Concept Development of Integrated Monitoring System Model to Support Activities Monitoring in the Border Region

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***Abstract*— Regional Integrated Border Surveillance System, is a system that is capable to providing a wide range of data and actual informations. This system is very suitable to support efforts to control the border area by the government. Basically this system is the result of the integration between sub-system monitors. In this research activity has built models of Integrated Surveillance Systems Border Region, which consists of three sub-systems monitoring. Expected Integrated Surveillance System is able to improve the performance of agency-related agencies, which are replied the border of the region. In this Integrated Monitoring System model contained several types of technology, namely; telemetry, data acquisition, image processing, and smart multi-microcontroller-based Data Logger. This paper discusses the model development concept of Integrated Border Area Surveillance System, which allows it to be built in Indonesia as a model of integrations monitoring system for monitoring the border area.**

Keywords: smart data logger; microcontroller; telemetry; data acquisition; image processing.

I. INTRODUCTION

Border areas, both on land and at sea is one of the locations prone to crime. Various attempts have been made by the government to prevent crime in the border region or who use the border crossing. Measures that have been taken by the government, among others through social-economic approach and security. From the results of the survey which has been conducted by the research team in the border area, the attempt would be more effective if the stakeholders in the border area have actual data and information about the various conditions on the border.

Availability of data and information relating to the condition of the actual border area is required by the government or relevant agencies in order to make the right decision or policy as well as the positive impact on the surrounding community. As shown in the figure below, the concept of an integrated surveillance system. The concept of this system is, some kind of data coming from different sources are collected in a data base and then be processed into various types of information.

One of the problems faced by the government, particularly the agencies on issues related to security, immigration and customs are the actual limitations of the data and information relating to the condition of the border region or in the border crossing. The problem is due to the lack of availability of monitoring systems supported by modern IT technology. These constraints result from the reliance on technology and components from abroad. Resulting in the construction and operational costs are high.

In this research activity has been carried out studies on the model of Integrated Border Area Surveillance System, which is in accordance with the conditions in the border region. Suitability of these conditions include the availability of infrastructure, technological mastery, ease in finding supporting components to build the system, as well as ease of operations. The system is able to provide information many type to users, because it is supported by a variety of data sources.

II. LITERATURE REVIEWS

In building a model of Integrated Border Monitoring System this region, is closely associated with some of the results of previous studies, among others:

- Construction of microcontroller based Smart Data Logger.
- Utilization of GPRS services of the GSM network operator for data communication.
- Image processing for processing data derived from "long range camera".
- Utilization of Remote Terminal Unit (RTU) to support the development of EWS (Early Warning System) and web-based information systems.

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Some of the research that is needed to support the development of this system, among others; Design of a Dual-microcontroller Scheme to Overcome The Freeze Problem for a Smart Data Logger. This study discusses the construction of a data logger using two microcontroller to maintain stability [1], Design VMS (Vessel Monitoring System) Transmitter Monitoring System to Support Development Journey Fishing Vessels. This study discusses the development of VMS for fishing vessels [2], utilization of the GSM / GPRS network for data communications at data logger [3]. CCTV cameras for surveillance applications and object recognition [4,5,6,7].

Based on the results, built a model of Integrated Border Area Surveillance System which is an integration of various sub-systems. The objectives of this research activity is to provide technology that enables the supervision system to be built using components that are easy to find and take advantage of the infrastructure that has been available in various border regions. The expected impact of this activity is the increased ability to build an integrated monitoring system and processing of various types of data from different sources.

III. METHODOLOGY

In this research, the methodology used to construct the model system combine several sub-systems monitoring devices into a single system.

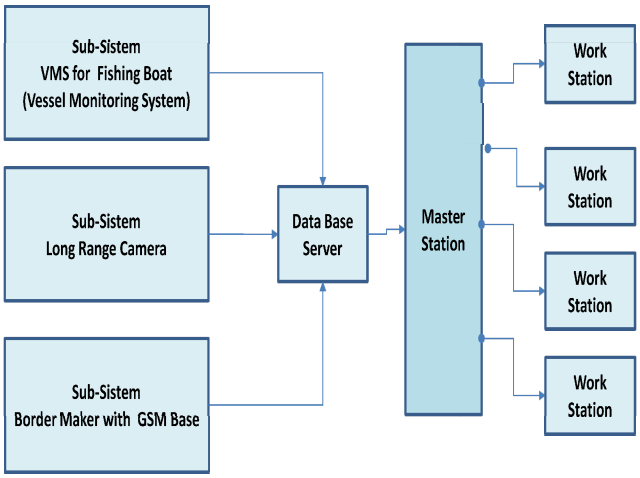

Figure 1. Block diagram of the Integrated Monitoring System.

