

Border Alert System using Smart Boat to Safeguard the Fisherman

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Abstract— Due to the lack of awareness about the ocean frontiers and advanced alert instruments in the boats, fishermen are caught and killed by the naval forces of the neighbouring country. Hence, maritime security has become major concerns of all coastal areas. The fundamental requirement of maritime security is protecting the fisherman and providing the assistance about sea frontiers via alerting, tracking and monitoring of vessel. Hence, a path breaking technology of border alert system using smart vessel is proposed here that would foster the coast guard officials to effectively monitor the fishermen and alert them if they sail inside the other country's border.

The embedded system is implemented here to alert the border to safeguard the fisherman and make the good relationship between seaside nations. This system uses GNSS which helps to find out the current latitude and longitude values of vessel. If the fishermen are very close to the IMBL means then smart boat border alert system aware the fishermen through visual and audio alert. If the fisherman did not take any reaction about the alerts and move further, then the smart vessel should be reversed automatically and information will be transmitted to nearby Coast Guard station. Then the guards in the shore can assist and provide additional help to those fishermen.

Keywords- Fisherman, IMBL Border, GNSS, Engine Control Unit.

I. INTRODUCTION

Historically, there is no border problem and there is no conflicts till the civil war in 1983. After this, due to security concern, the seaside nations are isolated by their International Maritime Boundary Line (IMBL) borders. Such as, there are three boundaries of borders are defined. The first two borders come under the parental country circumstances. The last border between the two countries will be a final state boundary. First two border crossing will be monitored by parental government.

In Tamilnadu, about 20,000 vessels make spinning routinely stay into the International Maritime Boundary Line (IMBL) of India- Sri Lanka for fishing. The identification of international borderline is fairly difficult for fisherman in almost all given situations. They could be easily caught or imprisoned by sea pirates or foreign navy while crossing these borders inadvertently. This lack of knowledge in identifying the maritime boundaries of two countries during fishing could put the lives of the fishermen in a lot of danger such as, killing and detention. The foreign trawler easily overcoming our coastguard security force by killing or imprisoning the fisherman. Even though, the existence of elaborate understanding, various agreements and excellent relations between the Indo-Srilankan, the most outstanding problem is being going on for trans-border fishing. Hence, the fishermen issue has triggered unexpected fret in the relations.

The main problem in the fishing rights in the Palk Bay is that of the conflict between the laws of the sea and traditional fishing rights. Sometimes, the death of penalty and imprisonment of the Tamil Nadu fishermen, supposedly by the Sri Lankan Navy, becomes an emotive right to life and livelihood (human rights) issue in the domestic politics of maritime boundary between India and Srilanka. Defense is a key factor to enable safe navigation in fishing in sea. Hence, National defense are addressed in terms of marine safety, maritime security, lifesaving, law enforcement, maritime environmental security and fisheries by Indian coastal guard.

Thus, the target of proposed system is designed here to foster the coast guard officials to effectively monitor the fishermen and encourage the fisherman to explore inside our sea nation border by using smart boat vessel. The figure 1 describes the maritime boundary between India and Srilanka.

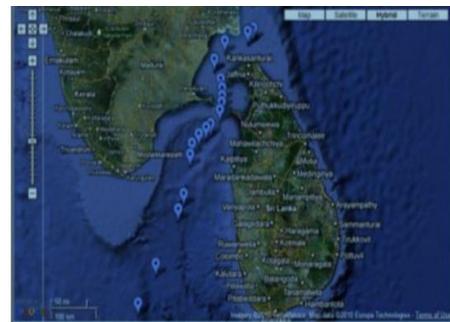


Figure 1: Maritime boundary between India and Srilanka

II. LITERATURE SURVEY

Sureshkumar et al. (2010) proposed the design of Low Cost Maritime Boundary Identification Device Using GPS System to navigate the fishermen and provide guidance about the nautical border with GPS. Surekha et al. (2014) proposed system using ARM processor. They identified the location of the travelling the boat using GPS and alerts the fisher man if the boat nears to the boundary and also passes information to control section through ZIGBEE transmitter.

