RAPID

Radar Acquisition Processing Interconnection and Display

Introduction

RAPID is a cost-effective and flexible solution for providing modern data processing and visualization capabilities to radar systems. Based on state-of-the-art technology, RAPID maximizes the use of software components and commercial of-the-shelf (COTS) hardware, ensuring easy maintenance and upgrading, and lowering overall system costs.

Applicability

RAPID can be used as a part of newly designed radars, or as an upgrade kit for legacy radars. RAPID significantly increases efficiency of legacy radars and prolongs their operational lifetime by introducing modern data processing algorithms and visualization subsystem, while preserving expensive RF parts.

RAPID is directly applicable for conventional radars with mechanically rotated antenna, including:
- military air-surveillance radars,
- air-traffic control radars,
- civil marine radars,
- vessel tracking service radars.

Key Features

- Radar video acquisition from analog signals,
- Automated target detection and tracking,
- Radar data visualization on high resolution color displays,
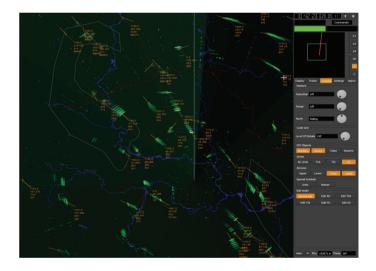- Remote operation from safe distance

Main Modules

RAPID Acquisition & Control

- Samples analog video signals and antenna azimuth signal from primary and secondary radar, using video trigger for synchronization and converts the sampled data into digital radar video format used throughout RAPID.
- Provides on-line control and status monitoring of radar transmitter, receiver etc.

RAPID Extractor

- Analyses digitized primary radar video and generates plots (up to 2000 per antenna turn), which represent potential targets. Its operation consists of three phases:
    - Clutter processing using clutter map,
    - Adaptive thresholding using CA-CFAR, GO-CFAR or LO-CFAR algorithm,
    - Detection of target-like shapes among video samples that passed thresholding.
- Provides on-line status monitoring and configuration of extraction parameters.

RAPID Tracker

- Generates tracks (up to 1000), which represent actual targets whose presence is confirmed with a sequence of plots from consecutive radar scans.
- Global Nearest Neighbor (GNN) is used for data association, and it is implemented using Munkres algorithm. Prior to association, ellipsoidal gating is applied.
- Interacting Multiple Model (IMM) consisting of two or three Kalman filters is used for filtering and prediction.
- Track initiation and maintenance is implemented through use of M/N logic
- Recording and reproduction of plots and tracks is provided.

RAPID Fusion Tracker

• Provides multi-radar tracking through fusion of local tracks with tracks obtained from peer radars and superior control center.

• Enables use of decentralized system architecture which is resilient to failures and facilitates balanced resource usage.

RAPID Display

• It is the primary human-machine interface (HMI) of RAPID. It displays:
  - raw radar picture in plan position indicator (PPI) format,
  - plots & tracks,
  - overlay graphics including maps, azimuth and range markers, code grids, air-traffic corridors, navigation aids, zones, etc.
  - raw radar video in A-scan format.

• It is designed to accurately and naturally emulate properties of analog radar displays:
  - effect of continual fading;
  - double persistence effect (achieved with two phosphor layers in analog radar displays).

RAPID Interconnection

• RAPID Interconnection is a set of libraries used for local or remote inter-process communication (IPC). It is based on TCP/IP.

• All software modules in RAPID are implemented as separate processes, connected by means of RAPID Interconnection.

• This way, weak coupling of software modules is enabled, increasing system modularity, flexibility and stability.

RAPID Communication

• Allows continuous real-time plot data reporting to superior control center.

• Allows continuous real-time track data exchange with superior control center and peer radars.

• Supports ASTERIX, CD2 and proprietary Marconi protocols.

• Other protocols can be implemented on request.

RAPID Voice Communication

• Provides IP-based intercom and telephony services.

• Interfaces with conventional voice communications systems and the PSTN.

• Provides customizable touch screen HMI.

RAPID Height Finder Control

• Provides on-line status monitoring and control of height finder radar.

• Supports manual and automatic height measurement requests.

References

• Serbian Army (as mobile system CVOJ M11 for S-600 and AN/TPS radars)

• Iritel / Serbian Army (as modernization kit for P-12 radar)

• MTT-Infiz / Kenya Air Defence (as modernization kit for S-600 radar).