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Project Report

Intruder Detection System

Lecturer: TS. DR. NORHARYATI BINTI HARUM

Group Members	Matric Number
Muhammad Izham Bin Norhamadi	B032020039
Ahmad Sha Herizam Bin Tahir	B032020009
Affendy Elyas Bin Azhari Sharidan	B032020024
Nur Ilyana Syahirah Binti Mohamad Azhar	B032020041
Muhammad Ikmal Bin Mazlan	B032020002

Table of Contents

1.	Introduction.....	3
2.	Problem Background	4
3.	Usage Plan	5
4.	Comparison with current technology.....	6
5.	List of tools	8
5.1	Hardware	8
5.2	Software.....	10
6.	Physical Design.....	11
7.	Product Work Flow.....	12
8.	Source Code.....	13
9.	Conclusion	15
10.	References.....	16

1. Introduction

Today, there are many reports on home and residential security issues, as well as cases of break-ins. As a result, security systems have emerged as a major concern in today's modern lifestyles. Therefore, it is imperative that the property manager use a surveillance system to monitor any unauthorised actions that occur within their worksite. The goal of this project is to inform the residents of any intrusion into their venue due to the high level of insecurity currently present in the world. Due to a greater understanding of security systems, surveillance systems offer a great substitute for delivering appropriate security. As a result, this project's objective is to offer a Raspberry Pi-based smart security system. Using information technology and modern smart devices to monitor a home, residential surveillance has developed into an intelligent way to help the holder.

The solution to this problem is Intruder Detection System. A low-cost alarm system that uses a Raspberry Pi will be suitable for adding an additional layer of security. Motion detection is getting cheaper and more adaptable every day. Additionally, it is simple to implement on different entrance points and send any anomalies to a chosen notification channel. It might be possible to develop a compact, portable, reasonably priced, and processing platform. Once the sensor activates the buzzer to alert the homeowners, an application like Telegram is used to alert the user. This project focuses on the low-cost aspect of technology, making it possible to use it without having to invest sizable sums of money.

2. Problem Background

Doors are often the first and last line of barrier between someone with malicious intent and your safety and valuables. There will always be a chance that someone will break in and enter your personal land, regardless of how safe the entrance is. As a result, it only makes sense to add an additional layer of security to entrances like door in order to deter or identify burglars. Unfortunately, installing a detection mechanism on every important main gate that is also versatile enough to operate on different types of entrance points is rare and costly.

Some detection systems even though there are expensive, it takes some to lot of effort to get it up and running. Even though the expensive ones have a lot of fancy security features, the core purpose of an intruder detection system is to detect an intruder and able to notify the occupants which this project proposed system also can achieve. Besides, some intruder detection systems are wired that are not flexible and hard to install such as the doors or windows of a building is different with another building or houses thus the circuit for the wired systems need to be custom to the building or houses floor plan.

Then, some company that provide the intruder detection system only provide proprietary hardware. It has been designed and programmed to work properly with their systems. Hence, the system installation is not flexible. In a nutshell, this project aims to provide an intruder detection system that are low – cost, easy to install and easy to use.

3. Usage Plan

1. Setting up the Hardware:

- Connect the Raspberry Pi to the breadboard using jumper wires.
- Connect the infrared sensor to the breadboard, making sure to connect the power and ground pins to the corresponding pins on the Raspberry Pi.
- Connect the buzzer to the breadboard and also connect it to the Raspberry Pi.

2. Configuring the Telegram Bot:

- Create a new bot on Telegram and obtain the API token.
- Configure the bot to receive and send messages.

3. Programming the Intruder Detection System:

- Write a script that utilizes the infrared sensor and buzzer to detect an intruder.
- When an intruder is detected, the script will trigger the buzzer and send a notification to the Telegram bot.
- Test the system to ensure that it is working properly.