Figure 1 shows that the merging is done at the level of Data Base. Each sub-system will transmit data at the same data base server. For currently used data base servers located in the Informatics Research Centre - LIPI.

The incorporation of each sub-system will result in an integrated system model as shown in Figure 2. In the picture above can be seen, that the model of integrated border control system that has been tested is composed of several sub-systems, namely:

- Sub Border Surveillance System using Long Range Camera (CCTV). The output of this sub-system is a visual data (image data).
- Sub System VMS (Vessel Monitoring System) for fishing boats / fishing. The data generated by the sub-system is the data position / coordinates and identity of the fishing boats.
- Sub-System Automatic Boundary Marker. The data generated by the sub-system is a data position / coordinates, where the device is placed.

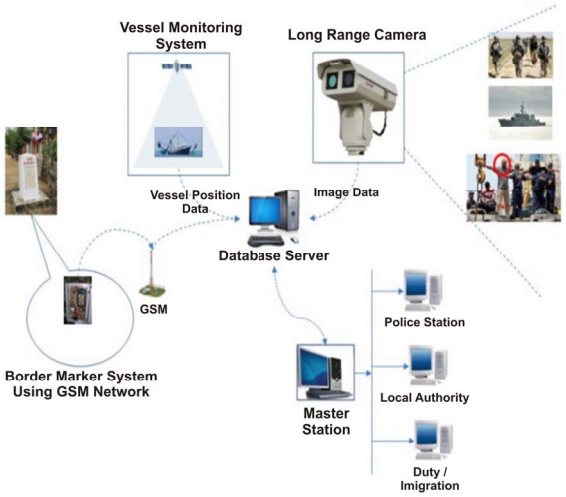

Figure 2. Border Surveillance system design.

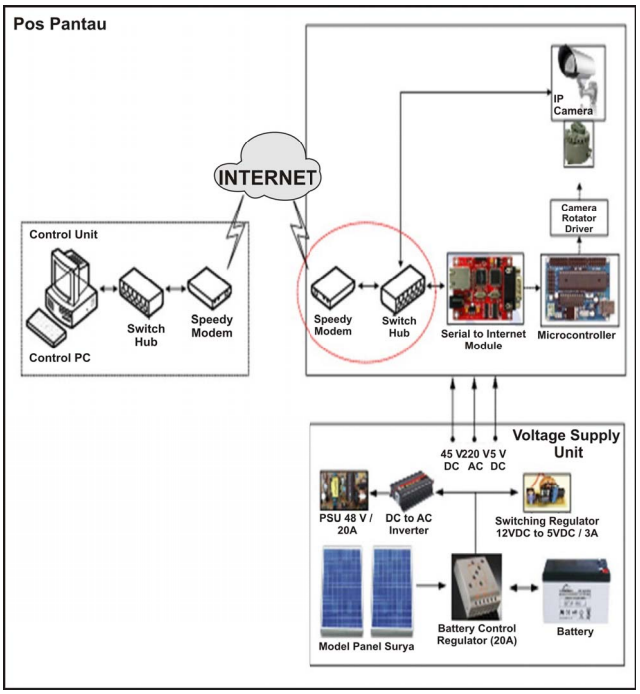

Figure 3. Monitoring Devices

The workings of each sub-system are as follows:

1. Sub-Border Surveillance System using Long Range Camera (IP CCTV), as illustrated block diagram in Figure 3. Long Range Camera IP cameras are used manifold. This camera has a motor drive which can be controlled remotely, over a network Inthernet. Image data produced by this camera is sent to the data base server through the Internet.
2. The system has been tested and demonstrate in Laboratorium and outdoor application and the system work well.

This device has been placed on the shore of Merak-Cilegon as a test site. The camera is placed on a tower with a height of approximately 10 meters above the ground and use the 120 Watt Solar Panels as a source of energy, as shown Figure 4.

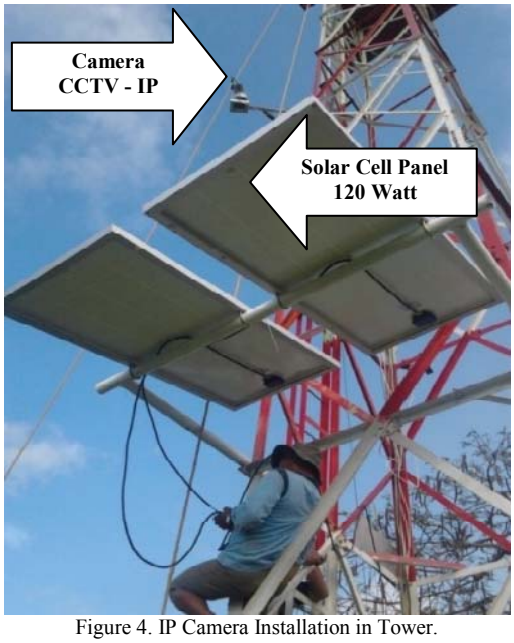

Figure 4. IP Camera Installation in Tower.

