

ROBUST REAL TIME FENCING SYSTEM FOR SMART BORDER SURVEILLANCE

**Abhijeet Aman, A. John Anvesh, Akshay Mahato, Biswajith Patra, Prof.
Sowmiya Bharani B**

School of ECE, Reva University, India

ABSTRACT

In Today's world due to dispute between the countries and increasing terrorism, the insecurities near the border has been increased. Protecting International Borders has become a major issue for many nations. Beside wars, illegal entering of terrorist causes more harm to nation and its property. In India's perspective, border surveillance is done by conventional method, patrolling by troops and it has been practiced from a long time. The conventional border patrol systems are highly labour intensive, requiring constant human involvement. Smart Surveillance and automatic combat system are proposed in this paper as a solution of above problem. Smart surveillance system refers to automatic intruder detection which can be achieved by using smart electronic barrier, PIR Sensor, Ultrasonic Sensor and Pi camera. Automatic combat system refers to take immediate action on the intruder detected without or less human intervention.

Keywords-Arduino Uno, Automatic Laser Gun, Border Surveillance, PIR Sensor, Smart Electric Fencing, Wireless Technology

I. INTRODUCTION

Among countries, border protection is a sensitive issue and measures are being taken to improve security at the border, despite of that terrorism has destabilized the peace of the nation and unusual killings of innocent people. Although we have developed new technologies for air and water surveillance, but we are lacking in technologies for land surveillance like advanced fencing, smart surveillance, Intruder detection and combat system. Many research papers, journals have been written and system has been proposed on Border Surveillance which are mentioned in the related work. There is need of well-established and technologically advanced real time surveillance system. Today as the cost of electronics devices and microcontrollers is dropping and the technology is advancing at a rapid pace, we need to implement them to create an efficient and intelligent system. This paper proposes a system based on smart electronic barrier and PIR sensor for border surveillance applications that can help to solve many of the challenges that are faced by conventional systems generally concerned to intruder detection, area of coverage, deployment and maintainability.

Our proposed system working domain is IOT, IOT is rapidly growing in the last few years. The Internet of things (IoT) also known as Internet of Everything is the connected network of devices, comprising of electronic

devices, related software, different type of sensors, actuators, and connectivity which allow these devices to exchange data among them. The IoT involves send and receive data from devices, such as desktops, laptops, smartphones and tablets, to any range of dumb or non-internet-enabled physical devices and everyday objects. Wireless technology allows these devices to communicate over the Internet and can be remotely monitored and controlled.

II. RELATED WORK

There are several research papers and journals have been written in the area of border surveillance.

The authors R C, Jisha & Vinodini Ramesh, Maneesha & Lekshmi [1] explains about Intruder tracking using wireless sensor network in their paper. This paper refers that, their proposed system is to establish a centralized computer application that needs to detect moving objects in a specific area by collecting sensors data. Their proposed system is essentially designed to detect movement of human intruders. Their objective was to implement an object tracking system using a wireless sensor network (WSN). This application can be used to detect and track objects, and alert direction of movement and speed of the intruder to a centrally located base station. The intruder was detected using a passive infrared (PIR) sensor. The PIR sensor was attached to a MICAz sensor node. The sensor can detect the intruder and provide collected information related to the direction of the movement to central base station. The collected data from the sensor network was given to the central base station for processing. Their proposed system can be easily deployed, and which does not require any human intervention for monitoring.

The authors Dushyant Kumar Singh^{*} and Dharmender Singh Kushwaha [2] explains in their paper that Smart surveillance refers to automatic intruder detection in the video captured by surveillance camera, which was accomplished by using optical flow information collected to detect motion of intruder in the surveillance area. The optical flow used in the proposed smart surveillance system makes it more robust and more accurate system. Use of a smart fence detection makes their system real-time, simple and work efficient. The auto combat system was also implemented to respond against the activities of intruders.

Paul Viola and Michael Jones [5] paper describes a visual object detection framework that was capable of processing images rapidly with high detection rates. Three key contributions were described in their paper. The first was the introduction of a new image representation called the "Integral Image" which allows detected object to be computed very quickly. The second was a learning algorithm, which was based on AdaBoost, that points a small number of critical visual features and yields efficient classifiers with high extent. The third contribution was based on a method of integrating classifiers in a "cascade" which allows to get rid of background regions of the image quickly.

