# Design and Analysis of a Lab IP Spy Camera and Alarm System using Raspberry Pi and ATMEGA328P

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*Abstract: Security is a very important thing to be concerned in our day-to-day life. Everyone wants to be secured as much as possible. Knowing our home or office is secure provides us peace of mind. With the increasing concern over better protection of people and assets, security departments are required to provide a higher level of security than before: proactive prevention, better situational awareness, earlier detection, quicker identification and prompter action. Now many organizations are continually reevaluating and enhancing their video surveillance to provide optimal daily security and operational efficiency. As the technology is advancing day by day, there are various alternatives occurring for the already present or previous technologies. Internet of Things (IOT) is an upcoming technology that makes use of Internet to control/monitor physical devices connected to the Internet. The basic premise is to have smart sensors collaborate directly without human involvement to deliver a new class of applications. IOT gives user the ability to control more than one digital thing easily through a comfortable Graphical User Interface (GUI) over the Internet. This paper aim to design an Embedded Real-Time Security System Based on Raspberry Pi for intruder observation that reinforces surveillance technology to provide essential security to the Lab equipment and associated control. And also to design a low cost Alarm system based on Microcontroller and ultrasonic sensor that takes proper measure to prevent intrusion, unwanted and unauthorized user(s) into the Lab. Ultrasonic sensor sense the presence of an intruder & Controller reads the signal from sensor, if intruder is detected, it turns on the buzzer. At the same time the live stream vide of the intruder can be monitored, and also the IP spy camera control system will send an image of the intruder via Gmail to the user. The designed system has been proven to be a reasonable advancement in access control and security system technology.*

**Keywords:** IOT, Raspberry Pi, IP Camera, Microcontroller, Ultrasonic sensor, Gmail notification, Security.

## 1.0 Introduction

The demands on video surveillance systems are rapidly increasing in the present day. One of the first things people will want to know about their surveillance system is whether or not they have the ability to connect to it over the internet for remote viewing. In the past, security systems had to be monitored by a guard who was locked away in a room all day watching the monitors to make sure that nothing would happen. The other option was to come back and review the footage but damage could have happened. Therefore, researchers and scientists had to come up with ways of overcoming that and thus improving security at large. In security risk areas, people often install alarms which are triggered by sensors. There are many types of sensors being used is the security systems. As the technologies expand rapidly through the time, security systems have forward from alarms to cameras and even computers. There are many kinds of sensors such as infrared sensor, PIR sensor, radio frequency and ultrasonic sensor. However, for ultrasonic sensor, it is only used to trigger alarm in case of an intruder because of its uniqueness and high sensitivity to movement. Lab IP spy camera and Alarm system is an essential mean of protecting Labs from illegal intrusion. A general Lab security system consists of Ultrasonic sensor, IP spy camera, and Buzzer alarm. IP camera captures image in 24 hours to identify what goes around the Lab and in the Lab around the door which holds evidences if there is any intrusion in the Lab and sends the image of the intruder to the Lab attendant via Gmail (SMTP server).

## 1.1 Objectives

The main objective of this research paper is to design and implement a low cost and power consumption friendly security system that includes features such as motion detection, image processing, alarm system and emailing notification system. The system is to be based on Raspberry Pi and Microcontroller.

➢ To design a security system that ease problems of unauthorized entry in the Lab.
➢ To design and implement a security system with an alarm system that alert the Lab attendant if an intruder entered in the restricted area.

### 1.2 System Description

The Raspberry Pi and Microcontrollers are capable of implementing a low power consumption, cost effective, and low maintenance security system for various applications. This new arising technology related to security provides a comfortable and safe environment for Labs. The various objectives of the system are to detect an intruder, take an image of the intruder and also convey an alert message to the Lab attendant. In doing so it thus allows remote monitoring of Labs from anywhere in the world via live stream video. In this system, raspberry pi and microcontroller are used to control all the attached devices across the external electronics equipment which are: ultrasonic sensor, IP camera, fan and buzzer. All these devices are combined to make a surrounding environment secure from unknown intruders. Security is an essential part for Lab, office and other insecure regions. Ultrasonic sensor sense the presence of an intruder & Controller reads the signal from sensor, if intruder is detected, it turns on the buzzer immediately. At the same time the live stream vide of the intruder can be monitored using smart phones or laptop computers via IP address of the system, and also the IP spy camera control system will send an image of the intruder via Gmail to the user. The power supply provides the voltage and current required for effective performance of the system. This supply is tapped from the 12V DC power source and then regulated before being fed to the system.

