WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Border Surveillance System

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ABSTRACT

The most crucial duty in the area of national defence and security is border monitoring. An entire nation's boundaries must be constantly monitored in order to preserve peace and guarantee the protection of its citizens. It is crucial to tightly secure border regions from such operations, especially in the current climate, when infiltrations by terrorists and the unlawful movement of both live and non-living objects have become commonplace. The least that can be done to stop such events in border regions is to offer continuous surveillance. The border security forces, who are in charge of constantly monitoring the borders, conduct this surveillance manually under the current situation.

It requires a lot of resources and labour and resources since the boundaries span hundreds of kilometres and have harsh terrain and weather conditions. Designing an automated border surveillance system that can carry out the surveillance mission without the need for human intervention is therefore urgently needed. It can do away with the necessity of constantly deploying personnel in dangerous situations. Additionally, the system must be capable of making the appropriate judgements and taking the required measures in the event that it discovers something suspect in addition to sending alarm signals to the human controllers. It is possible to place the central control rooms away from the border region. The next course of action must be chosen by the human controller once he is aware of the incursion.

KEYWORDS: Detection of Intruder, Safety of country, Radar controlled defence system, movement control.

I. Introduction

Nowadays, harmful incidents are frequently caused by people's carelessness. An intelligent border security system is created to implement real-time border inspection and monitoring. The most crucial problem is effective administration and oversight of borders for both Member States and Countries. Currently, a separate stovepipe system is frequently used to carry out border monitoring. There are few choices for border security because many monitor devices cannot be shared. Cross-border surveillance systems must incorporate and exchange all pertinent data sources that are part of a border law enforcement agency need in order to get around these restrictions and be interoperable. The border is monitored at various organisational, management, and local levels; we need to find immediate solutions to make this possible. In order to respond quickly and effectively to impending danger, relevant information must be made available at the regional level and communicated. This will allow for the taking of preventative measures and the prevention of crises escalating. If the local government is unable to handle the problem, reinforcement is needed. A special-purpose system called an embedded system is one in which the object that a computer operates entirely encloses the computer. An embedded system, as opposed to a general-purpose computer like a personal computer, performs preset functions, sometimes with highly particular specifications. The system may be optimised by design engineers since it is focused on a single purpose, which lowers the

II. RELATED WORK

Zhang, Lijing & Liang, Yingli [1]. "Motion human detection based on background subtraction," 2010.

Based on the backdrop removal approach, provide a novel way for detecting moving human bodies. A backdrop picture is first acquired. The difference between the current frame and the background picture is calculated in order to extract the moving areas from the current frame. Finally, it is decided whether or not the moving region is caused by a human using the form attributes of the extracted parts.

Singh and Khushwaha, AlDhelaan, Abdullah M. & Akyildiz, Ian F [2]. "BorderSense: Border patrol through advanced wireless sensor networks," 2011.

Offer a system for intelligent border monitoring and automated defence. It takes use of characteristics that were taken directly from the scene's optical flow data. Depending on the relative location of the intruder to the border fence, appropriate action is conducted if an intruder is automatically detected.

If the intrusion occurs behind the fence, just tracking is done. An alert is sounded if the burglar is trying to get over the barrier. When the invader has stepped over the fence, auto-firing can be turned on.

Bhaskar, Harish [3]. "Integrated human target detection, identification and tracking for surveillance applications," Sofia, 2012.

Demonstrates a surveillance architecture that includes human target detection, tracking, and face-based human identification. The technique of background removal is used to find moving objects. The process of face recognition requires identifying the target's face. Target tracking will continue without enhancing the target's identify if facial detection is unsuccessful.

R. Bellazreg 2013[4] in his paper "Border surveillance using sensor-based thick-lines".

Applications for Wireless Sensor Networks (WSNs) range from smart home networking to target surveillance in combat zones. We can discover the border monitoring applications among the more recent WSN applications. This class of applications' major objective is to monitor and track a nation's border by identifying intruders who may be present close to the boundary. In this research, we suggest a global architecture for developing such applications based on WSNs.

