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Prison Break Monitoring and Alerting System (PBMAS)

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ABSTRACT

Presently many surveillance systems are available in the markets that provide solutions to monitor the activities of outsiders in or near your place. These aids can be installed in the public places like banks, shopping malls, offices, government organizations, houses, etc. Similarly to ensure safety in the Indian prisons several vigilant officers, security solutions and drones for monitoring are introduced. These systems are not effective in the long run as they are not economical and have many technical issues like flickering in videos, blurry images, receiving no signal, deteriorated picture quality at night, no recording by DVR, etc. These problems can give chances to the inmates to plan an escape from the prison. To overcome this problem many projects have been introduced in the vend that provide setups to assure safety against prison breaks. But theses existing systems have several drawbacks. Basically the currently usable devices are either internet based or SMS based. Connectivity issues can be detected in the Wi-Fi enabled systems and they can suffer cyber-attacks while there can be an issue of delayed notification alert in SMS based mode of communication. This problem inspired us to design a technically compatible and economical setup that fulfills the security need in the Indian prisons.

Keywords —*Prison Break Monitoring and Alerting System, Non-removable Wearable Device, Controlling unit, Arduino , Location tracking, GPS, GSM, Accelerometer, LDR, Laser, NRF Module , SMS based communication, Security, Virtual Fencing, Siren.*

1. INTRODUCTION

This paper focuses on the urgent demand of a reliable and cost-effective security system for the Indian prisons. So through this paper we propose a setup that targets on the situation of prison breaks. The setup is framed in two modules; the first module is a wearable device that can be installed on the clothes or the body of the inmate in the form of badge or a belt which cannot be detached in any case. This wearable consists of a microcontroller, GPS, NRF module, GSM, and Accelerometer. The second module is the controlling unit that comprises of a microcontroller, display unit, NRF module, Laser, alarm and LDR. This module receives the data from the module 1 and performs analytics and shows the real-time location of the prisoner on the display unit. SMS based communication mode is preferable in this setup to avoid connectivity issues caused in areas with dense population and multi-storey buildings. A virtual fencing of the prison will be done so that if the prisoner tries to flee out from the jail then an alert signal with a siren will be broadcasted throughout the prison.

2. WORKING OF THE DEVICE

The module 1 fetches data from the GPS, GSM, NRF module and Accelerometer and sends it to the module 2. Microcontroller (Arduino Nano) is used in the module 1 to make the wearable compact. It is the basic platform that acts as a medium to emit the fetched data in the environment. The data released from the module 1 is received by the microcontroller (Arduino UNO) of the module 2. After performing analytics the raw data is converted into information that indicates the current status of

the inmate. A virtual fencing is done to form a limited boundary for prisoner's movement. In case the prisoner attempts to escape from the prison and his/her location is identified near the boundary then an alert signal will be sent to the officers posted in the prison to look after the security of the inmates. This alert signal will be broadcasted in the form of SMS and an alarm signal.

3. BASIC BLOCK DIAGRAM

A. Module I

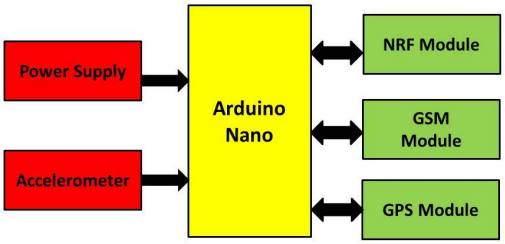

Figure 1 Block diagram of Module I

Figure 1 above illustrates the block diagram of module I. It comprises of a Microcontroller (Arduino Nano) that is interfaced with an Accelerometer, NRF Module, GSM and GPS. The accelerometer measures the speed of the inmate. NRF trans-receiver acts as a transmitter and transmits the signal to the module II. GPS tracks the real-time location of the prisoner and GSM sends an alert signal in the form of SMS to the concerned authorities of the jail in-case any change in location is detected by the GPS.

