

Based on preliminary research and analysis of existing video analysis software products and technologies, a set of automatically detected events (described in detail below) that will enable the user to identify meaningful activities in a designated location was defined. With consideration to these detectable events, screenshots of an application that georeferences an input video stream and displays detected events on a location-relevant map (see screenshot on page 2) were developed. The proposed application gives an overhead view of the analyzed area over time and enables the user to see micro and macro information about that region. color, hue, and intensity indicate a range of the total number of events from all categories.












The user can choose relevant categories, and the colors within the map change accordingly. The user can zoom into the region for a detailed view of the events. Information graphics describing the quantity of events over time are also displayed. The user can detect the areas of interest by the macro view and then quickly move to the micro view for more specific information.

SPECIFYING EVENTS

Based on research, four main event categories of automatically detected events were defined:

1. Movement events – Object moving within covered area at a certain speed
2. Object's presence/absence – Object is taken from the covered area, or inserted into the area
3. Line crossing events – Object crosses a line that was drawn by the user onto the image (e.g., over borders)
4. Counting – Number of objects in a specific area

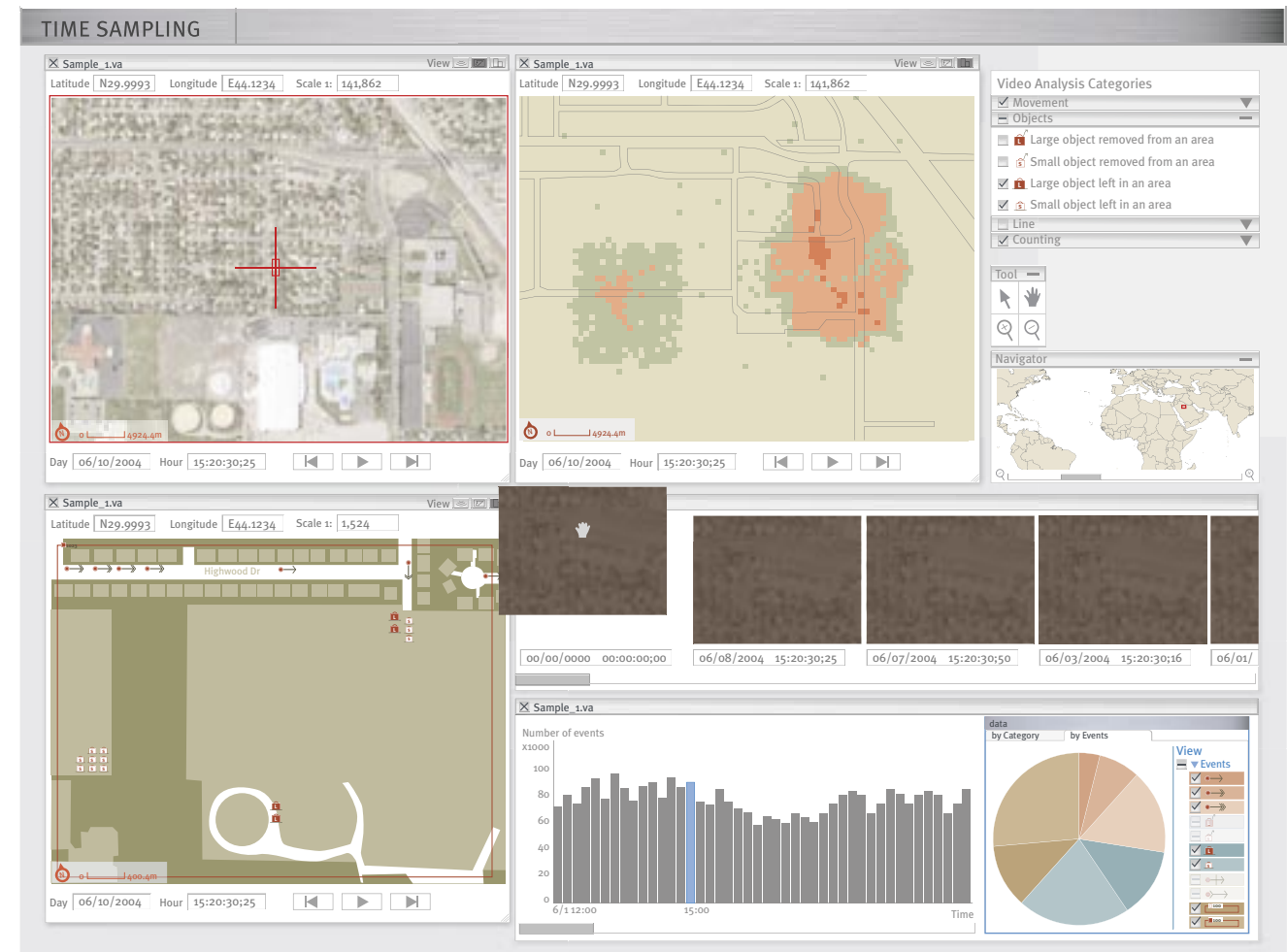
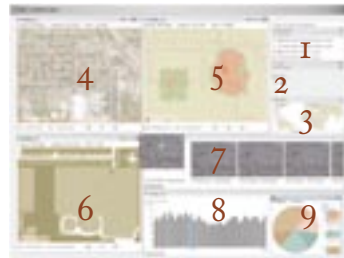
PHIM designed intuitive symbols to represent each event:

	<i>Slow speed movement</i>
	<i>Medium speed movement</i>
	<i>High speed movement</i>
	<i>Large object was removed from area</i>
	<i>Small object was removed from area</i>
	<i>Large object left in area</i>
	<i>Small object left in area</i>
	<i>Line crossed</i>
	<i>Two lines were crossed (enter and exit specific predefined area)</i>
	<i>Number of big objects</i>
	<i>Number of small objects</i>

USER INTERFACE

The interface designed to detect events from input video contains the following windows and menus:

1. Categories / Events Selection menu – The user can select the categories and events of interest and the selection updates all other windows accordingly.
2. Toolbox window – The user can zoom in or out, move, and select tools on the selected window.
3. Large-scale map indicates global location of the video input.
4. Main video window – This video window shows the live or recorded video stream from the selected area. The user can retrieve previously recorded video and all the other windows will update accordingly.
5. Events color map window – This window shows the quantity of automatically analyzed georeferenced events on a map of the covered area. Red colors indicate a high number of events. The map is divided into a grid and events are summarized for each cell in the grid.
6. Map of zoomed area with events - The user can zoom in to a specific area of the colored map and see specific events in this area.
7. Bookmarks window – The user can save meaningful points/frames in time. When clicking on a saved frame, all data relating to this frame is loaded and all other windows are updated accordingly.
8. Histogram window – This window shows the histogram of all events for the area covered in the main video window (4). In this example, the events are summed every hour, but the user can change the time resolution from seconds to years. When a single time bar is selected (blue), a pie chart showing specific events for this bar is displayed (9).
9. Pie chart – This window uses a pie chart to show specific events for the selected bar in the histogram. The user can select events to be displayed in the pie chart, and the pie chart will be updated accordingly. The pie chart can be divided by categories or by specific events.



SYSTEM ARCHITECTURE

The workflow of the video analysis is as follows:

1. The video input is fed from several cameras that cover a given area either placed on location, or from an MRPV (Mini Remotely Piloted Vehicle) or a plane flying over the area.
2. The server farm performs the automatic detection for the video input and georeferences the events.
3. The video and events are streamed into the application(s) over a secured network.

