Improved Internet of Things Based Prison Break Monitoring and Alarming System: A Case Study of Degema Prisons

URANTA, CHIKA JOYCE[1], S. ORIKE[2], B.J. LUCKYN[3]
[1, 2, 3] *Electrical/Electronics Department, Faculty of Engineering, Rivers State University, Port Harcourt*

Abstract- ***This work is focused at improvement of internet of things prison break monitoring and alarming system, a case study at Degema Prisons. Thus, the understanding of the existing design from previous works about the monitoring and alarming system. Though the previous design has many flaw as sensor can only identify the presence of individual or object at 2cm to the device. The improvement enabled the system to activate alarming at 20cm from the device with the help of sensors and internet of things enabling the monitoring team to notice the current event. The design was simulated using proteins software and test for effectiveness. The simulation was test with the previous and a graph showed that our improvement will make the prison monitoring and alarm system effective.***

Indexed Terms- IoT, Alarming System, Monitoring System

I. INTRODUCTION

This study looks at the IoT prison break monitoring and alerting system's design and looks into how it may be enhanced to create a system that can significantly lower prisoners' chances of escaping through an effective alerting signal network. The nascent idea of the Internet of Things (IoT) has drawn interest from both industry and research communities around (Jun, 2016). The two terms Internet and Things, which make up the phrase "IoT," and their definitions influence the IoT's final design. In contrast to "Intranets," which only analyze data within their local range, "Internet" here suggests that IoT is built on the existing Internet infrastructures and meant to execute data transmission and information exchange in a relatively broad and widespread manner (Miorandi et al. 2012; Atzori et. al., 2010).

The Internet of Things (IoT) represents a vision of a society in which billions of items connected via IP (Internet Protocol) networks have inherent intelligence, communication tools, and sensing and actuation capabilities (Simone et. al., 2019).

To replace the duties of security guards and stop convicts from escaping from prison, monitoring prisoners in prison environments, tracking the movement of patients with mental illnesses, patients in hospitals, etc., requires assistive technology (Priya, 2018). IoT is a technology that makes it possible to connect various physical objects and environmental monitoring sensors. It enables the sensors to communicate with other sensors and share data, enabling appropriate action (Priya, 2018).

- Past Work

According to Burrus (2004), the most important technology trend that is now taking place is the Internet of Things. Over the next five years, it will both cause the biggest upheaval and offer the biggest opportunity. The Internet of Objects was created with data created by people, whereas the IoT is about data created by things.

Emeasoba, et. al., 2019. Home Appliances Energy Consumption Control Using Internet of Things (IoT). They propose on their work that Advanced Technology like Internet of Things (IoT) enables users to control hardware devices through a software over a wide coverage area at very fast speed with little source of energy. This energy places an important role in household appliances, industries, agricultural machinery and so on. Controlling the energy efficiently for appliances in the home is very important too. In this work, home appliances are controlled through the internet. The design developed into a system that can control several electrical loads which

were connected at different terminals. Upon connection then User interface were developed to interact with the system that allows user to easily control these home appliances through the internet. The system when routed through the IP address enable easy access to the appliances at home from distant locations. Thus, the time delay inherent in-Home automation systems technologies that includes Bluetooth, Zig bee and Z-wave uses remote control either through sending (SMS) are eliminated in IoT devices and designs based on the technology in question. However, the user can control the appliances with great ease thereby conserving the consumption of energy control proportional as a result.

A semantic framework was developed by Abraar et al. (2018) to support data integration and interoperability between various jail monitoring systems. They created a jail monitoring system based on Ibeacon, which can track vital signs of offenders' relevant information and assess the physical state, activities, status, and position of convicts to pinpoint the right individual for identification.

A model for monitoring air pollution was proposed by Revathy et al. (2011) and employs an MSP430 microcontroller to handle sensor input values. For detecting gases like CO and CO2, the gas sensor MQ7 is employed. This variant transmits data using GSM and Wi-Fi modules. To tracking the city's air quality, Robin and Sankaran suggested a model. This model can identify different gases including CO, NO, SO2, and other harmful gases. The High-Volume Sampler is positioned above the ground, and the air samples are collected to measure the air quality.

"Using ML to safeguard IoT systems," Canedo and Skjellum (2016). The writers have examined several security issues, including the growing number of devices and system heterogeneity. To address the security issues in an IoT framework, the authors of the research have suggested the use of machine learning techniques and a testbed construction process. RFID as an IoT Enabler:

The Nigerian Prison Service may be a shelter for corruption, even though Mohamadu Buhari's federal government is making great efforts to clean up the nation of corruption. Since the start of the Buhari administration, at least three major jailbreaks and riots have rocked the Nigerian Prison Service in various parts of the nation (Ripples Nigeria, 2017).

