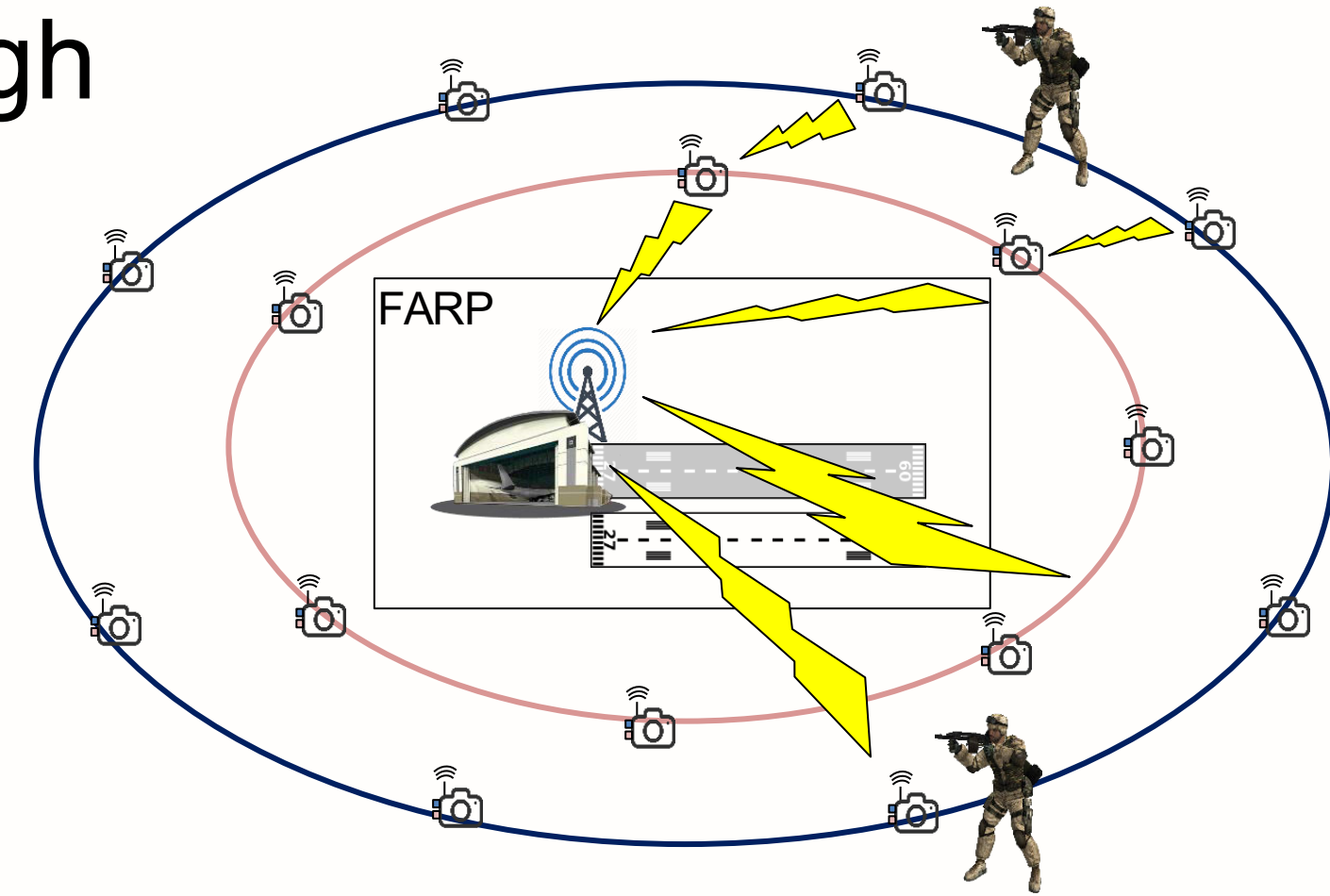


Low-Cost Ground Sensor Network for Intrusion Detection

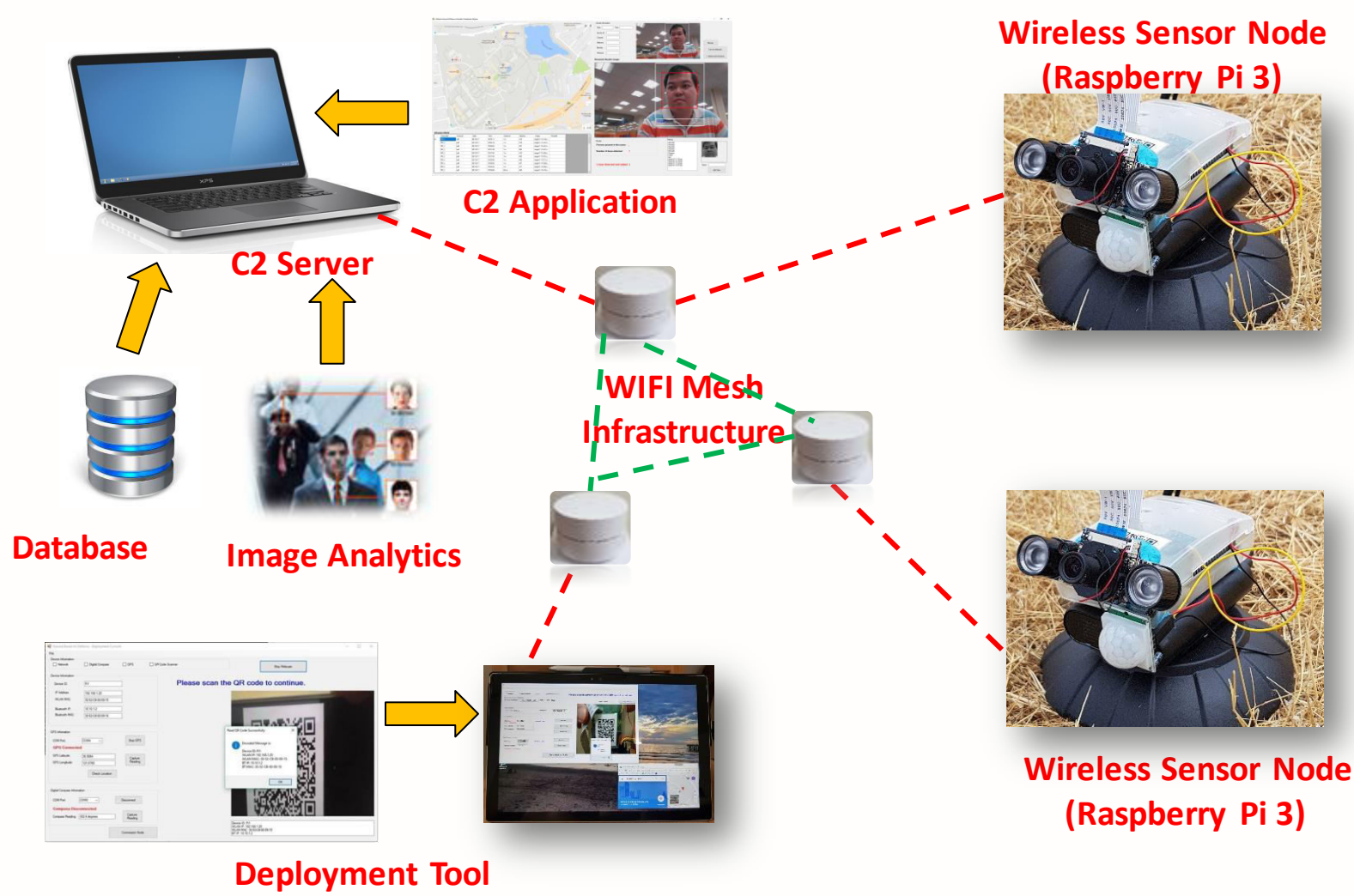
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Objectives of thesis

The objective of the thesis is to design, develop and validate a low-cost unmanned wireless ground sensor network using COTS equipment (with an aggregated unit cost of approximately USD \$100 per node) for surveillance in tactical forward operating environment like Forward Arming Re-fuelling Points (FARPs).



