

# **FISHERY MONITORING AND MODELLING**

## **M<sup>2</sup>C APPLICATION**



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## **GENERAL**

M2C technology will be used by AZ Global Research & Engineering Ltd. to build the system that will include fishing area map, fishing vessels, restricted and another special zones, oceanography data (water temperature, currents, etc.), weather data, enforcement vessels and another sea vessels in the area by demand. It will be capable also to import 1B processing level satellite radar or multispectral images that may be used for detection of illegal fishery operations or another illegal activities within the monitored area.

## **DEFAULT SYSTEM FUNCTIONALITY**

AZ GLOBAL RESEARCH & ENGINEERING LTD. proposes as a starting point to offer to the customer the system that will provide the following functionality.

1. Real time monitoring of location and other related data of the sea vessels

The system monitors incoming notification messages through standard MS Outlook Express e-mail client. At this time the system is pre-set to monitor messages in CLS NovaCom format, but another formats are also possible. Messages shall be of alphanumeric character, and are expected to carry, among other data, vessel ID, coordinates and catch.

2. Integrated situation display with layered object representation. User will be able to see and review:

a. The map of the area with of the markers indicating location of the vessels. The color of the marker corresponds to the type and conditions of the vessel.

- i. For instance, the vessel that is known as the one that has all permits in proper order and is fishing within allowed area and did not exceed its quota is marked green (Fig.1);
- ii. The vessel that has generated the distress signal and needs immediate help will be marked red;
- iii. The vessel that is fishing, but has no permit, or is violating its permits will be marked orange;
- iv. The law enforcement vessel at normal conditions will be marked blue, and so on.

b. Restricted areas. Areas that are restricted for fishing will be marked on the map by neutral color. However as soon as fishery (or suspicious) activity within restricted area will be detected, the color of the area's perimeter will change, attracting the attention of the operator. System will include internal pattern analyzer that will use the history of the vessel locations to single out the vessels that are fishing.

