IOT PRISON BREAK ALERTING AND MONITORING SYSTEM (P-BAS)

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1. Introduction

The prison system in India, as known to everyone, is the not as good as we see in the films. It is quite shocking to know that in a digitally modern country like India, the prison system is quite orthodox.

So in such an orthodox system the jail breaks are very common and most usual thing to happen. There is no such count but prison escapes keep happen, either at large scale or in smaller scale. A thought of these inmates still roaming around within us is itself very scary. The changes required in the today's prison system is that, that the system should be a bit digitalized rather than using human force to guard the inmates.

The digital system to be used can be made reliable that it can't be under cyber attack. There are some more aspects that can be used to make this system more reliable against cyber attack.

2. Applications

Well so here we propose a prisoner tracking system that helps detect prison breaks and instantly alert authorities using IOT. The system makes use of a microcontroller based circuit to achieve the task using RF technology. We make use of RF trackers on each inmate to detect their presence in the premises. The 2 central monitoring units are used to scan through all inmates as per data fed to it and constantly keep track of each prisoner. Each prisoner is mounted with a RF tracker transmitting a unique prisoner code wirelessly. Whenever a prisoner exits the facility the centralized system is unable to receive his/her code. At that time the receiver circuitry instructs the controller to tack action against particular prisoner. The System now transmits the prisoner details over to the officers alerting portal to send out instant alert and catch the prisoner before he runs even 50 meters away from the facility. Here we use IOTGecko to develop the online alerting portal system to receive input from monitoring device and display alert and sound alarm through internet.

3. Introduction to the Project

a. Problem Definition

The problem statement is to make a digitally useful system for prison break alerting and monitoring the inmates using IOT.

b. Aims and Objectives

The main aim of the system is to keep a proper monitoring system on the inmates and track their location on regular basis.

The main objectives of the system are:

- To monitor the inmates on regular basis.
- To detect the location and change in location of the prisoners with the help of radio frequency.
- To send the alert signal throughout the prison if there is any prison break.

c. Scope of the Project

The system is made of Arduino module and a radio frequency (RF) module which helps us to achieve the desired results. The officer's main portal is made with the help of IOTGecko. The RF module is placed of each inmate, continuously tracking their location. Once the prisoner is out of his/her authenticated location an alert signal is passed on to the officer's portal and throughout the prison alerting about the escape.

d. Features of the project

The features of the project are:

- The system is made using the principles of IOT and Arduino which is a cross platform application which is written in java programming language. This makes the system work in real time.
- The system uses radio frequency system to track the location of the prisoner which can't get distorted by the walls or any such solid obstacles.
- The system is so delicate that any change in the radio frequency will send an alert signal in the system.
- Output Current up to 1A.
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V.
- Thermal Overload Protection.
- Short Circuit Protection.

4. Review of Literature

a. Internet of Things Definition

IOT is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive. More than a concept Internet of Things is essentially an architectural framework which allows integration and data exchange between the physical world and computer systems over existing network infrastructure.

b. Arduino UNO

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on wiring), and the Arduino Software (IDE), based on Processing.

c. Embedded System

An Embedded System is a combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is a microcontroller-based, software driven, reliable, real-time control system, autonomous, or human or network interactive, operating on diverse physical variables and in diverse environments and sold into a competitive and cost conscious market.

d. Radio Frequency Module

RF itself has become synonymous with wireless and high-frequency signals, describing anything from AM radio between 535 kHz and 1605 kHz to computer local area networks (LANs) at 2.4 GHz. However, RF has traditionally defined frequencies from a few kHz to roughly 1 GHz. If one considers microwave frequencies as RF, this range extends to 300 GHz. The following two tables outline the various nomenclatures for the frequency bands. The third table outlines some of the applications at each of the various frequency bands.