This system consists of two parts, Hardware and Software.

**The Hardware parts include:**

- IP spy Camera
- Ultrasonic sensor
- Raspberry Pi 3 B
- ATMEGA328P
- Fan
- WiFi Router
- 12V DC Transformer
- Buzzer
- 5V DC Regulator
- Resistors, Capacitors and Diodes.

**Software parts include:**

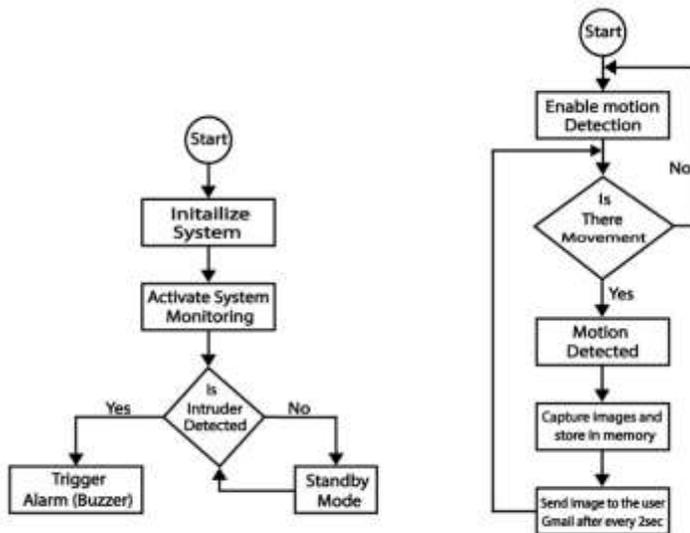- Motion-eye-OS Raspberry Pi3
- Arduino IDE

### 1.3 Flow Chart



**Fig1. The flow chart of the system**

## 1.4 Block Diagram



**Fig2. The block diagram of the system**

## 1.5 Circuit Diagram



**Fig3. The circuit diagram of the system**

### 1.6 System Overview

The following figure 4 shows the entire overview or the structure of the system.

**Fig4. The entire System Overview**

## 1.7 Applications

- ➢ Currently, this system is applied at Kampala International University, School of Engineering and Applied Science, Telecommunication Lab under the department of Electrical, Telecommunication and Computer Engineering.
- ➢ It can also be applied in home, office, and big/small organizations.
- ➢ Server room, examination room, hospitals, etc.

## 1.8 Results

The following are the results achieved from this work:

The IP spy camera and ultrasonic sensor scan for intrusion movement around the access door of the Lab. On detection of motion, the ultrasonic sensor sends a signal to the Arduino which triggers the alarm (buzzer), and the camera captures the image of the intruder and sends a Gmail notification to the Lab attendant with that image attached to it.
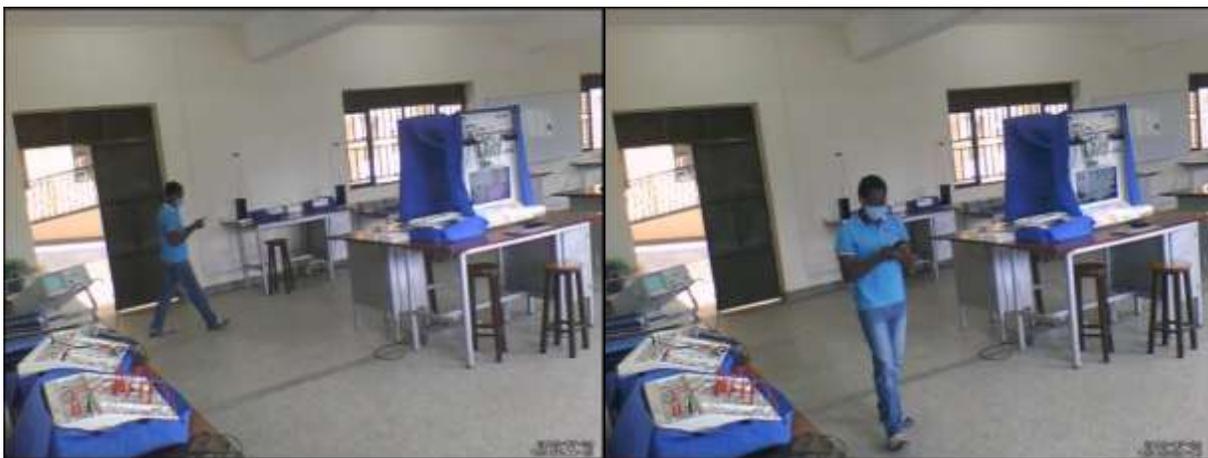