B. Module II

Figure 2 demonstrates the block diagram of module 2. It is composed of a microcontroller (Arduino UNO) which is connected to NRF trans-receiver which is here in this module working as a receiver and receives the transmitted signal of the wearable device .LCD is used as the displaying unit to show the location tracked by the GPS. A virtual fencing is also connected with the Arduino Nano that is used to a form perimeter wall in the prison to allocate a fixed area under surveillance. LDR is linked with the microcontroller which receives signal in the form of light from the Laser beam and when the prisoner pursuits to get-away from the prison and crosses the laser beam, an alert signal is generated and the siren turns on to notify the entire prison about the breakout. SMS is sent on the mobile phones of the cops to report them about the jailbreak.

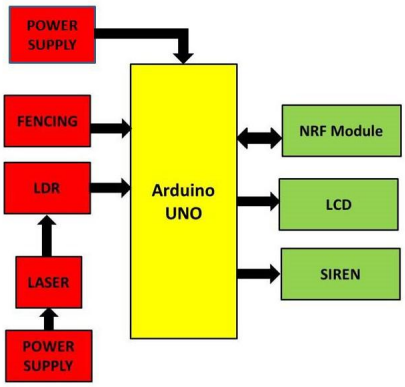

Figure 2 Block diagram of Module II

4. HARDWARE REQUIREMENTS

A. Arduino

i) Arduino Nano

Arduino nano is a breadboard-receptive and compact microcontroller board and it is based on the ATmega328 (Arduino Nano 3.x). It usually weighs approximately 7g. The motive to use it in module I is to design a concise wearable and light in weight. It consists of 22 I/O pins (in which 6 are PWM) and 8 analog pins. Andin module I we are using sensors that are analog. It runs at 5V with a clock speed of 5 MHz.

ii) Arduino UNO

It is an open-source microcontroller based on ATmega328P microcontroller .It is furnished with 14 digital I/O pins (6 suitable for PWM output) and 6 analog I/O pins. In this project it used in module.

B. Sensors

This project uses two sensors-LDR and Accelerometer.

i) LDR (Light Detecting Resistor)

It is a photo resistor which is light sensitive device that works on the principle of

photo conductivity. In this project it used to receive photo signal coming from the Laser.

ii) Accelerometer (ADXL335 3 Axis)

It is a concise, lightweight, low power, complete 3-axis accelerometer which has signal conditioned voltage outputs. Here in this project it is used to measure the speed of inmate in-case he/she tries to escape.

C. GPS

SIM 28M global positioning system (GPS) module is used in this project. It is compact, high yielding and reliable and consumes low power. It is used to send the specific position of the prisoner by alerting the cops by SMS.

D. GSM

SIM 900A GSM module is used in this system. It is a kind of a chip or circuit used to authorize connection between a mobile or a computer and a GSM. It is condensed and impeccable wireless module.

E. NRF

NRF24L01 is a sole chip wireless radio transceiver module that functions in the 2.4 – 2.5 GHz ISM band. Here NRF is used as transmitter and receiver both. It is used to wirelessly impart data for ultra-low power utilizations. Its operation and configuration can be done through SPI (Serial Peripheral Interface) Protocol. It can relay data at a scale up to 2 Mbps.

F. LASER

A virtual fence will be created on the boundary of the prison and soon as the prisoner crosses the laser beam the light will be fed as photo signal on the LDR and it will be detected by it. An alert signal will be produced in the form of a broadcasted SMS and an alarm to inform the security officers..

5. SOFTWARE ASPECTS

Arduino IDE

Arduino Integrated Development Environment (IDE) can be used to create software programs on a computer that are mainly known as Sketches. IDE provides us a platform to write and edit the code and convert it into commands that can be apprehended by Arduino. These instructions are uploaded to the Arduino board.

6. CONCLUSION

Through this paper we have proffered a device which would not only monitor but also ensure to locate the exact location of the prisoner and help to reduce the probabilities of Jailbreaks.

7. FUTURE ASPECTS

The predicaments with currently attainable devices were restricted Wi-Fi range, connectivity issues and the risk of cyber-attacks. In future this device can be miniaturized by using Nanotechnology. By doing so the device can transformed into a chip and can be installed in the body of the prisoner that will make it more feasible.

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