5. System Description

a. Design

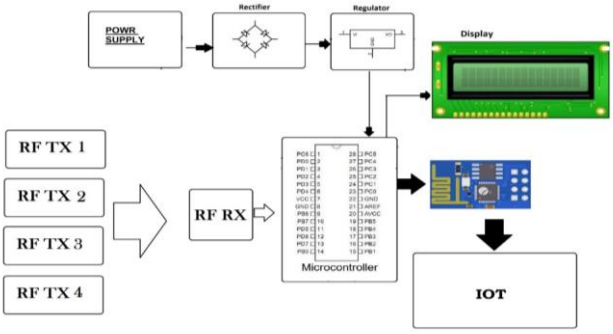

Fig 5.1 Block Diagram

b. Hardware and Software components

- ATmega328P Microcontroller:
  The Atmel ATmega328P is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz. The ATMEGA328-PU comes in a PDIP 28 pin package and is suitable for use on our 28 pin AVR Development Board.
- ESP8266 Wi-Fi Module:
  The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network.

- RF Transmitter Receiver:
  The ST-TX01-ASK is an ASK Hybrid transmitter module. ST-TX01-ASK is designed by the Saw Resonator, with an effective low cost, small size, and simple-to-use for designing.
  The ST-RX02-ASK is an ASK Hybrid receiver module. An effective low cost solution for using at 315/433.92 MHZ.
- LCD:
  A 16x2 LCD means that it can display 16 characters each line and there are two such lines. In this LCD each character is displayed in pixel matrix.
- The other components being Resistors, Capacitors, Push Button, Crystal Oscillator, Cables & Connectors, Diode, PCB, LED's, Transformer/Adapter.
- Arduino Compiler:
  The Arduino Programmer is based on the Processing IDE and uses a variation of the C and C++ programming languages.
- MC Programming Language:
  Embedded C language which is most frequently used to program the microcontroller.
- IOT Gecko:
  IOT Gecko is a free IOT system development platform for students, researchers and developers.

c. Implementation Methodology

- Research:
  First things first, our initial step was to do deep research about the current prison system and the main changes needed to be done in the system
- Planning out the system:
  Second step was to list down all the components needed to make our system. How to move ahead with the circuit, learn all the types microcontroller and which type of microcontroller is needed for the system.
- Choosing Microcontroller:
  Make a list of required hardware interfaces. Examine the software architecture
  Select the architecture. Identify Memory Needs. Start searching for microcontrollers.
  Examine Costs and Power Constraints.
- Designing the circuit:
  Once all the components are acquired we can move forward to making the circuit of the system and putting all components in proper order.
- Testing connectivity and issues:
  The testing is done by using multi meter and oscilloscope to check weather all the soldering done is proper or not.
- PCB Printing:
  Once all the testing is done we take the work of PCB printing which is used to connect all the electrical components in the circuit design.
- Coding:
  Coding is done in an integrated development environment, it can be used for many programing languages.

6. Final Prototype

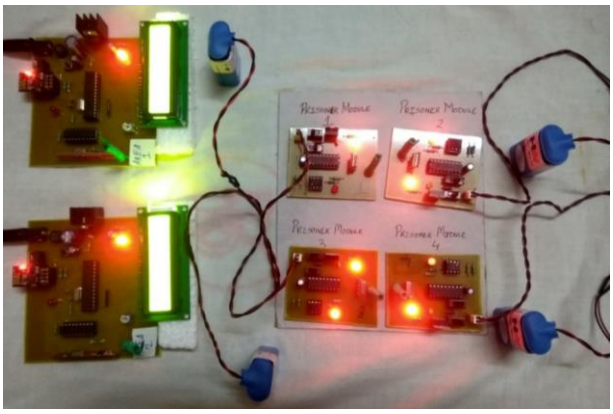

Fig. 6.1 P-BAS

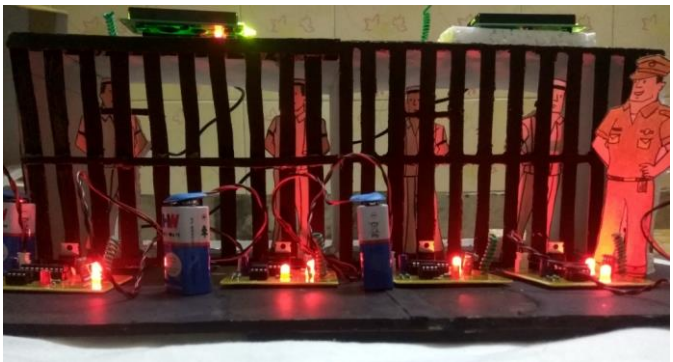

Fig. 6.2 P-BAS (FULL MODULE)