III. PROPOSED WORK

3.1 Working of module

The inputs to ARDUINO are PIR sensor, Ultrasonic sensor, Current Sensor (ACS712), Vibration Sensor and Wi-Fi module. The outputs are Servo Motor module and laser Gun. Current Sensor (ACS712) is used to detect the flow of current in the electronic barrier, if current is flowing in the fence then send digital 1 signal to base station and if someone cuts the fence then send digital 0 and alert signal to base station. Vibration Sensor senses the vibration which is generated if someone tries to dig, if vibration is detected then send alert message to the base station. Wi-Fi modules fulfils the need of two-way communication between module and control station, two-way communication is required to send alert message to the control station and at same time receive command from control station to operate the Laser gun which is attached to Servo motor module to provide complete rotation. PIR Sensor and Ultrasonic Sensor based Radar is used to detect the movement of intruder. Pi camera is fixed above a servo meter to provide a complete 180° video coverage.

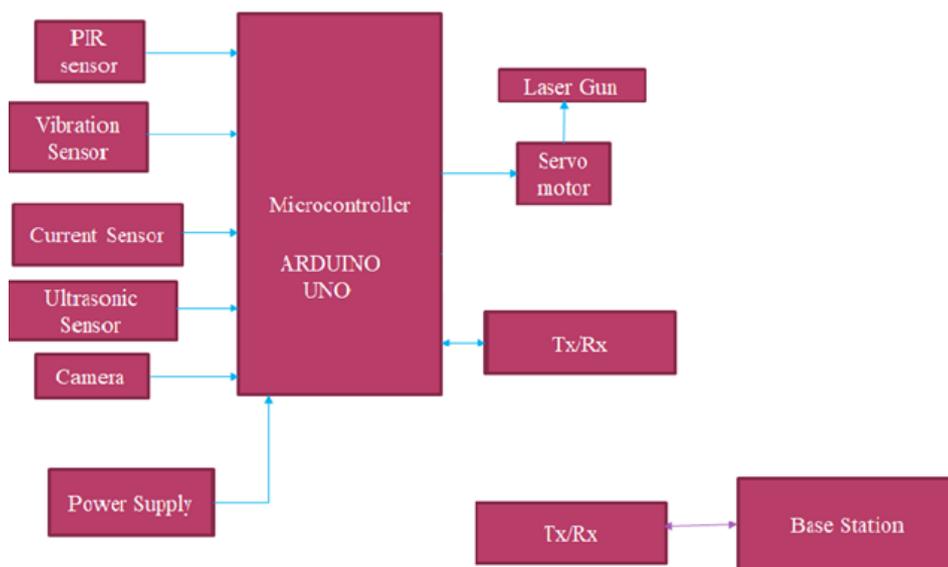


Fig 3.1 Block diagram

3.2 Working of Arduino IDE

The Arduino software is where you will do most of your programming for the Arduino board. The software is compatible with Windows, Mac OSX and Linux. The software is open-source and can be downloaded from www.arduino.cc. Once the code is error free, it can be dumped to the board. Compiling process converts the code into machine level language, readable by the Arduino.