Naveen et al.(2014) proposed the work of Border Alert and Smart Tracking System with Alarm Using DGPS and GSM is used to tracking the location of the boat using DGPS and to trigger an alarm which consist of a Piezo – Buzzer, when the border is crossed. Also, in addition, the DGPS information is send to control room where it is read and then through a GSM device, information is send to the family at regular time

intervals who are in anticipation about their family member's safety. They aim at providing a system that will alert the fishermen will in advance and ensure maximum safety and peace at the borders and also notify the family members

Sivagnanam et al. (2015) proposed the coast guard alert and rescue system for international maritime line crossing of fisherman upon sighting an intruder, the device allows fisherman to calculate its exact location using the integrated GPS receiver, and radiates the information to the nearest coast guard station via GSM communication. Jim Isaac et al. (2015) proposed the concept of Advanced Border Alert System Using GPS and Intelligent Engine Control Unit which is used to stop the movement of fishermen navigation towards the other country's border. They detect the location of the boat via GPS module which is the most accurate and fastest way of locating the vessel, alert them with the help of an alarm and if, smugglers and intruders to neglect the alarm, the boat engine will be stopped to prevent from trespassing into the other border by an intelligent engine control unit and alert the coast guard.

Kamalakaran et al. (2016) presents an embedded technology which uses GSM (Global System for Mobile), and LPC2148 Arm microcontroller and RFID (Radio Frequency Identification) can protect the innocent fishermen's from the shooting and arresting by the other country navy. They warned the fishermen by using the warning devices such as speaker (a buzzer) and an LCD display, while they crossing the parental country circumstances. If warning system fails, the motor in the boat will be turns off automatically, while crossing third border. Now Information about the fishermen's will be acknowledged to both the government.

III. BORDER ALERT SYSTEM

The proposed border alert system is designed to protect the innocent life of fisherman. The main contribution of this system alerts the fisherman and rescues them from international maritime line crossing punishments. This system uses Global Navigational Satellite System (GNSS) to monitor and track the movement of spinning boat vessel which is strayed in sea.

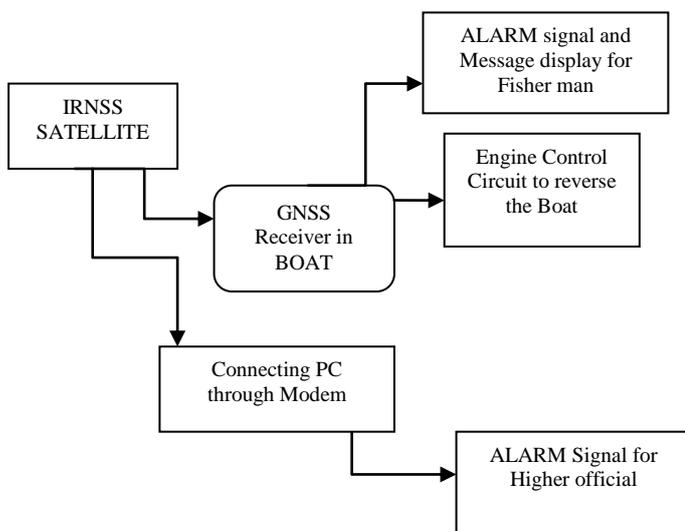


Figure 2. Block diagram of a Border Alert System

The proposed system's tracking services includes acquiring the exact location, ground speed of a spinning boat vehicle and driving behavior of the fisherman in the current moment at the IMBL borders. Thus, this GNSS receiver acquires the location of an object among other vital information by communicating with Indian Regional Navigation Satellite system (IRNSS).

IV. WORKING PRINCIPLE OF GNSS

IRNSS is constellation of satellites providing coded satellite signals from space that transmit positioning and timing data to GNSS receivers, such as, satellites regularly broadcast their parameters that define their orbits and time, as well as their status.