The camera is connected to the Internet, so that visual data can be directly transmitted over the Internet to the Control Unit in the form of a PC. The camera also contained a microcontroller module that serves to control the DC motor movements, so that the camera can be controlled. Microcontroller Modules are connected to the Internet as well, so that the operator can move through Camera Control Unit remotely.

Sub-System Automatic Boundary Marker, a device that serves as a boundary marker border region. Components contained in this device consists of; units of solar panels as a power source, GPS + GSM module, and panel boxes that are resistant to corrosion. Figure 5 and 6 show the block diagram of the device.

Coordinate position data, will continuously be obtained from the GPS module. Furthermore, these data at regular intervals will be sent to the Data Base server via the GSM network. Access to location data can be done through SMS. If the device is moved, the new location of the data will be communicated immediately to the operator.

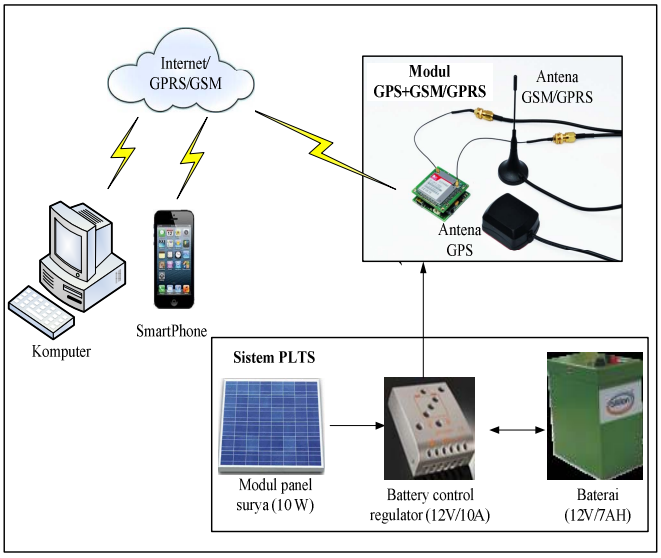

Figure 5. Configuration Component Boundary Markers.

Figure 6 Unit Automatic Boundary Marker.

Sub-System VMS (Vessel Monitoring System) specifically for fishing boats / fishing. This device serves to monitor the direction of the movement of fishing vessels. Ship position data can be used for analysis of a ship cruise lines.

In Sub-System VMS consists of two component units, ie Unit Receiver and Transceiver Unit. The receiver unit consists of a notebook, a GPS module and a radio modem. The receiver unit is placed on a fishing boat. Transceiver unit consists of a PC / Notebook, GPS and radio modem. Notebook and PC functions in each unit is to run application programs are built using the Java Programming. Figure 7 shows the Figure block diagram of the sub-system VMS.

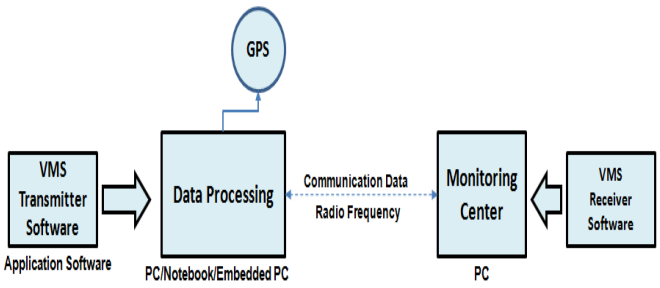

Figure 7. VMS-based PC

Transmitter VMS software is used to receive data from the GPS module, the vessel position data, vessel speed, and direction angle of the bow of the ship. These data will be sent to the Receiver Unit. On the Receiver unit are functioning VMS Software Receiver displays data received from each vessel on the monitor screen.