4. Using the Intruder Detection System:

- Once the system is set up and configured, it can be used to detect intruders in a given area.
- The Telegram bot can be used to receive notifications of intrusions, allowing the user to take appropriate action.
- Regularly check and maintain the system to ensure that it is working properly.

5. Placement:

- Place the infrared sensor at the bottom of the door panel, at leg level, and facing towards the entrance. This will ensure that any movement at the door's threshold will be detected. This system is not possible to use for a sliding door, only for a door that swinging open and close.

4. Comparison with current technology

From the related work that being studied, there are many types of development and methods being used. As a conclusion for the difference of the Intruder Detection System, a summary has been done as shown in table 4.1.

There are three type of different system which is An Intelligent Door System using Raspberry Pi and Amazon web IoT (Basha, 2016). The second one is Smart Motion Detection System using Raspberry Pi (Patel, 2016), the third one is IoT Based Home Security System using Raspberry Pi (Dinakar, 2018).

In the aspect of costing, the Intelligent Door System, Smart Motion Detection and IoT Based Home Security system are much more expensive than Intruder Detection System. This is due to the higher technology and security level, which will result in higher than anticipated costs for installation and maintenance. Although the intruder detection system offers a moderate level of security, it provides the least maintenance and setup fees of all the intruder detection systems, making it a feasible option for small and medium-sized businesses to adopt.

Besides that, having Wi-Fi access makes it possible to use a smartphone app and connect the system to the internet to get the notification through the application Telegram when there is an intrusion. An Intelligent Door System, Smart Motion Detection and IoT Based Home Security System provides a longer read range compared to Intruder Detection System.

In conclusion, the Intruder Detection System is suitable for small companies to implement. It required a low cost with comprehensive functionality to prevent any burglary.



Table 1 Comparison with current technology

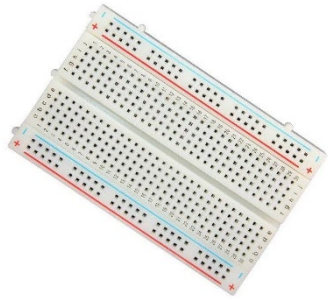


Aspect	Intruder Detection System using Raspberry Pi	An Intelligent Door System using Raspberry Pi	Smart Motion Detection System using Raspberry Pi	IoT Based Home Security System using Raspberry Pi
Cost	Cheap	Expensive	Expensive	Expensive
Wi-Fi connectivity	Yes	Yes	Yes	Yes
Power source type	USB connection between hardware and software	Wireless	Wireless	Wireless
Sensor range	Short	Long	Long	Long
Functionality if damaged	Possible	Impossible	Impossible	Impossible
Advantage	Notify the owner when there is an intrusion through an application Telegram	When there is an intrusion, notify the owner and record all data into a Google spreadsheet for further checking.	Authorized users can access their surveillance system through the internet using a smartphone and keep monitoring on the application. When an anomaly is detected, the system will send an alert to an	Provides a burglar alarm and email notification to the owner when a human anomaly detection is detected.

			Android smartphone.	
Disadvantage	Short range in sensing	Expensive	Expensive	Expensive



5. List of tools

5.1 Hardware

HARDWARE	PICTURE	PURPOSE
Motion sensor – Infrared sensor		Will detect objects and motion like the movement of door.
Buzzer		Alert the owner by making a loud sound when an intruder is detected.
Breadboard		Used for building temporary circuits without the need for soldering.

		
Raspberry Pi		The raspberry pi 2 used as a small computer that runs Linux to program the system.
Jumper Wires		A jumper wire is a short electrical wire with connectors at both ends, used for making temporary connections between two points in an electronic circuit.

5.2 Software

SOFTWARE	PICTURE	PURPOSE
Python 3.0	 The Python logo, featuring two interlocking snakes, one blue and one yellow, followed by the word "python" in a lowercase, sans-serif font with a trademark symbol.	A general-purpose object-oriented programming language is used as the language of this system.
Telegram	 The Telegram logo, which consists of a white paper plane icon inside a blue circle, all set against a blue square background.	To integrate with Raspberry Pi.