3.3 THE HARDWARE SETUP

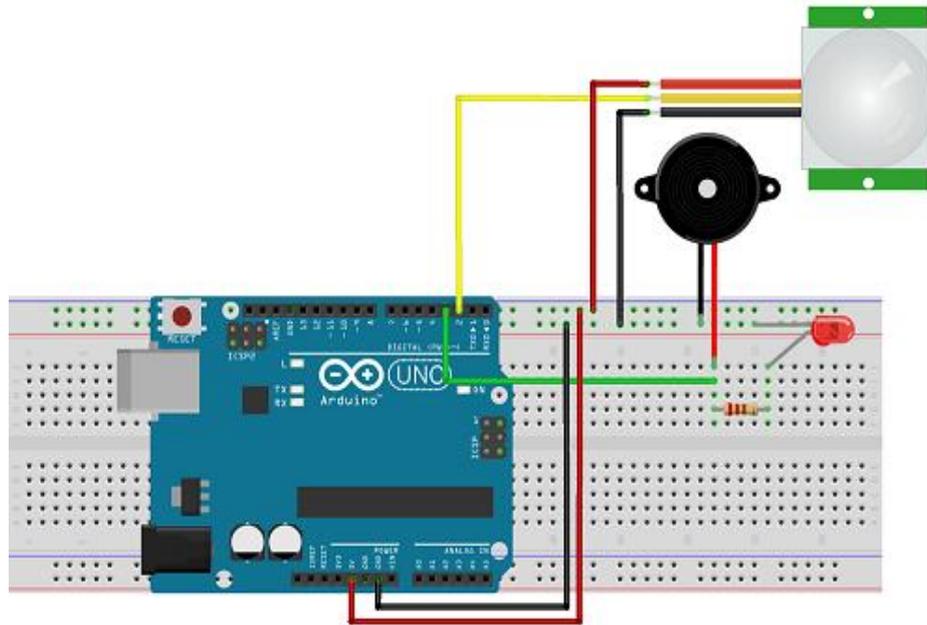


Fig 3.3.1 Interfacing PIR Sensor with Arduino

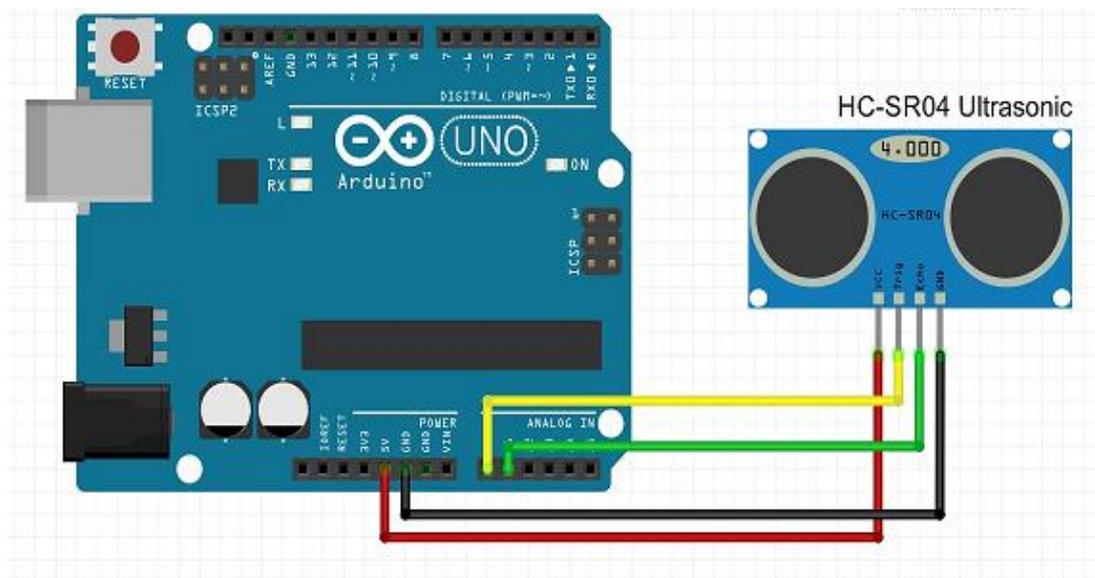


Fig 3.3.2 Interfacing Ultrasonic Sensor with Arduino

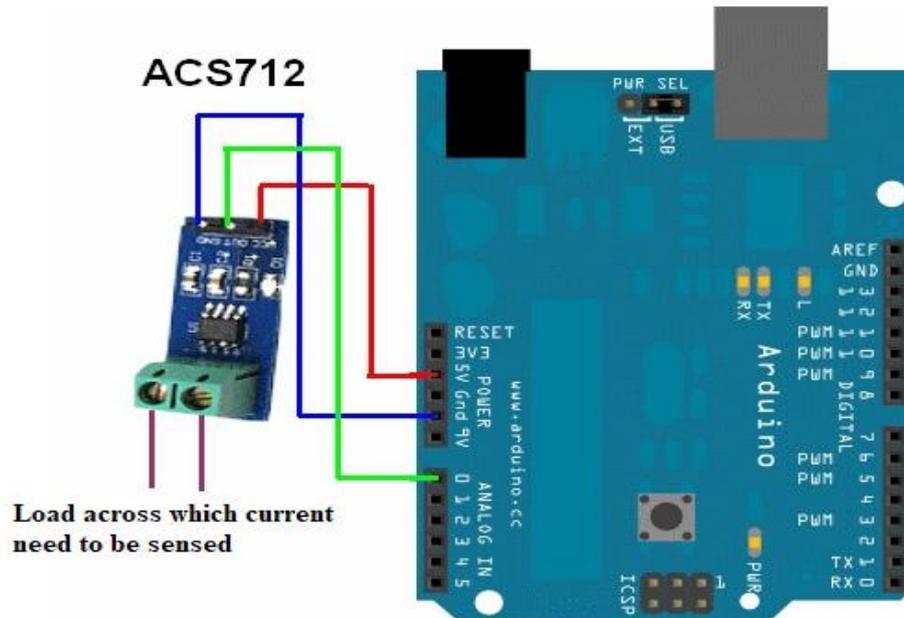


Fig 3.3.3 Interfacing Current Sensor with Arduino

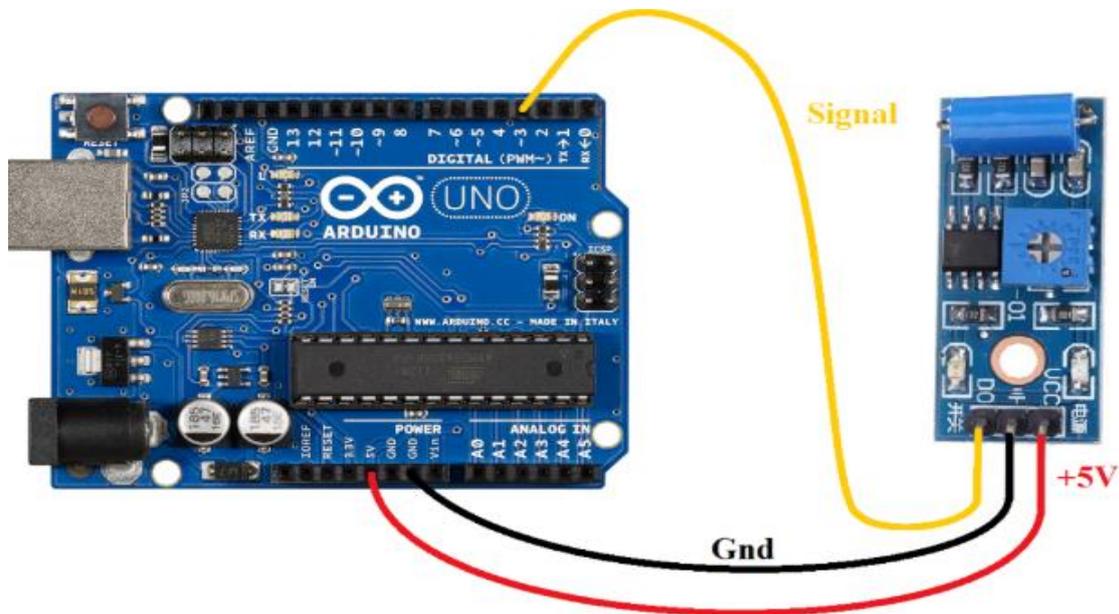


Fig 3.3.4 Interfacing Vibration Sensor with Arduino

Fig.3.3.1 shows the connection of PIR sensor with Arduino board. VCC and GND pin of Sensor is plugged to 5V pin and GND port of Arduino respectively. OUT pin is connected to digital input of Arduino.

Fig.3.3.2 shows connection of Ultrasonic sensor with Arduino. VCC and GND pin of sensor is plugged to 5V pin and GND port of Arduino respectively. Trig and Echo pins are connected to Digital inputs of Arduino.

Fig.3.3.3 shows connection of Current sensor with Arduino. VCC and GND pin of Current Sensor are connected to 5V and GND of Arduino respectively. Output of current sensor is given to analog input of Arduino and load

is connected across the wire in and wire out port of Current sensor ACS712. In this setup we are using wire of an electronic barrier as a load.

Fig.3.3.4 shows connection of Vibration sensor (SW- 420) with Arduino. VCC and GND pin of the Sensor are connected to 5V and GND of Arduino respectively. Output of the sensor is given to digital input of Arduino.

IV. HARDWARE AND SOFTWARE REQUIREMENTS

Table:4.1 Hardware and Software requirements