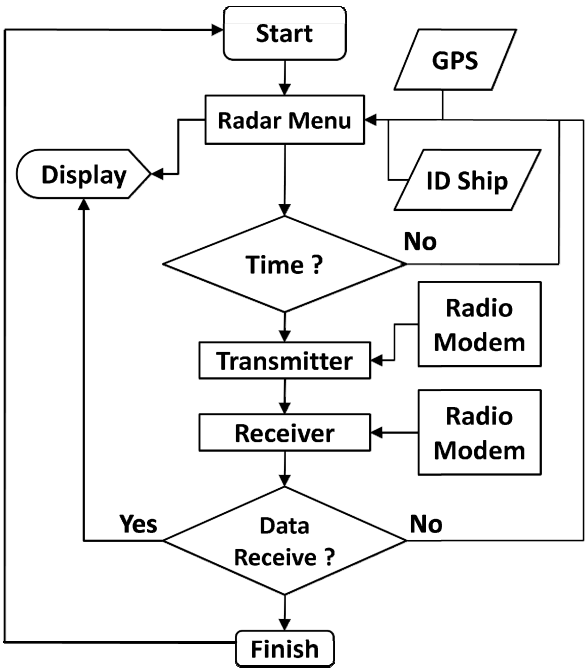

Figure 8. Flow chart Transmitter VMS Software.

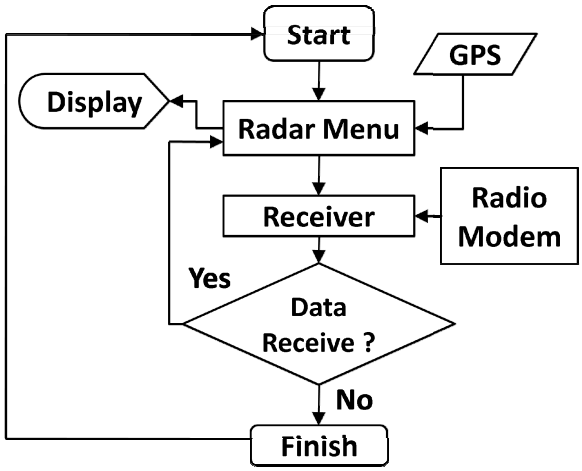

Figure 9. Flow Chart VMS Software Receiver.

To the workings of each application program can be seen in the flow chart Fig. 8. As the flow chart in Fig. 8, transmitter VMS Software, with a certain time interval will always transmit position, speed and direction of the bow of the ship. So that these data can be received by the Receiver VMS Software through flow chart in Fig. 9. Then it can be displayed to the screen. On VMS Receiver residing in the central office, the data received from each other ships will be stored in a data base.

IV. RESULT

The results of testing on each sub-system produces the following outputs:

1. At trial Long Range Camera, has built an application program that serves as HMI (Human Machine Interface) which is able to provide services remotely access the camera operator. The typical result is shown in Fig. 10.
2. At trial Unit Automatic Boundary Marker has built models of Location Information System Web-based Boundary Markers. The Fig. 11 shows the display of the information system.
3. Some examples of the application program menu VMS Receiver is built using Java Programming, as shown in Fig. 12, and 13. The pictures are the result of a VMS application software testing function Receiver, while the picture below is a look at the Transmitter VMS software applications.

Figure 10. Visual Display Information from CCTV-IP Remote

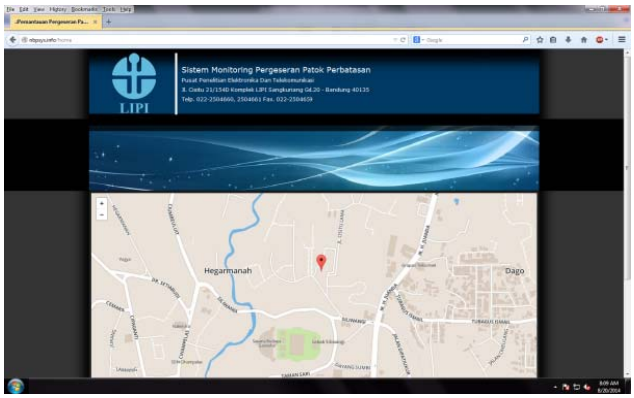

Figure 11. Display Location Information System Web Bookmarks Borders.

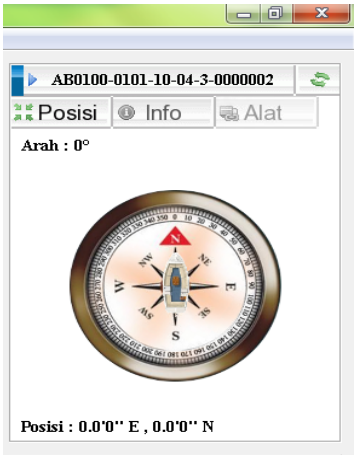

Figure 12. Compas Menu (Navigation Ship)

Figure 13. Menu Identity Ships.

V. CONCLUSION

Development of an integrated surveillance system model of border regions is done by combining several sub-systems into a single system is one way to further speed up the development of IT infrastructure in the border area. From the testing that has been done shows that each medium for data communication has a limited range. The use of satellites for data communications should have been considered at this time.

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