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# MONITORING SYSTEMS

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***Abstract:*** *The proposed project target is to develop an integrated experimental system for monitoring moving or stationary, marine, land and air targets and displaying the information about these objects on an electronic chart[1]–[7]. The proposed system will improve the capabilities of the Romanian authorities to incidents and accidents at sea, performing search and rescue missions, and will help to prevent loss of life and to conserve marine flora and fauna in protected areas.*

The Logical architecture of the proposed system is a flexible architecture that allows system reconfiguration and extent depending on the mission specific. This will consist of:

- Maritime Segment contains AIS sub segment and Underwater sub segment;
- Land Segment contains GPS - Land Tracking System
- Air Segment contains RADAR extractor, Asterix, NMEA Module
- Network Segment contains Communications server
- Monitoring-Console Segment

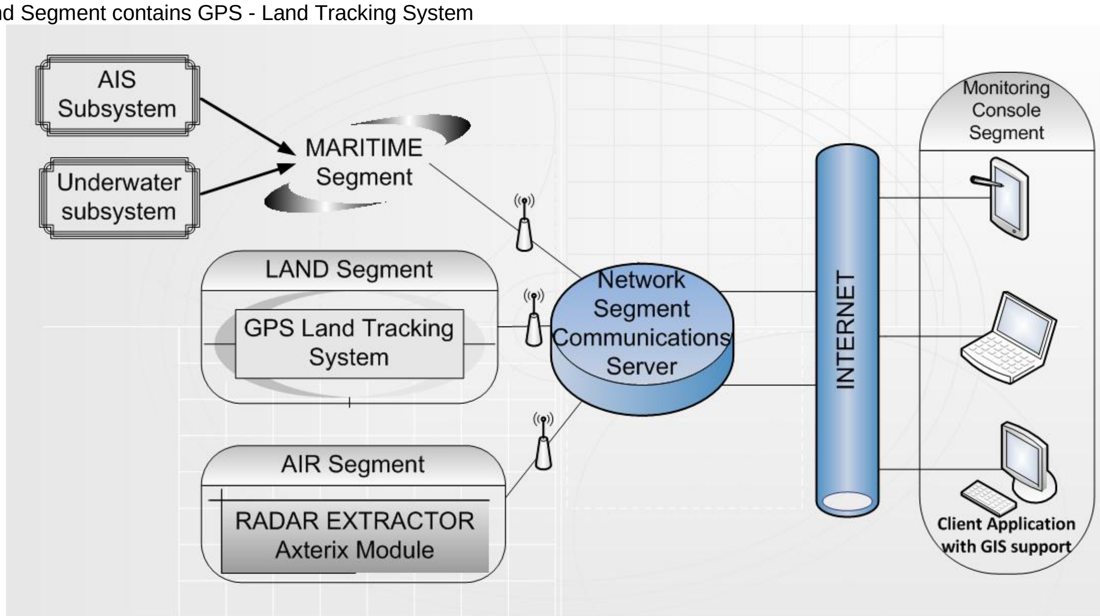


Figure 1 Logical architecture

**AIS Module**

The proposed system will respect specific national procedures. Therefore the system contains a high performance AIS receiver capable of receiving AIS information from ships equipped with AIS transmitters. The AIS receiver must be easy to install necessitating only the coupling of a VHF antenna and a personal computer. The AIS receiver must be compatible with any ECDIS (Electronic Chart Display Information System) system capable of processing AIS NMEA 0183 phrases. The equipment should be conforming to IEC954/EN60954 and ITU1371-1, IEC61993, IEC 61162-2[8], [9].

**Application functionality:**

System should be comprised of a unique server component and mobile instances. The server component should have the following characteristics:

The AIS server is a unique software component with the function of routing messages among clients connected to the network. The server is responsible for establishing and maintaining the connection with the mobile AIS systems defined under it. The AIS messages should be decoded and transmitted in a compressed form from the mobile systems to the central server. The transmission should be possible over any media including internet in a secure mode.

The transmission of data from a mobile AIS system to the central server should be made in real-time selectively through Ethernet, GPRS, 3G or CDMA. The time interval at which ship dynamic data are communicated should be in the frame of 2 to 10 seconds. Between the mobile AIS systems and the central AIS will be circulated data processed locally on the base station in such a manner that a 9 kbps channel could be used.