HARDWARE REQUIREMENTS	SOFTWARE REQUIREMENTS
<ol style="list-style-type: none">1. ARDUINO UNO R3(Atmega328-P Microcontroller)2. PIR Sensor (HC-SR501)3. Ultrasonic Sensor (HC-SR04)4. Servo Motor5. Vibration Sensor (SW-420)6. Current Sensor (ACS-712)7. WIFI Module.8. Laser Module.9. 9V Battery10. Raspberry pi311. Pi Camera.	<ol style="list-style-type: none">1. Arduino IDE (Version 1.8.5).2. Python IDE.

V. CONCLUSION

A prototype Robust Real Time Fencing System for Smart Border Surveillance system is working efficiently according to the given scenario. This system can be used in places where security is a matter of concern. We are using this system in Border surveillance so that we can prevent the entry of intruder in our territory. This system will take immediate action on intruder detected near the Border without or less human intervention and many of the Border Security Forces lives can be saved. The officers can be notified about the intruder and act accordingly. Smart electronic barrier and combat system makes this system robust real and real time surveillance system. It reduces the dependence on ground patrolling by troops and save the lives of Border Security Forces patrolling near the Border who lose their lives due to conflict between them and terrorist.

In future, it can be made more power efficient by using Solar Panels and battery backup system. Use of fully automatic guns can improve its reliability and accuracy.

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