Palagati, Harish, Palagati, Subhashini, R. & Priya, K [5]. "Intruder detection by extracting semantic content from surveillance videos," 2014.

Propose a model to study videos captured by surveillance cameras and extract features from it after converting video to shots. Basic features are extracted by employing an object-tracking method based on ROI. At last, semantic content extraction results in recognizing the intruder without any false matching

Arjun, D., Indukala, P. K. & Menon, K. A. U [6]. "Border surveillance and intruder detection using wireless sensor networks on Communication and Signal Processing Chennai, 2017.

Present a survey of wireless sensor networks for Border Surveillance and Intruder Detection. The aim is to devise a multi-sensing system that is developed by combining different techniques of surveillance and intruder detection, for varying border scenarios such as flat surface movement or water-body movement. Different sensors for human intruder detection such as geophone, hydrophone, infrared and surveillance cameras are discussed.

Jisha, Sagar, R N, Sharmila, S P, Suma, B V [7]. "Smart Home Intruder Detection System, 2017.

Propose a system for intruder detection which employs an object detection technique using Wireless sensor networks. PIR (Passive Infrared) sensors are used which are further connected to the MICAz sensor node. The proposed system is expected to detect and track the intruder and report its speed and direction of movement to a central base station for further processing.

III. PROBLEM STATEMEN

The US-Mexico border is currently a hot political topic. The border is not entirely secure and is open to threats of various kinds. With an unsecured border, the US opens itself to terrorist attacks and extensive drug running and other forms of smuggling. In addition to these problems, there is also a large influx of illegal aliens. It is estimated that there are 500,000 illegal entries each year.

The most recent attempted solution was Boeing's SBI net in 2006. Boeing's system was going to cover both of the US borders, Canada and Mexico, a total range of 6,000 miles. They would employ a tower system consisting of 1800 towers, with both sensors and/or border agents, command centers, and Border Patrol Agents with GPS devices and UAVs. They built a pilot section in Arizona that spanned 28 miles and cost

$67 million. The estimated cost of completion was between 2 and 8 billion. In January 2011, the program was cancelled due to both cost overruns and a lack of effectiveness.