II. METHODOLOGY

- Implementation Methodology

i. First things first, we conducted extensive research on the state of the jail system today and the key reforms that need to be implemented. preparing the system: The second stage was to create a list of every component required to construct our system. How to proceed with the circuit, what microcontroller kinds are available, and which type is required for the system.

ii.

- Choosing Microcontroller: Identify the hardware interfaces that are necessary. Look at the software architecture choosing the architecture. Locate Your Memory Needs. Start your microcontroller search. Analyze the power and cost constraints.

- Designing the circuit: After we have all the necessary parts, we may create the system's circuit and arrange the parts in the right sequence.

- Testing connectivity and issues: To evaluate whether all of the soldering is done correctly, oscilloscopes and multimeters are used.

- PCB Printing: The task of printing PCBs, which is required to connect all the electrical components in the circuit design, is taken on after all the testing is over.

- Coding: An integrated development environment, which may be applied to various programming languages, is where coding is done.

- IoT Board and Developing System

We use an IoT Arduino board in this work, and IoT Gecko is used for development. The Arduino is a powerful and adaptable board with several benefits. The alerting system in this instance can be built using the free and user-friendly Gecko development platform.

- RF Transmitters and Receiver

An RF transmitter is put on each prisoner. Each transmitter is given a special code that contains the precise information about the prisoner on whom it is attached. The transmitter and receiver will be in constant communication. The receiver will quickly send a notification to the prison staff with information about the prisoner's whereabouts if any of the transmitters are out of range.

- Microcontroller

To achieve proper alert producing in this arrangement, a microcontroller is required. The microcontroller and receiver are coupled. The microcontroller aids in communicating with the Internet of Things.

- Wi-Fi Module

The IoT board in this location is connected to a Wi-Fi module, which wirelessly sends the data to a screen that the officials may access.

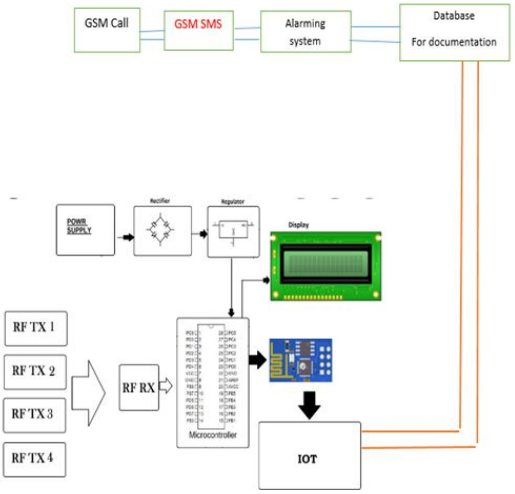

Figure 1. Improvement of Prison Break Design

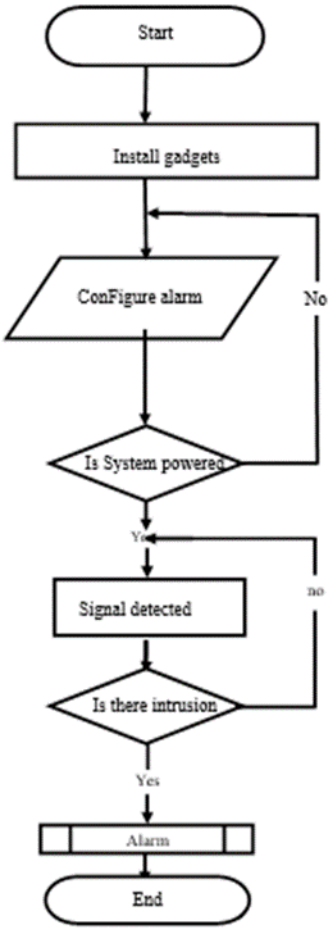

Figure 2: Flowchart of the working Principle

III. RESULTS

- Discussion on Results of Light Source Approach

In this configuration, the perimeter wall of the prison can be divided into numerous zones, each of which has a Laser module installed on one side and an LDR to detect laser beams on the other wall. The laser beam would be broken if the prisoner tried to approach the wall, raising an alert by activating the siren and sending brief signals to the authorities. The circuit connection for connecting a laser sensor, LDR, and an Arduino Uno board is shown in Fig. 3. This circuit enables an alarm system (Siren/Buzzer) and processes the signals supplied by the light source module.