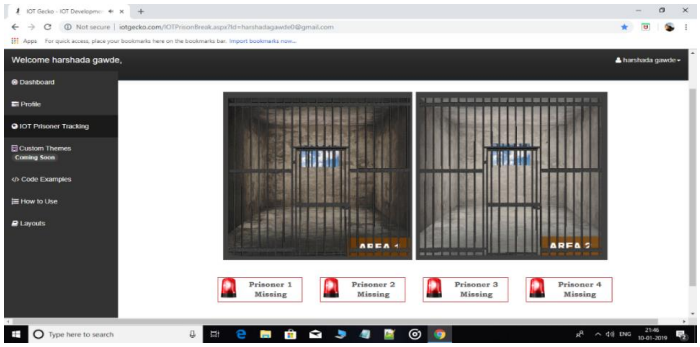

Fig 6.3 Interface (Case 1)

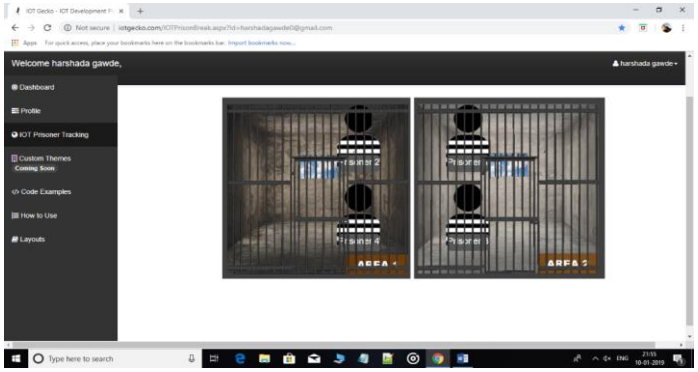

Fig 6.4 Interface (Case 2)

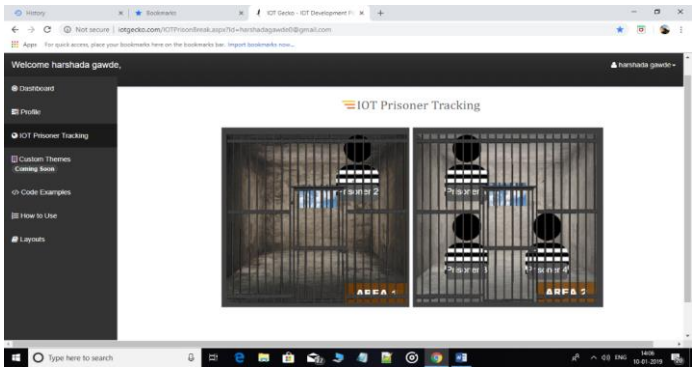

Fig 6.5 Interface (Case 3)

7. Conclusion and Future scope of the project

- Conclusion

The conclusion of the project is that if this system is implemented in our prison system it would add a new level to the security rules of our country. This system will bring some difference in the number of jail breaks happening per year.

- Future Scope

If any time in future this system is implemented it can be made using nanotechnology reducing the size of the transmitter into a small chip. This chip can be planted anywhere on the inmates clothes without giving the inmate any clue of it.
Even GPS system can be added on the chip making it easier to be tracked.

8. Constraints for real time deployment

Since this system is deployed in the real time there are some obvious constraints that cause problem while executing.

- The first constraint is the internet system. The system needs strong internet connection to be executed so if we lose the internet connection the system needs to be reset.
- The front end interface should never be closed. If the window is closed the system loses connection making it lag behind.

9. Reference

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