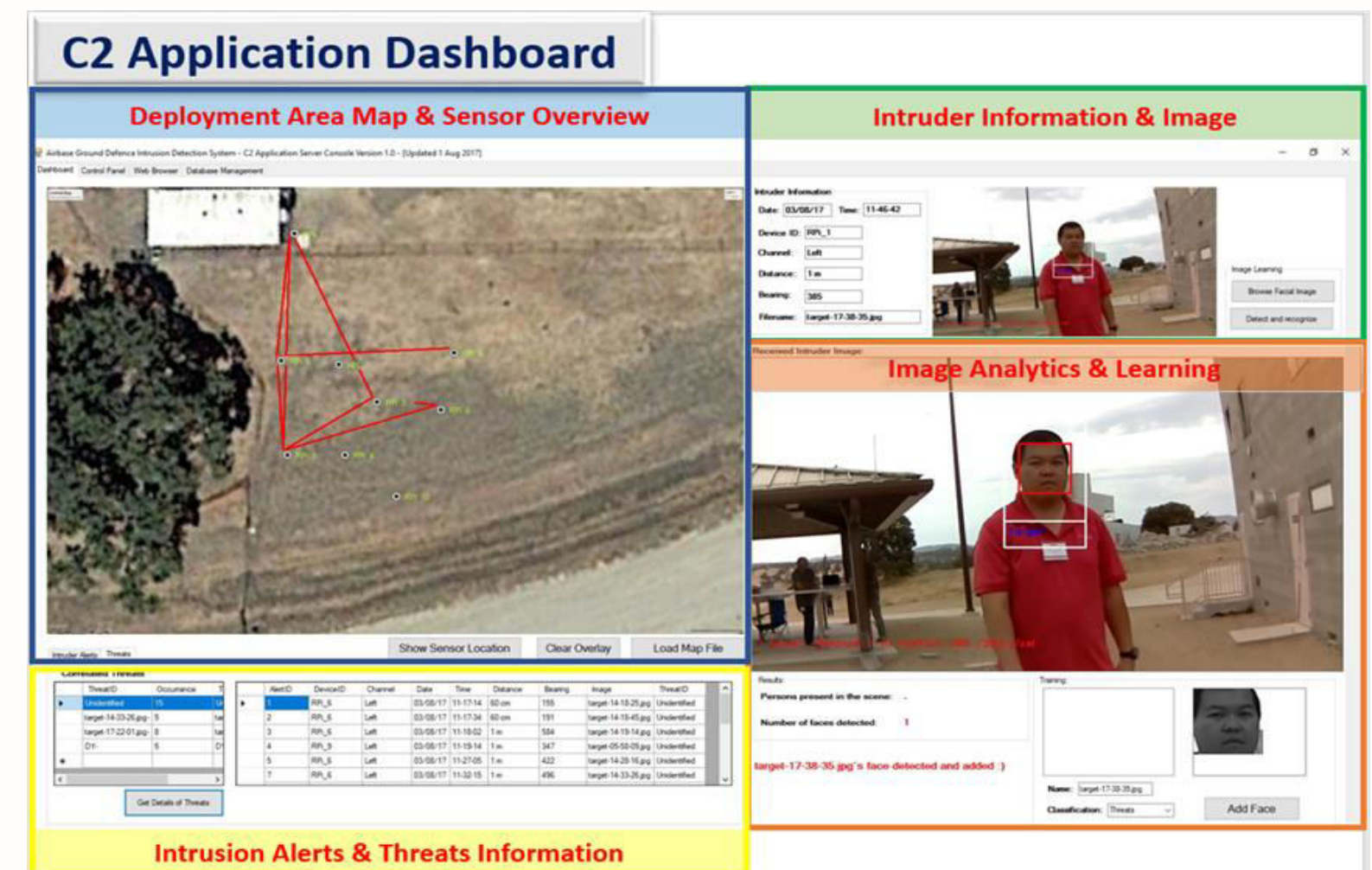
Main Research Ideas



1. To design and develop a wireless ground sensor (WGS) node using COTS equipment like Raspberry Pi and low-cost Passive Infrared sensor and Pi Camera/USB Webcam.
2. To leverage COTS equipment to create Wi-Fi mesh network that runs on battery.
3. To develop facial image detection capability on the WGS node, facial recognition capability on C2 Application server using OpenCV and develop C2 application to perform threats correlation, analytics and reporting.

Research Results

Two variant of WGS nodes (both below USD \$100 per node) were developed, tested and validated with Google Wifi mesh network in the actual field environment. The WGS node and mesh Wi-Fi network worked well with the OpenCV based facial detection and recognition algorithm to provide early intruder detection, recognition and tracking capability.



Potential Applications of the Research

The WGSN can be deployed around the perimeter of forward operating bases at different stand-off distance, around a military base or around protected installations to provide 24/7 round the clock early intruder detection to relieve precious manpower deployed within observation post or to conduct 24/7 patrol around the perimeter of the operating environment. Being low-cost and COTS component based, the WGS nodes and Wi-Fi mesh routers can be remotely wiped and abandoned during a hasty retreat.

Follow-Up Research Activities

Research on more powerful low-cost processor board, longer range motion detection sensors, better camera and faster facial detection and recognition algorithm can be conducted to enhance the WGSN.



Inner Layer Deployment



Outer Layer Deployment



Mid Layer Deployment



Camouflage Deployment