It is assumed that the perimeter walls around the jail have numerous levels and are off-limits to any inmates. A 10 m gap separates the LDR positioned on one side of the wall from where the laser sensor is deployed at one end of the wall. The IOT Gecko

platform will alert the jail guards if someone breaks through this wall to flee.

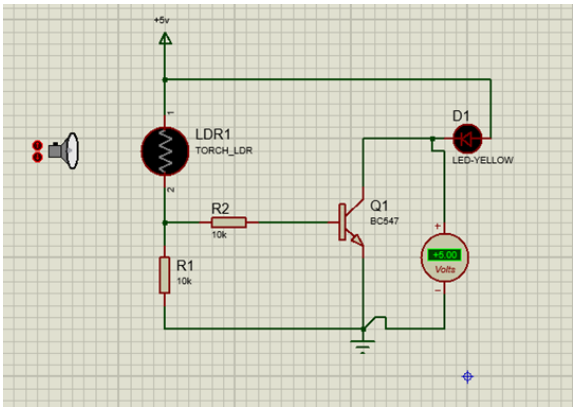

Figure 3: Simulation of LDR Circuit

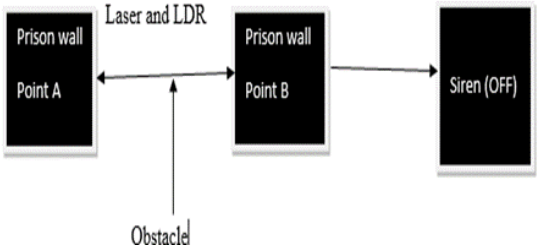

Figure 4: Block Diagram of an Intruder System (Siren OFF)

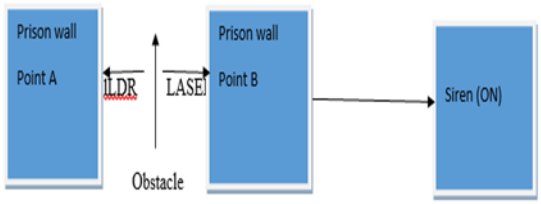

Figure 5: Block Diagram of an Intruder System (Siren ON)

From the results of our simulation, it was observed that when there is an obstruction between the LDR and laser the LED glows the LED here was used as an indicator for the purpose of simulation a buzzer was used in the design.

Table 1: Conventional IoT Prison Break Feature Comparison

COMPONENTS	ONLINE COMPONENTS			OFFLINE		
IMPROVED IOT /COMPONENTS	GPS	GSM MODULE	WIFI MODULE	LDR	LASSER	RF pair link
CONVENIONAL IOT/COMPONENTS	GPS	GSM	WIFI	NO	NO	NO
ONLINE FEAUTURES	YES	YES	YES	NO	NO	NO
OFFLINE FEAUTURES	NO	NO	NO	YES	YES	YES

Form Table 1: we can say that the improved IOT prison break has a better efficiency, because it can track the inmates irrespective of the situation of the network.

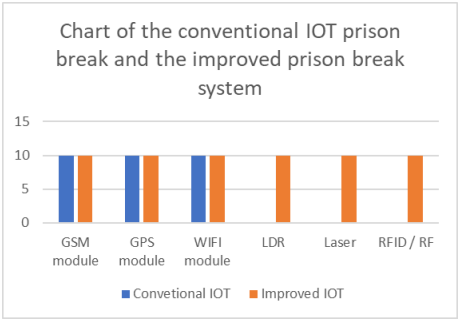

Fig. 4.7: Conventional IOT Prison Break and the Improved Prison Break System

We used the number ten (10) to represent any system in Figure 4.7 that contains a certain component, and zero (0) to represent any system that lacks it. The traditional IOT system just had IOT functions, however our upgraded system has both online and offline features, as is evident. When there is a network outage or the system is being attacked by hackers, the upgraded system can still function thanks to the offline capability.

CONCLUSION

The work conclusion is that if this method were to be adopted in our jail system, it would raise the bar for national security regulations. This approach will make a difference in the annual number of jail breakouts. Several IoT-based solutions to identify inmates attempting to flee the confines of a prison have been described in this work. It is assumed that the perimeter walls around the jail have numerous levels and are off-limits to any inmates. A 10 m gap separates the LDR positioned on one side of the wall from where the laser sensor is deployed at one end of the wall.

The IOT Gecko platform will alert the jail guards if someone breaks through this wall to flee. The device can be set in sleep mode to save energy and awakened when accelerometers sense vigorous movement.

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