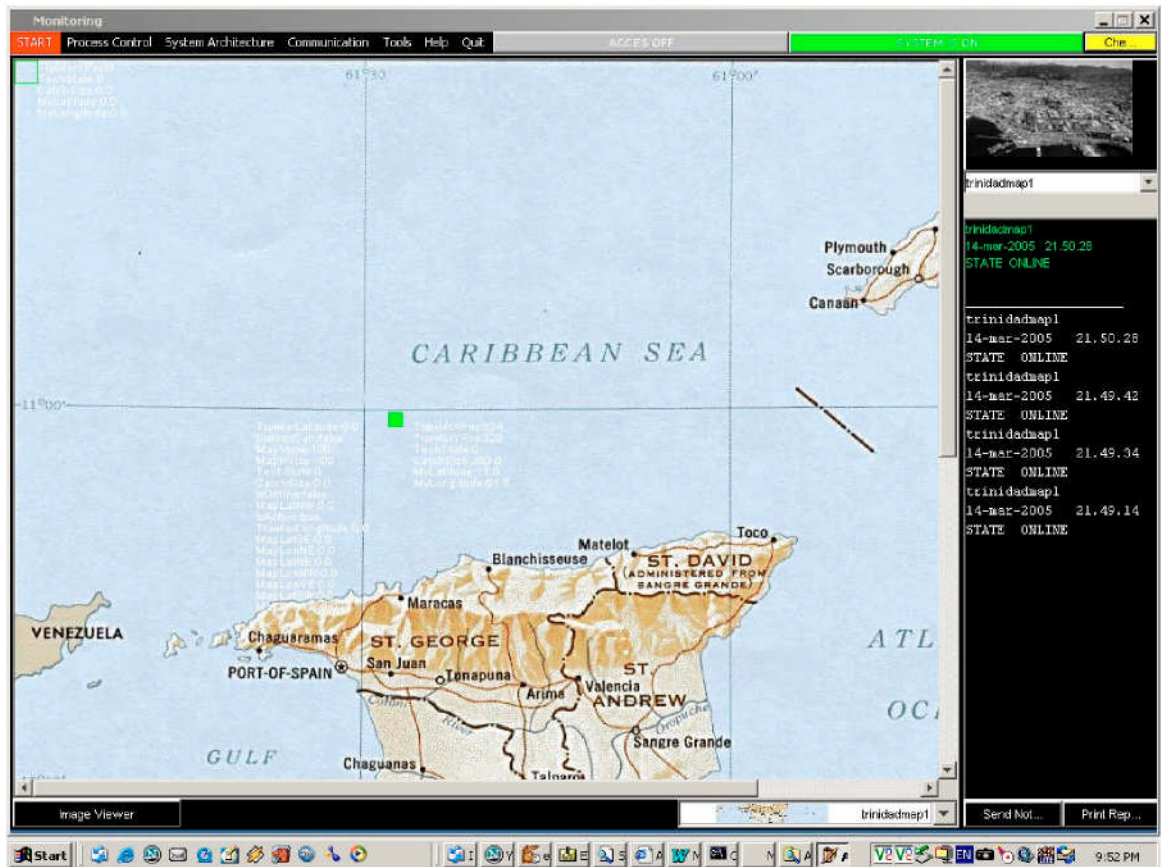


Figure 1. Situation display with status panel and single vessel visible.

- c. Ocean currents. If data are available, location and strength (speed) of the currents will be displayed.
- d. Ocean temperature. If data are available, the User will be able to bring up water temperature data for any point on the map, or to bring up temperatures map in the separate window.
- e. Weather data. Direct feed of weather data for the given region from NOAA or another sources will be supported. In the case of active or dangerous weather conditions in the monitored region the map of the region will be framed with the contour of the correspondent color.
- f. For each vessel or another object in the system the User will be able to bring up:
  - i. Its “raw” data, e.g.-geographical coordinates, ID, crew, owner, etc.
  - ii. Its “status” data, for instance – vessel’s technical conditions, status in regard to permits and conducted activity, its proximity to bad weather or restricted areas, in the case of oceanographic data – anticipated fish availability, etc.
  - iii. Historic charts of the object’s parameters, like catch or location of the specific vessel

- iv. Map or engineering drawing of the object, like enlarged map of the ocean current, or vessel's blueprint, or weather map;
    - v. Image of the object
    - vi. Multimedia data stream from the object, static visual data in the case-specific format, or another object-specific data in the separate window All these data may be displayed in the separate windows, or User may bring up raw data and status panels to the left and to the right of the map, or data may be overlaid on the map (overlay text color is white).
  - g. User may also define what kind of objects have to be displayed on the situation display, effectively reflecting traditional GIS layered data representation.
3. Object display.
- User is able to bring up enlarged blueprint, map or engineering drawing of any object in the system instead of the system's situation display. Notwithstanding which object is displayed User still can monitor raw data and status data of another objects in the system. For instance, if certain ocean current is displayed at the principal panel, User may still watch change of the raw data for specific vessel, and monitor status of specific zone in the ocean.
4. Notification.
- As soon as parameters of any object in the system start approaching to pre-set margins, or example sea vessel approaches the margin of the restricted zone, or total catch of the monitored fleet approaches or surpasses the quota, the system automatically generates the notification and sends correspondent messages to preset list of recipients.
5. Use of satellite images.
- System supports importing of georeferenced satellite images, and automatically applies images to the map. Use of radar satellite images allows to detect illegal vessels in the area; use of multispectral imagery of different resolution have multiple oceanography applications that may be used for prediction of the future catch, etc.
6. Modification of the system
- The system supports wide variety of system modification options:
- a. Adding object to the system. If new vessel enters the area, or is detected using satellite imagery or using other means, it may be added to the system. Same applies to new restricted areas (military exercises, for instance), to ocean currents (like eddies in the Gulf of Mexico), etc.
  - b. Removing objects from the system
  - c. Changing the object's area. In the case if restricted area configuration has to be changed for whatever reason, the operator may simply draw new area on the screen using computer mouse
  - d. Including or excluding existing object in the overall modeling. For instance, if there are several fishing vessels in the area that carry different national flags, the

ships from the foreign country may be excluded from the national quota calculation, etc. None of these modifications requires system restart.

7. Modeling.

Each object of the system has built-in modeling capability. These models may be used to predict the catch, to estimate availability of certain kind of fish in the area using oceanography data, etc. Results of the modeling are reflected in the status panel of the main situation display. Results of modeling may be presented in graphical or alphanumeric form.

It is possible that certain models (like fish availability vs. oceanography data) already exist, possibly written in Fortran or another programming language. The system will support running such model as well, as a separate computation process.

User may switch between alternative models without system restart.

8. Support for planning and management

The system may be used for off-line analysis of “what if” situations, like changing the parameters of the fishing area, possible impact of adverse weather, impact of the overfishing by foreign operators, etc.

9. Data access

a. Incoming (“raw”) data.

