MISTRAL®
... Partners in Real Time

C4ISR for Traffic Management Systems

Introduction

C4ISR stands for Command, Control, Communications, Computing, Intelligence, Security and Reconnaissance. It was formulated by the US Department of Defense (DoD) in response to the need to evolve a mechanism for integrating and acting on combat information coming from various sources, geographies, and using different types of media.

A C4ISR System can be thought of as a framework for organizing multi-media information emanating from a situation (typically a crisis), in a manner that enables non-local users to analyse such information (from multiple sources); act on that information or advise local players on actions to be taken; receive feedback from local players on actions taken; based on which a follow-up set of actions or advice can be initiated, towards the objective of resolving the situation to the advantage of the users.

C4ISR and Traffic Management

C4ISR has been adapted, from its military origins, for Homeland Security given the similarity in the situations faced by a city reeling from a terrorist strike or a major conflagration, and an army battalion in hostile action. Subsequently, the concept has been applied to systems that involve co-ordination among multiple agencies, function in an environment which is in a state of constant flux, and are given the responsibility of addressing crises (albeit not of the type resulting in major fatalities).

Figure 1: Integration of sensor data in GIS

City-wide Traffic Management is one such system, internationally, where C4ISR concepts have been applied. Traditionally, Traffic Management Systems in India have relied on the following components:

Components	Functions
Sensors	
• Traffic Light / Traffic Policeman	• Regulate traffic, with the objective ensuring smooth flow of traffic
• Surveillance Camera	• Monitor traffic, with the objective of identifying potential congestion points
• Enforcement Camera Point sensor	• Record traffic violations
• Point sensor	• Gather data on traffic flow, volume, speed, and lane occupancy
Communications Network	
• Sensor Network	• Send sensor data to a central Traffic Management Centre (TMC)
• Voice Network	• Receive and transmit verbal instructions to traffic policemen and response teams (field units)
• Data Network	• Receive and transmit data to field units
Control Centre	
• Traffic Management Centre	• Control centre for receipt of all sensor data and for citizens to call in
• Traffic map	• Locate accidents, incidents, and traffic problems on a GIS system
• VMS	• Alerts broadcasted directly to motorists on the roads
• Voice / Data Network	• Text messages and data sent to motorists whose device details are available
Response Team	
• 2-wheeler / 4-wheeler	• Respond to accidents, incidents, and traffic problems on the road

These components have, usually, worked independent of each other, or in an uncoordinated manner. A C4ISR approach to Traffic Management will integrate the above components and present a Common Operational Picture (COP) to traffic managers; as well as allow these managers to respond to field units and motorists in real-time, and in a planned manner.

The Benefits of a C4ISR implementation in Traffic Management:

Implementing a Traffic Management System on a C4ISR framework, will allow traffic managers to optimize the data coming in from existing sensors and field units, through fusion of the data on a visual representation of the city.

Integration of sensor data streams in the GIS

Traffic managers will be able to integrate surveillance and enforcement camera feeds into the Traffic Management GIS. Typically, such a GIS will have an overlay consisting of traffic light junctions in the city, and key emergency features (hospitals, police stations, fire stations, etc.). Using a C4ISR application, camera feed from a specific traffic junction can be embedded in the GIS, so that a click on that traffic light icon, on the GIS, displays live video stream from the cameras positioned at that junction. This feature can be enabled for any sensor data stream.

Integration of multi-media information in the EMS

Voice and data communications, from motorists and field units, can be fed into the C4ISR application and associated with an incident or location, so that clicking on that incident/location, brings up all recorded information associated with that incident/location. This Common Operational Picture (COP) approach to analysing situations is unique to C4ISR solutions.

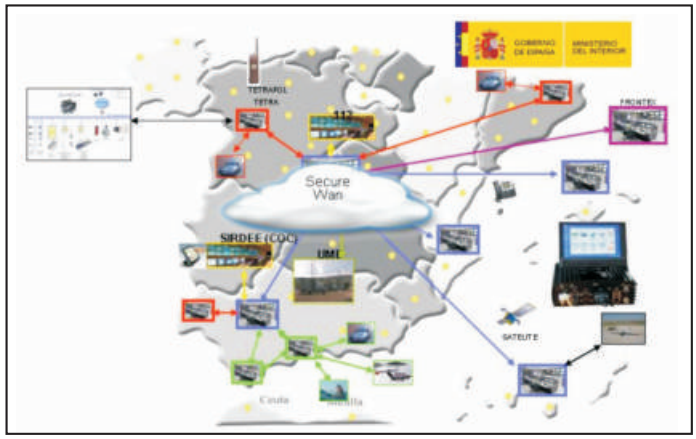

Figure 2: Multi-media information in the EMS

Multiple communications protocols communicating seamlessly

Patches between multiple communications protocols (GSM, CDMA, U/V/HF, PSTN, Tetra, etc.) seamlessly, thereby allowing traffic teams to communicate with the TMC and amongst themselves using a variety of communication devices. Also patches motorists, providing eye-witness information, communication to relevant field units.

