Fusion of navigational data in River Information Services

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River Information Services (RIS) is the complex system of solutions and services for inland shipping. It has been the scope of works carried out in most of European countries for last several years. There were also a few major pan-European projects like INDRIS or COMPRIS launched for these purposes. The main idea of RIS is to harmonize the activities of various companies, authorities and other users of inland waterways in Europe. In the last time growing activity in this area in Poland can be also noticed. The leading example can be the works carried out in Chair of Geoinformatics in Maritime University of Szczecin regarding RIS for the needs of Odra River.

The Directive 2005/44/EC of European Parliament and Europe Council, followed by European Commission regulations, give precise guidelines on implementing RIS in Europe, stating the services that should be provided. Among them Traffic Information and Traffic Management services can be found. As per guidelines they should be based on tracking and tracing of ships in the inland waters. The results of tracking and tracing are Tactical Traffic Image and Strategic Traffic Image.

The guidelines stated that, tracking and tracing system in RIS shall consist of various type sensors. The most important of them is thought to be Automatic Information System (AIS), and particularly its river version - Inland AIS. It is based on determining the position of ships by satellite positioning systems (mainly DGPS) and transmitting it to other users on radio VHF frequences. This guarantees usually high accuracy of data related to movement of ships (assuming proper functioning of system and ship's sensors), and gives the possibility of transmitting additional information about ship, like dimensions, port of destination, cargo, etc.

However the other sensors that can be used for tracking shall not be forgotten. The most important of them are radar (traditionally used for tracking purposes in Vessel Traffic Systems) and video camera. Their main advantage over AIS is total independence from tracked target's facilities. For example, wrong indications of ship's GPS would affect AIS accuracy, but wouldn't have any impact on values estimated by radar. In addition to this in many times update rate for AIS data is longer than for radar.

Thus, it can be noticed, that efficient tracking system introduced in RIS shall use both AIS receivers (based on satellite derived positions), and independent radar and camera sensors. This will however cause determining at least two different set of information about positions and movement parameters of targets. Doubled or multiplied vectors for single target are unacceptable, due to safety of navigation and traffic management. Hence the need of data fusion in RIS is obvious. The main goal is to develop unambiguous, clear and reliable information about ships' position and movement for all users in the system.

Data fusion itself is not a new problem in maritime navigation. There are systems of Integrated Bridge on sea-going ships, which use information coming out from different sources. However the possibilities of integration of navigational information in the aspect of inland navigation, especially in River Information Services, still needs to be thoroughly surveyed.

It is quite useful for simplifying the deduction, to introduce two data fusion levels. First of them is being done on board of the vessel. Its aim is to integrate all information coming from different sensors in the so called Integrated Navigational System. The other task of this fusion is to estimate reliable information about other objects based on AIS and radar. The second level is the integration of AIS, radar and closed-circuit television (CCTV) carried out in coastal station in order to determine Tactical and Strategic Traffic Image.

The navigational information in RIS itself can be divided into two main groups. The first one is called

static data and contains al basic information related to ship itself and the voyage, like dimensions, destination, etc. The second group is called dynamic data and contains all the information, which variability is important for creating Tactical Traffic Image. Both groups require different fusion algorithms, which take into consideration sources, update rate and method, accuracy and reliability.

The article contains different issues related to navigational information fusion in River Information Services. It includes short description of structures and sources of navigational information and also the most popular integration methods. More detailed analysis was made for fusion of position derived from satellite systems (GPS) and from radar. The concept of tracking system, combining Inland AIS, radar and CCTV for the needs of RIS is introduced.