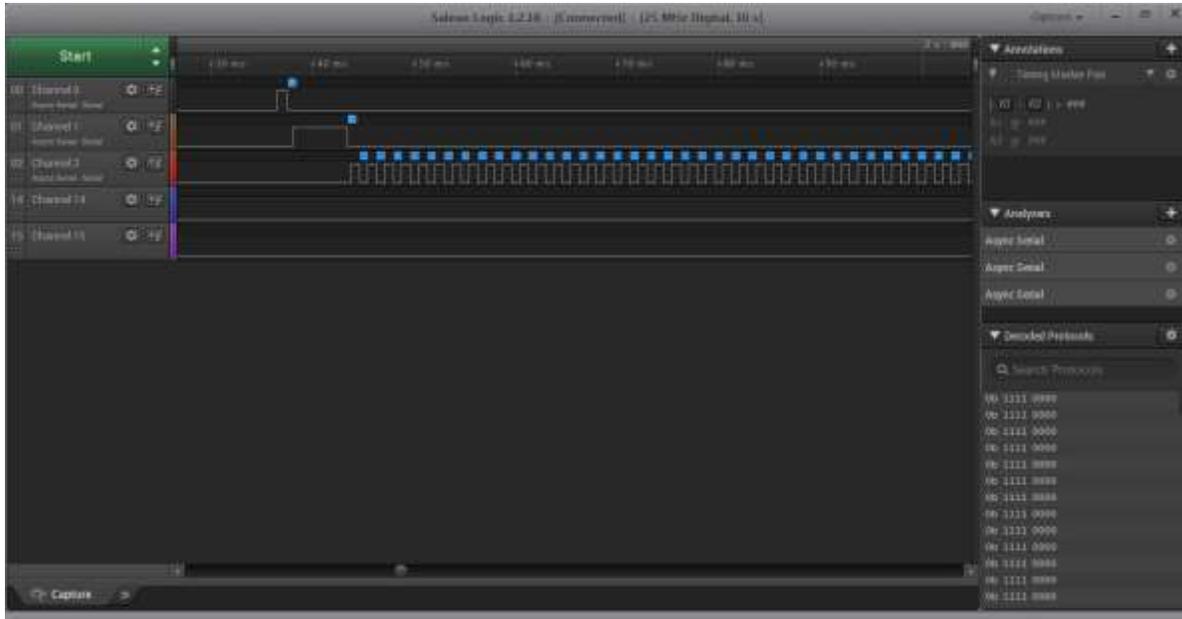**Fig5. The IP Spy camera result pictures**

**Fig6. The ultrasonic result via Saleae Logic**

## 1.9 Conclusion

The system informs the Lab attendant of any intrusion in the Lab via Gmail no matter where he/she is, except if he/she is in the region where there is no network coverage at the time of intrusion. This system is affordable and easily operated, so that anyone can make use of it. All the devices communicate well, especially, the Ultrasonic Sensor communicates well with the Arduino, the IP spy camera communicates well with the raspberry Pi, which communicates well with the SMTP server and Gmail notification sent successfully.  It can be concluded here that the system has been successfully implemented and the aim is achieved without any deviations. The results achieved in this project are genuine and are a product of sincerity and hard work.

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