system.

Contact:

Pedro de Almeida
palmeida@di.ubi.pt