In GNSS receiver, the antenna acts a single point of communication for all the satellite signals; it has to split up the antenna signal into multiple identical replicas. From each replica, the Navigation message and its delay due to propagation from a different satellite will be extracted. The separation is done only after down conversion for cost reasons. Through this way, receiver uses a single (costly) mixer (per frequency band). After down conversion of the Radio Frequencies (RF) signal to lower Intermediate Frequency (IF) signal, then the signal is digitized by using an Analog to Digital Converter (ADC). Then, this data will be used to determine the longitude and latitude of the vessel.

The constant maritime boundary values are shown in Table1.

Table 1. Sample Maritime Boundary in Bay Of Bengal

Borders	Boundary values	
	Latitude	Longitude
B1	10° 05'.0 N	80° 03'.0 E
B2	10° 08'.4 N	80° 09'.5 E
B3	10° 33'.0 N	80° 46'.0 E

These Indian maritime boundary line values are stored in GNSS of boat. The constant maritime boundary values are compared with the current waypoint values of the display in GNSS. If the result of the comparison confirms that, the boat vessels is near to the country border area (area which is 1km nearer to maritime boundary) then, the Fisher man is alerted by the border alarm circuit to warn the IMBL limits. Also, Information about the fishermen's location will be informed to the higher officials.

The speed of the boat vessel is also monitored at the border by using latitude and longitude positions of vessel at different time stamps. This calculation of vessel speed at the border helps to predict the trespass movement into the border. Additionally, the vehicle can also be reversed to prevent the trespassing of border.

V. ENGINE CONTROL UNIT

If the result of the comparison shows the boats/vessels is in Final IMBL area (area which is nearer to final maritime boundary), then, the Engine Control unit operates the Pneumatic valve which is fitted with the fuel injector reduces the fuel flow into the engine, then engine will quickly slow down. By using actuator, the direction handle is positioned astern then; the compressed air is admitted to the engine to turn it in the astern direction. When turning astern under the action of compressed air, the fuel is admitted, the combustion process

will take over and air admission is ceased. Hence, the vessel will be reversed automatically. From this, further trespassing of IMBL border is stopped.

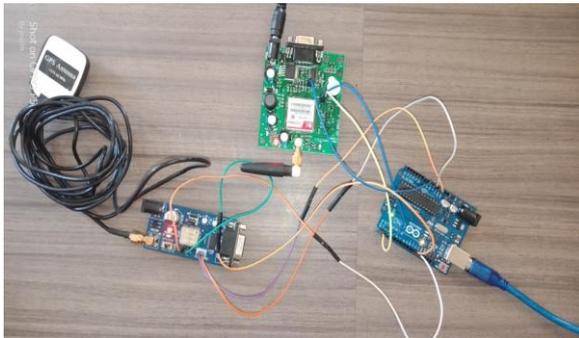


Figure 3. Hardware implementation of border alarm circuit

VI. RESULT

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COM13
$GPRMC,1.1,03.17,,38.12,,34.05,,49*7B
$GPRMC,235950.968,W,0.00,0.00,050180,,N*4E
$GPGGA,235951.968,0.0,M,0.0,M,0.0,0.0
$GPRSA,A,1,,,,,,,,,,,,,*1E
$GPGSV,1,1,04,17,38,12,33,05,49,02,34*7E
$GPRMC,235951.968,W,0.00,0.00,050180,,N*4F
$GPGGA,181834.103,0.0,M,0.0,M,0.0,0.0
$GPRSA,A,1,,,,,,,,,,,,,*1E
$GPGSV,2,1,05,17,38,12,33,24,35,05,49*79
$GPRMC,2,2,05,02,35*7B
$GPRMC,181834.103,W,0.00,0.00,110180,,N*41
$GPGGA,181835.103,0.0,M,0.0,M,0.0,0.0
$GPRSA,A,1,,,,,,,,,,,,,*1E
$GPGSV,2,1,05,17,38,12,33,24,36,05,49*7A
$GPRMC,2,2,05,02,34*79
$GPRMC,181835.103,W,0.00,0.00,110180,,N*40
$GPGGA,181836.103,0.0,M,0.0,M,0.0,0.0
$GPRSA,A,1,,,,,,,,,,,,,*1E
$GPGSV,2,1,05,17,38,12,33,24,36,05,49*7A
$GPRMC,2,2,05,02,33*7E
$GPRMC,181836.103,W,0.00,0.00,110180,,N*43
$GPGGA,181837.103,0.0,M,0.0,M,0.0,0.0
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Figure 4. Latitude and Longitude Positions of vessels