The mobile system should be able to function both standalone and client-server;

The mobile system should be operable and accessible in any point of the globe through commercial communications;

The system should be able to display on a digital map ship positions and the information transmitted by their AIS transponder;

Between several mobile consoles of the system the following interactions should be possible:

-secure chat message exchange;

-display of tactical drawing visible to all the members of the mobile units network in real time;

-the display of ships should be superimposed over a digital map that should be loadable from local and public sources;

-the console will have a multilingual user interface (Romanian, English, French, German and Spanish);

-the console should be able to load and display drawings external to the system geographically referenced and scalable;

-the data received from the ships should be saved in a database;

-the database should allow for the following reporting mechanisms: MMSI display, MMSI historical display of successive positions for the duration of the monitoring action;

-highlighting of a monitored MMSI within certain geographical boundaries, reports regarding ship traffic relative to certain AIS sensors, ship type reports;

**Underwater segment will be realized from Land Tracking segment on a floating platform interfaced with a hydrophone. The segment transmits acquisitioned data**

**from the hydrophone when the surveillance area is violated.**

**GPS – Land Tracking System**

The GPS Land Tracking System must be a Java based product built around a core of GIS functionalities. This core should allow for the import and display of maps and geo-referenced satellite images. In addition the system should have the capability of zooming and panning and the ability to work with multiple information layers associated to map positions[3], [5]–[7], [9]–[11].

Another module should cover remote detection.

The module should integrate remote detection sensors like telemetry, gyro, angular and magnetic sensors display the vehicles attitude about its center of mass and its orientation by magnetic north. In addition following the acquisition of targets it should be able to display and qualify these targets. All this information must be replicated between all networked consoles. The operators of the consoles should also be able to use a chat to exchange information between them.

The information should be replicated between the systems' consoles using both Ethernet networks and GPRS/3G. This should be achieved through a module which facilitates data exchanges over Ethernet and GPRS/3G with a central server specially designed for gathering and distributing the information from consoles and sensors.

**RADAR EXTRACTOR and ASTERIX Module**

The module should be based on high-tech COTS elements, in order to offer an affordable way to include analogue radars in modern air control systems. The RADAR module should transform the analog RADAR data into digital format (plots and tracks), being able to send the information using various digital channels[8], [12]–[15]. Usage***:*** For analogue RADARs mainly (but it should also be configurable to use digital interface)

The module should have the following functions:

- video-frequency radar signal processing;
- automatic data extraction, track generation and automatic track following;
- correlating information received from a secondary radar with information from primary radar;
- display radar information (primary video signal and additionally generated signals);
- recording of air situation over a period of minimum 24 hours, with continuous update, archiving and display of archived information;
- simultaneous information transmission over:
- a serial synchronous link using EUROCONTROL-ASTERIX protocol.
- an Ethernet LAN connection using Asterix protocol with TCP/IP connection or UDP multicast packets.

**ASTERIX Module**

The Asterix module should be comprised of a generator/ simulator component and a viewer component.

The generator/ simulator component should be a program which simulates real radar and generates Asterix Messages. This program should create and transmit Asterix messages (cat 1 and cat 48) on UDP port 1500 to everyone (broadcast) as described on the Eurocontrol web site.

The ASTERIX messages should be generated at a 3 seconds rate and such should be the update of the targets on the map. The ASTERIX message generating program should be operated/launched also on/from another machine in the network (must be same LAN for now) and the viewing component should be on another machine as long as traffic over the UDP port 15000 is allowed.

Asterix Viewer

This should be a component which receives Asterix Messages over UDP. It should load maps and display over them tracks extracted from the Asterix Messages.

The interface: the viewing application should be developed in Java.

Tracks: should be plotted using APP6 standard symbols and next to them should be printed relevant information like track number, altitude and speed. There should also be a vector reflecting the direction in which the track is moving[5], [12], [16], [17].

Logical architecture of the system proposed by the project will consist of:

- AIS segment developed within the project is for reception and transmission through network of the AIS information transmitted by the on board transceivers. IMO(International Maritime Organization) require all states to install lAIS transceiver onboard. The AIS platform includes AIS Antenna, AIS Receiver, AIS Decoder and Client Application with GIS Support.
- Land segment developed within the project is intended for reception and network transmission of information about moving or stationary land objects. Land platform includes GPS Antenna, GPRS Antenna, GPS Module,GPRS Module,Controller and Client Application with GIS Support.
- Air segment of the project is developed for video, antenna position and timings ignal processing transmitted by RADAR modulator to RADAR extractor and conversed in Asterix and NMEA format. Airplat form includes RADAR extractor, Asterix Module, NMEA, Client Application with GIS Support.
- Under water segment developed within the projectis meant to signal the presence of water target that enter the surveillance area without calculate the object coordinates. The module comprises and module disposed on the floating platform and hydrophone, Client Application with GIS.The module can be developed for other applications. The applications could be diversified by integrating a burglaryorfire sensor.