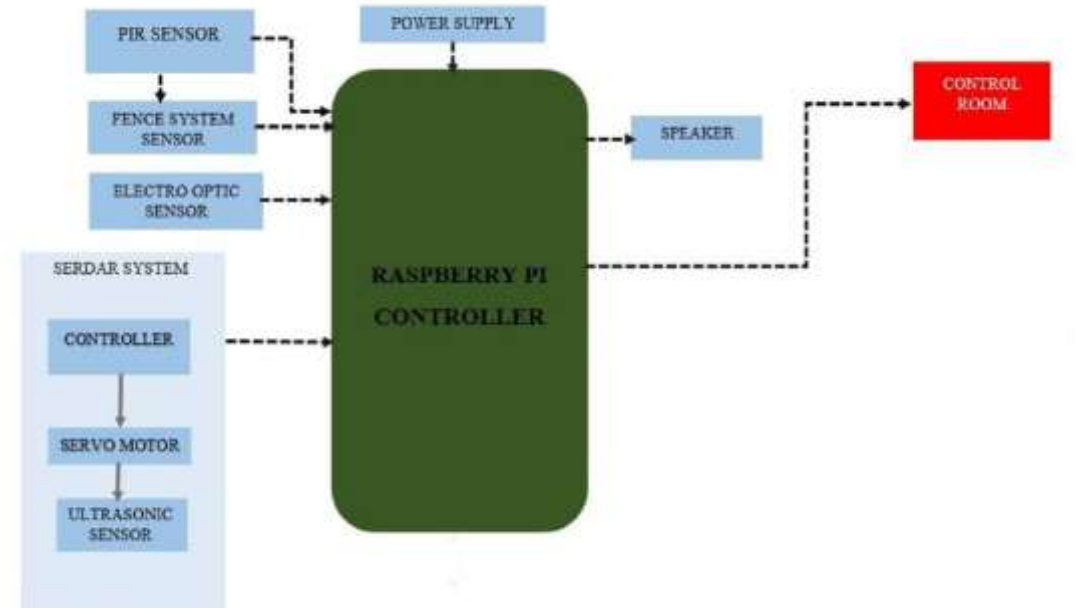
IV. OBJECTIVES

- The goal of the proposed work is to design a border security system. This surveillance system will be applicable for the security purpose of the nations.
- To design a new Optimization surveillance Model for national security purposes, and provide with updated versions of the technology like collaborating surveillance systems with the robot and IoT.
- To develop an advanced optimization approach to optimize the security system by considering standard surveillance and faster performance, and response of the security system
- To validate the performance analysis by finding the best global solution and achieving a better accuracy level of convergence.
- To protect the Indian Soldiers from the defraud attack

V. METHODOLOGY

The suggested system is an intelligent border monitoring system that might be beneficial to our border security personnel. Multiple electro-optic sensors and fence system sensors are covertly put on the border fencing to monitor the border area for any intrusions, allowing it to provide round-the-clock video monitoring in some locations. Various responses are conceivable depending on the intruder's position in relation to the border fence. We have looked at three distinct situations for the border monitoring system, and each one calls for a unique reaction. When a possible invader is beyond the border fence and not within range of the sensor in the first scenario, the camera just observes without moving and does nothing else.

VI. BLOCK DIAGRAM



VII. BASIC THEORY

- The video cameras are installed at a distance to continuously keep an eye on the border area and if any movement is detected in the area under supervision by the sensors, the camera positions itself according to the signals sent by the sensors and it is checked whether it is a human or animal
- In case, it is found to be a human the camera starts taking snapshots of the live video. An alert message along with the images is sent to the controller. The controller first issues an alert via a sound system to warn the intruder and ask him to surrender. If after a couple of warnings, the intruder is not willing to surrender, an auto-combat system is activated, which will send the information and snaps to the control room.
- In addition, the controller can send the intrusion alert to the closest military base such that they can get ample time to prepare themselves for taking the required actions. The video cameras are installed at a distance to continuously keep an eye on the border area and if any movement is detected in the area under supervision by the sensors, the camera positions itself according to the signals sent by the sensors and it is checked whether it is a human or animal.
- In case, it is found to be a human the camera starts taking snapshots of the live video. An alert message along with the images is sent to the controller. The controller first issues an alert via a sound system to warn the intruder and ask him to surrender. If after a couple of warnings, the intruder is not willing to surrender, an auto-combat system is activated, which will shoot the intruder
- In addition, the controller can send the intrusion alert to the closest military base such that they can get ample time to prepare themselves for taking the required actions. Furthermore, the generated images (snapshots) are transferred wirelessly from the remote system to the main system where they can be viewed and analysed for further enquiry..

VIII. IMPLEMENTATION

A Border surveillance system involves both hardware and software components. Here's an overview of the typical hardware and software components required for such a system:

Hardware Implementation:

Raspberry pi*:* Raspberry Pi is defined as a minicomputer the size of a credit card that is interoperable with any input and output hardware device like a monitor, a television, a mouse, or a keyboard

Ultrasonic Sensor: The GPIO pins only tolerate maximal 3.3V. The connection to GND is to have an obvious signal on GPIO24. If no pulse is sent, the signal is 0 (through the connection with GND), else it is 1. If there would be no connection to GND, the input would be undefined if no signal is sent (randomly 0 or 1), so ambiguous.

Raspberry pi cameraBoth static photos and high-definition video may be taken with the Raspberry Pi camera module. Beginners will find it simple to use, but if you're trying to increase your expertise, it has a lot to offer advanced users. Many examples of individuals using it for time-lapse, slow-motion, and other video ingenuity can be seen online. The libraries we include with the camera can also be used to make effects.