- i. System may receive data in automated regime from external sensors for any object in the system.
- ii. System may receive data (alphanumeric and graphical) for any object from external GIS
- iii. User may open incoming data panel for editing, and change data manually
- iv. User may import, create and edit images and maps/blueprints for any object in the system using built-in capabilities

b. Output (“status”) data

User may review and chart status data by object

c. Remote data access

- i. System automatically supports static web site with controlled access, that presents current and historic “raw” and “status” data together with the latest situation display.
- ii. System also supports remote “client” applications, that may run in distant locations, like remote fishery pier or even remote harbor.

d. Access management

Remote “client” locations and static web sites may be added, removed, connected to the system or disconnected from the system on the go.

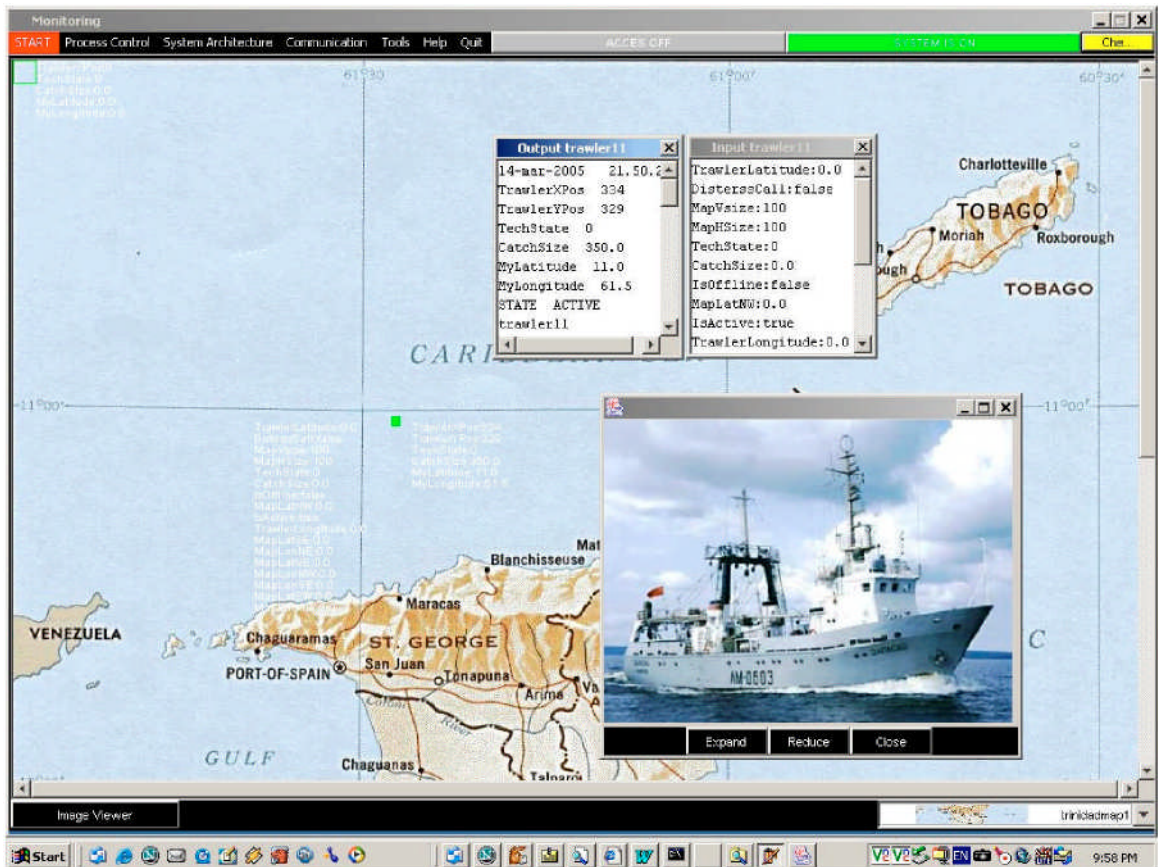


Figure 2. Area map with current and historic data, multimedia stream and status panel hidden.

#### 10. Operation control

User is able to change system update rate, pause or re-launch monitoring and modeling, change text and background colors, and reset standard system settings.

### **HARDWARE REQUIREMENTS**

System may be operated in Windows-2000, Windows-XP or Linux (tested for Red Hat 9.2) environments on the PC computer with Pentium-III or Pentium-IV processors, 128-256MB RAM, and requires about 100GB disk space, including installation of Java-2 (JDK 1.4.2 and JAI 1.1). System requires monitor resolution better than 600X400 pixels and was only briefly tested for Windows 9X environments.