VII. CONCLUSION

Among many livelihood challenges faced by fishermen, the major problem of fishermen is dealt in this paper. Here with, the concept of automatically acquiring the exact location, calculating ground speed of a spinning boat vehicle at the IMBL borders and safeguard of fisherman are discussed. Thus, the border alert system using smart boat saves the innocent life of fisherman from easily caught or imprisoned by sea pirates or foreign navy.

REFERENCES

[1] Sureshkumar, K. and Sharath Kumar, K., (2010), "Design of low cost maritime boundary identification device using GPS system" International Journal of Engineering Science and Technology, vol. 2(9), 2010.

[2] Surekha, M., Preethi, R., Padmapriya, K., Devika, T., Divya, N., (2014), "ARM Based Fishing Boat Security System", International journal of innovative research in Electrical, Electronics, Instrumentation and Control Engineering vol.2, Issue.2, 2014.

[3] Naveen Kumar, M., Ranjith, R., (2014), "Border Alert and Smart tracking system with Alarm using DGPS and GSM", International journal of Emerging Technology in computer Science and Electronics, vol.8, issue.1, 2014.

[4] Sivagnanam, G., Midhun, A.J., Krishna, N., Maria, G., Samuel Reuben, Anguraj, A., (2015), "Coast Guard Alert And Rescue System For International Maritime Line Crossing Of

Fisherman", International Journal of Innovative Research in Advanced Engineering, vol.2, issue. 2, 2015.

[5] Jim Isaac, D., Eugene kingsley, (2015), "Advanced border alert system using GPS and with intelligent Engine Control Unit" International journal of Electrical and Computing Engineering", vol.1, issue.4, 2015.

[6] Kamalakannan, B., Naresh, K., Sakthivel, P., (2016), "Protecting fishermen's by detecting and warning them while crossing sea borders using GSM and RFID technologies", Online International Conference on Green Engineering and Technologies, 2016.

[7] Michalski, M., Cjajewski, J., (2004), "The accuracy of the global positioning system", Institute of Electrical and Electronics Engineers, instrumentation and measurement magazine, vol.7, , issue.1, pp. 56-60, 2004.

[8] Kumar, R. Dinesh, Shubin Aldo, M., and Charles Finny Joseph, J., (2016), "Alert System for Fishermen Crossing Border using Android", International conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) – 2016.

[9] Sundar, S. Mani, and Hariharan, M.,(2013), "Deep Sea Fishermen Patrol System for Coastal Intruder Positioning", International Journal of Scientific Engineering and Technology, vol. 2, Issue. 3, pp. 129-132 1, April 2013.

[10] Vanparia, Pradip, and Ghodasara. Y. R., (2014), "Review Paper on to Study and Enhance Coastal Security System Using GIS/GPS Tool", International Journal of Computer Applications & Information Technology 1 (2014) .

[11] Vivek, S., AravindVenkatraman, TV., Aravinth, L., and Raagul, G.,(2015), "Automatic Border Crossing Detection and Navigation of Boat", "International Journal of Science Technology & Engineering , Volume 1 Issue 8, February 2015.

[12] Senthilkumar, A., (2013), "Portable life protection system for fishermen using global positioning system", Int. J. Emerg. Technol. Adv. Eng. 3(9), 60–64 (2013)