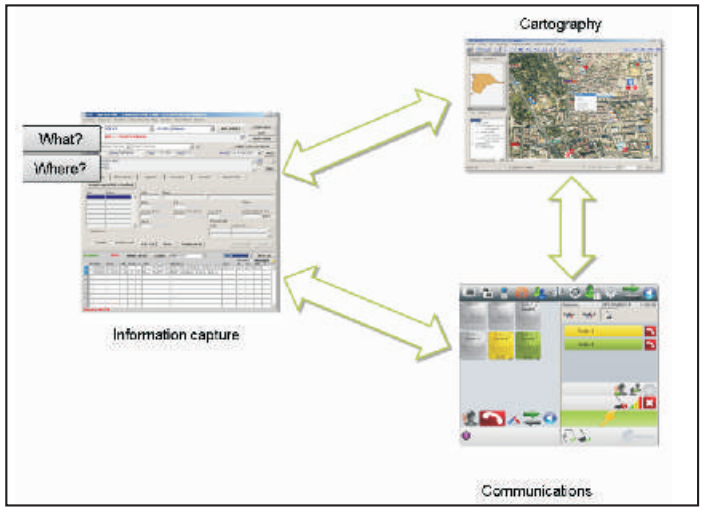

Figure 3: Multiple-protocol communication

Broadcast traffic control messages/signals in real-time

Co-ordinate output to a VMS, traffic signals (if they can be centrally controlled), and citizen database (SMSes regarding traffic jams, etc.) within a short time of the occurrence of an emergency. Databases can be linked to the C4ISR application, so that specific actions can be performed on a database.

Blue Force Tracking for field units

Optionally, provide GPS-enabled devices to all or key traffic personnel/response teams so that real-time monitoring of response to emergencies is possible. The GPS devices allow field units to be mapped on the GIS in real-time.

Risk & Action Protocols

Co-ordinate response to traffic problems and other emergencies (that may create traffic problems or may be exacerbated by traffic problems) in a planned manner, using all the media tools available to the crisis response team. SOPs can be defined for various situations and entered in the C4ISR application, so that when an emergency occurs, even inexperienced personnel can take control.

Integrate new sensor technologies as they are introduced

With increasing traffic and larger road networks, more sophisticated sensors will need to be deployed: traffic radar sensors, single/double loop detectors, etc. A C4ISR solution will allow data feeds from these sensors to be integrated with those from existing sensors.

Figure 4: EMS Components

Conclusion

Mistral offers a range of C4ISR solutions for Homeland Security needs in India. These solutions will allow traffic managers to further leverage existing investments in sensors and IT, towards making the roads safer and traffic smoother.

About Mistral

Mistral is a technology design and systems engineering company providing end-to-end solutions for product design and application deployment. Mistral is focused in three business domains: Product Engineering Services, Defense Solutions and Homeland Security. Mistral provides total solutions for a given requirement, which may include hardware board design, embedded software development, FPGA design, systems integration and customized turnkey solutions. Mistral's strategic partnerships with leading technology companies help provide customers with a comprehensive package of end-to-end solutions.

Mistral's Homeland Security group offers ready to deploy, proven, high-technology security solutions for strategic and tactical operations. Mistral provides solutions for Police Command and Control, Emergency Response, Emergency Operation Center, Mobile Command and Control, Border and Coastal Surveillance, Critical Infrastructure Protection, Biometrics, Video Surveillance, Crypto Solutions and other critical security applications.

MISTRAL
... Partners in Real Time

Mistral Solutions Pvt. Ltd.,
No.60, 'Adarsh Regent', 100 Ft. Ring Road, Domlur Extension, Bangalore - 560 071 India
Tel: +91-80-3091 2600 Fax: +91-80-2535 6440 E-mail: info@mistralsolutions.com