# Implementation of Virtual Fencing for Prisoners and Animals by Using RF Signals

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***Abstract*— Virtual fencing is a method of controlling animals without ground-based fencing. Control occurs by altering an animal's behaviour through one or more sensory cues administered to the animal after it has attempted to penetrate an electronically-generated boundary. This boundary can be of any geometrical shape, and through unseen by the eye, is detected by a computer system worn by the animal. The most recent autonomous programmable systems use radio frequency (RF) signals, emanating from global positioning system (GPS) satellites to generate boundaries. Algorithms within a geographic information system(GIS) within the device's computer use the GPS and other data to determine where on the animal a cue, or cues, should be applied and for how long. We are introducing virtual fencing theme into the field of prison compound security system. Whenever the prisoner crosses the compound wall, a high frequency sound alert is produced in the security office from the receiver station.**

***Index Terms*— Radio Frequency, GPS, GIS, cue, PCB, microcontroller, RF transceiver, RF receiver**

## I. INTRODUCTION

The purpose of this paper is GPS based virtual fencing. Usually, cattle rearing fence's constructed by a physical fence. Whenever the animal crosses the boundary a high frequency sound is generated until the animal return back to the boundary. Virtual fencing is a method of controlling animals without ground-based fencing. Control occurs by altering an animal's behavior through one or more sensory cues administered to the animal after it has attempted to penetrate an electronically-generated boundary. This boundary can be of any geometrical shape, and though unseen by the eye, is detected by a computer system worn by the animal. The most recent autonomous programmable systems use Radio Frequency (RF) signals, emanating from Global Positioning Systems (GPS) satellites to generate boundaries. Algorithms within a Geographic Information System (GIS) within the device's computer use the GPS and other data to determine where on the animal cue, or cues, should be applied and for how long.

## II. BODY TEXT

Here introducing virtual fencing theme into the field of prison compound security system. A GPS receiver with a transceiver is locked in prisoner's wrist which acts as transmitter section. The boundary limit is set as per the latitude of prison compound wall. Whenever the prisoner crosses the compound wall, a high frequency sound alert is produced in the security office from the receiver section.

## III. BLOCK DIAGRAM AND DESCRIPTION

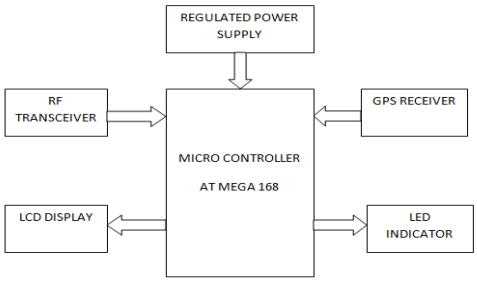


Fig 1: Transmitter Section

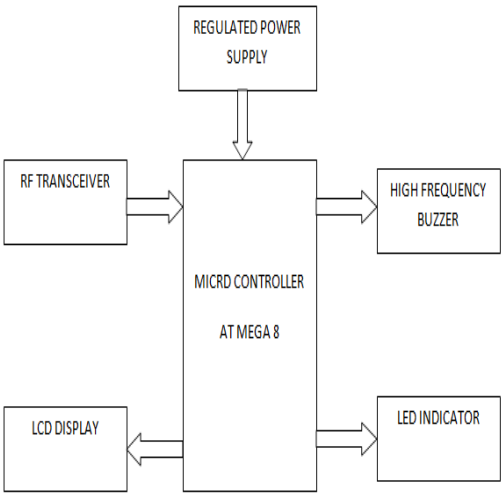


Fig 2: Receiver Section

### A) MICROCONTROLLER

- At Mega 168 is used in transmitter section
- At Mega 8 is used in the receiving section

**Features**

- High Performance
- Advanced RISC architecture is used
- 130 powerful instruction
- 32*8 General Purpose Registers
- Operating voltage 4.5 to 5.5 volts.
- 1 Kbyte internal Static RAM
- 512 bytes EEPROM
- On-chip 2 cycles Multiplier.

B) POWER SUPPLY

Power Supply is used to give sufficient power to the microcontroller. A step down transformer and a bridge rectifier is used here to convert AC to DC. A regulator IC is also used here to give constant supply. 7805 IC is used for supply and it is connected to the bridge rectifier. The circuit can give +5V output at above 150mA current, but it can be increased to 1 A when good cooling is added to 7805 regulator chip. The circuit has over overload and terminal protection.

C) GPS RECEIVER

- High gain GPS receiver is used with 4 pin 2.54 mm pitch berg strip.
- Receiver is made with 3G Patch antenna On Top (POT) GPS module.
- Only 4 pins are used they are 5V, TX, RX, GND
- Can be directly connected to the microcontroller's USART.
- The GPS chipset inside the module are designed by Media Tech Inc.