Pir sensors: Typically, radio waves, optical radiations, and occasionally acoustic waves are used to create wireless communication with a distant object. These wireless communications essentially alter their frequencies. All of these communications use a range of frequencies, including HF, LF, VHF, UHF, and others.

A servo motor is an electrical device that has extremely precise pushing and rotating capabilities. Use a servo motor if you wish to spin an object at a specified angle or distance. It is only composed of a straightforward motor that uses a servo mechanism. When a motor is employed, it is referred to as a DC servo motor if it is DC powered, and an AC servo motor if it is AC powered.

Software Implementation:

With support for systems like Arduino or MBED, this is a cross-platform code builder and library manager. Along with more than 15 development platforms and 10 frameworks, it supports more than 550 development boards. PlatformIO is independent of the operating system it uses. Actually, the only prerequisite is Python, which is available almost everywhere.

This implies that PlatformIO projects can be simply transferred from one machine to another and that PlatformIO enables simple project sharing across team members, irrespective of the operating system they favour using. Additionally, PlatformIO can be utilised on servers without the X Window System in addition to regularly used desktops and laptops. Despite the fact that PlatformIO is a console programme.

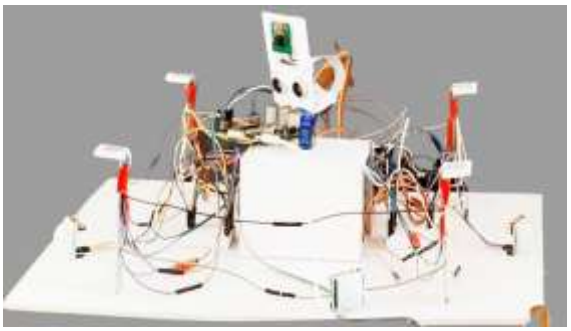
Integration:

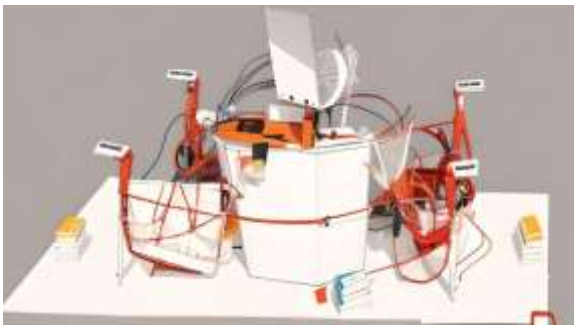
A microcontroller or other embedded device that can communicate with the software should be connected to the hardware components, such as the servo motor, PIR sensor, ultrasonic sensor, and pi camera. Radar and Rascode are examples of software elements that should be combined into a seamless system that communicates with the hardware elements in real-time.

To enable the border surveillance system employing radar, detect intruders, transmit alarm messages, and capture the intruder's image, the hardware and software components work together overall.

Experimental results:

The security of a country's borders can be considerably improved by a border monitoring system. The system collects data from multiple sensors and integrates it into a central command centre to give real-time and thorough situational awareness by continuously monitoring and identifying unauthorised border crossings.





IX. Conclusion

We successfully implemented a border surveillance system, and in order to detect the intruder, by the raspberry pi camera and multiple sensors mentioned above using radar technique which can be help our defence system regarding the border security.

X. References

[1] Arjun, D., Indukala, P. K. & Menon, K. A. U. "Border surveillance and intruder detection using wireless sensor networks: A brief survey," International Conference on Communication and Signal Processing (ICCSP), pp. 1125-1130, Chennai, 2017.

[2] Harish, Palagati, Subhashini, R. & Priya, K. "Intruder detection by extracting semantic content from surveillance videos," In Green Computing Communication and Electrical Engineering (ICGCCEE), 2014 International Conference on, pp. 1-5. IEEE, 2014.

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[5] Jin, Xin, Sarkar, Soumalya, Ray, Asok, Gupta, Shalabh & Damarla, Thyagaraju. "Target detection and classification using seismic and PIR sensors," IEEE Sensors Journal 12, 6, pp. 1709-1718, IEEE, 2012.