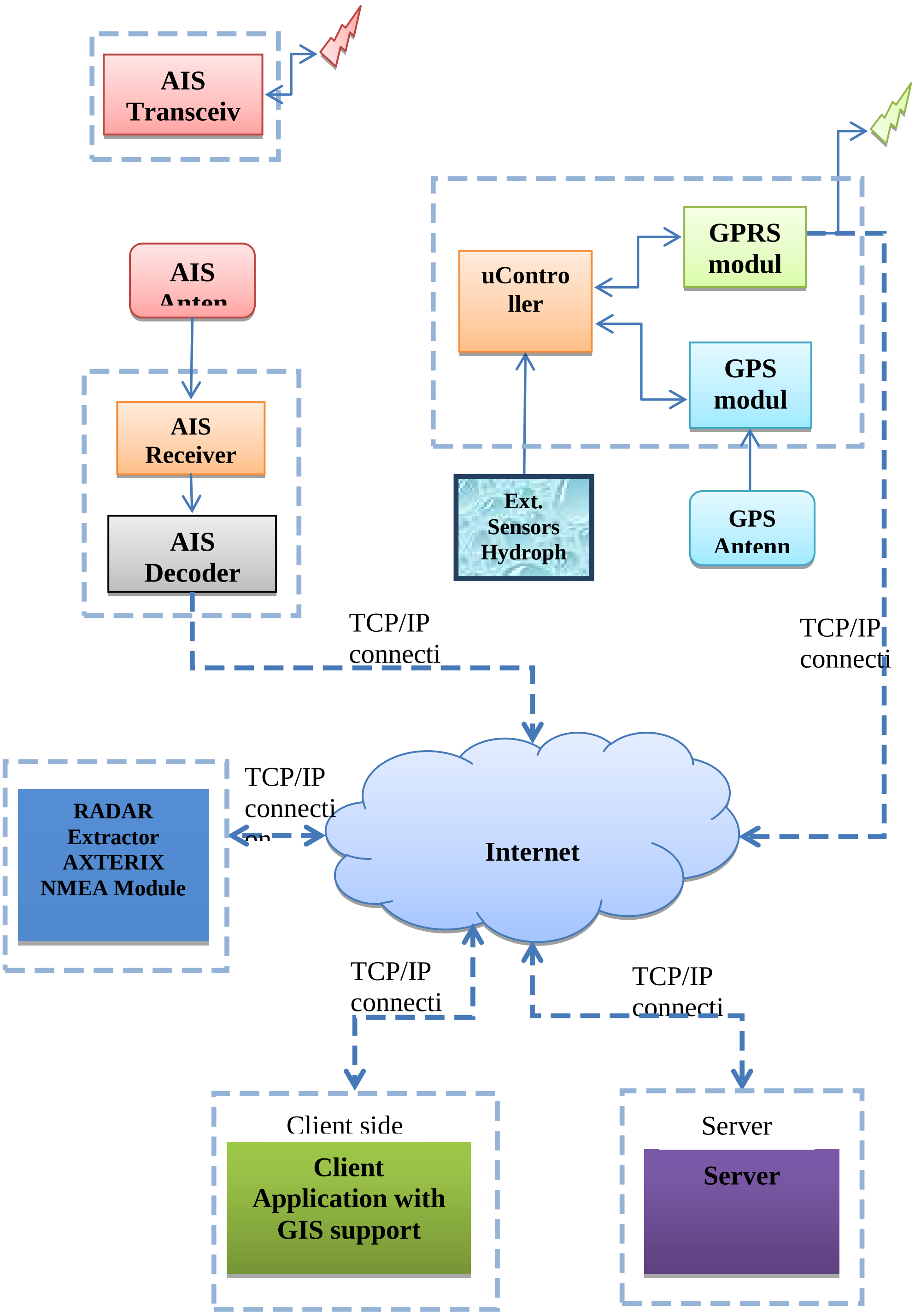


Figure 2 Block diagram

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