D) RF TRANSCEIVER

- 2.4 GHz carrier frequency.
- 255 possible channels.
- RS232 UART interface.
- Power LED indicator.
- Input supply 5V to 12V

E) LCD

Here LCD, made by Crystallonics, is 16*2 line interactive displays; it needs a power supply of +5v. The module has inbuilt controller chip, such as an HD44780, which acts as an interface between CPU and the row refreshing the display, and so on. The module has a back light driven by a pair of pads separate from the interface pads. The LCD module works in two modes for communicating with the micro controller-8 bit and 4-bit mode. In the later case only the higher nibble i.e. pins DB4-DB7 is used for communication. For controlling the LCD module we have used only the port.

F) BUZZER

Here the buzzer is located at the receiver section. Whenever the prisoner crosses the compound wall, a high frequency sound alert is produced in the security office from the receiver section.

G) OPERATION OF CIRCUIT

The transmitter section consist of a microcontroller AT Mega 168, regulator power supply, GPS receiver, LED indicators, LCD display and RF transceivers. A particular boundary limit is prefixed and programmed to the microcontroller in terms of the longitude and latitude of that boundary. The GPS receiver is used to receive the longitudinal details with the help of the satellite. The whole transmitter section is locked in the prisoner's wrist. The power supply given to the system is from a battery of 12V.Whenever the prisoner crosses the prefixed boundary, the RF transceiver transmits a signal to receiver section present at the security office.
The receiver section consist of AT Mega 168, RF transmitted transceiver, LED indicators, LCD display and a high frequency buzzer. The RF transceiver receives the transmitted signal from the section. The LCD displays a message whether the prisoners is in free zone or out of the boundary .If the prisoner is out of the boundary a high frequency alarm is produced from the buzzer.

H) PCB FABRICATION

The PCB fabrication involves the following steps.

1. PREPARATION OF THE LAYOUT

First the circuit is drawn in orcad and the layout is prepared by the orcad layout plus as explained in the layout making procedure from the layout plus the mirrored image of the top layer is printed on the butter paper. Using this, the film can be made and is exposed to the UV.

2. FILM PREPARATION

In this process, the negative of the film's made on photogenic film. For this, the printed image of the layout in butter paper is placed over the film and it is exposed to the UV rays from the top so that the film will be exposed to the UV rays in the region other than the layout. Then the developer solution is made and the film is taken out of the exposure unit is put in developer solution, then the reaction will take place, then the region not exposed by UV rays will become transparent and other regions are dark in colour. Thus the negative is produced. Then the film is washed in fixing solutions. After that film is kept for drying.

3. TRANFERING THE LAYOUT TO COPPER CLAD

First the copper clad sheet of requires size is cut by using cutting machine. Then the sheet is cleaned by using steel scrubber. After perfect cleaning of board, it is dipped in the photo resist solution so that film of photo resist is formed on the board. Then the copper clad sheet placed in an over for

some time, so that the photo resist will fix at to the surface of the board.

The next step is to form an image of the layout on the copper clad sheet. For that, the negative of the layout is placed over the sheet. Then it is placed on the UV exposure unit so that the UV rays will fall on the photo resist board in the regions of the layout where the negative is transparent. Then the board is taken out and put in developer solution for about 1.15 minutes. After that, the board is washed gently in water for about one minute so that the chemical reaction take place in the regions exposed by the UV rays. Then the board is washed in dye so that the dye will be fixed to the lay out regions. Thus we get the visible image of the layout on board. Then check the layout of the board with the actual circuit. If any mistake, the above processes are repeated. If layout is correct, the board now ready for etching.

4. ETCHING OF THE BOARD

When the board is ready for etching it is placed in a ferric chloride solution. It is checked in regular intervals to prevent over etching and successive damage to the port. After the etching is complete, the board is taken out of the etch and washed in water to remove the excess ferric chloride. Now the copper lines are exposed and hence body is checked with the magnifying glass to see whether all the lines in layout are clearly formed now the board is ready for timing.

5. TINNING

For tinning, the PCB is cleaned well and flux is applied to surface. Then it is passed through the tinning machine. In tinning the copper lines are platted with an alloy of tin and lead.

6. DRILLING

After tinning the next process is drilling. In this the holes of required size are drilled in PCB wherever needed, using an electrical PCB drilling machine.

7. FINISHING

In this process after drilling holes on PCB, the board is taken and a light coat of air drying insulating varnish is applied to the bottom side carefully avoided the pad areas. The PCB is then left the insulating varnish dries up. The application of insulating varnish prevents any types of oxidation on the track further providing better safe guards to the tracks after tinning. Now the PCB is ready to be soldered.

## CONCLUSION

The purpose of this paper is GPS based virtual fencing. The most recent autonomous programmable systems use Radio Frequency (RF) signals, emanating from Global Positioning System (GPS) satellites to generate boundaries. Algorithms within a Geographic Information System (GIS) within the device's computer use the GPS and other data to determine where on the animal a cue, or cues, should be applied and for how long. Our paper can be used for improving the security features for the police department. A GPS receiver with a transceiver is locked in prisoner's wrist which acts as transmitter section. The boundary limit is set as per the latitude of prison compound wall. Whenever the prisoner crosses the compound wall, a high frequency sound alert is produced in the security office from the receiver section.

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