6. Physical Design

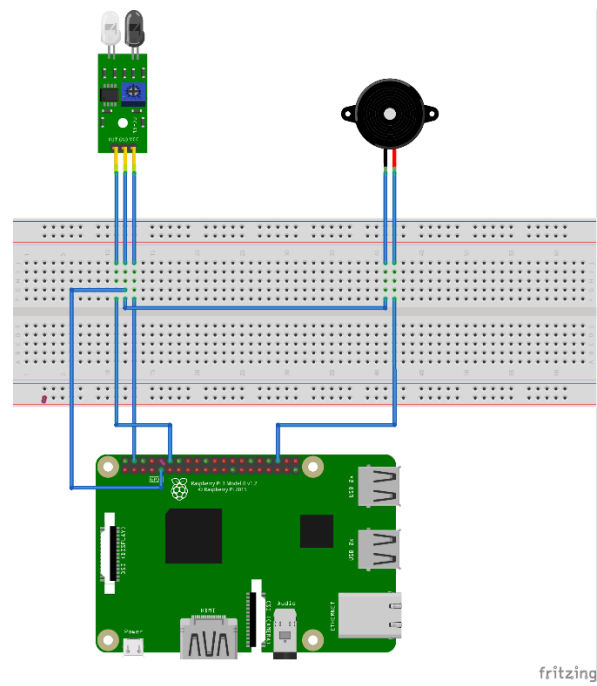


Figure 1 Physical Design

Raspberry Pi Pin Number	Description	Connected to
4	5V Power	IR Sensor left pin
12	GPIO18 (Input)	IR Sensor right pin
36	GPIO16 (Output)	Buzzer red wire
9	Ground	IR Sensor middle pin and buzzer ground wire

Table 2 Pin Relation Table

7. Product Work Flow

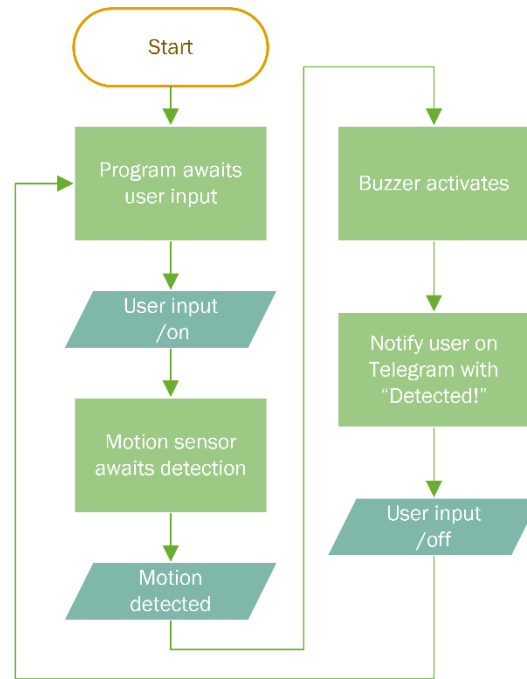


Figure 2 Product Work Flow

This flowchart outlines the product flow to provide a simple home security system. The product starts by powering up it up and attaching it to any door or suitable entrance. Then, the program will wait for user input from Telegram bot. User can type `"/Start"` to get a list of commands from the bot. Once the user inputs the command `"/on"`, the motion sensor begins to detect intrusion to its sensor. If the sensor trips, the buzzer activates as an alarm. Additionally, the user will be notified through Telegram with the message `"Intruder detected!"`. In case the user wants to turn off the system, they can input the command `"/off"` which will bring the system back to the state of awaiting user input.

8. Source Code

IDS.py

```
import RPi.GPIO as GPIO
import time
import telepot
from telepot.loop import MessageLoop

telegram_bot = telepot.Bot('5901069952:AAGtcDjItEQKsstD6ulccGV1kzMVTX0fwbg')

GPIO.setmode(GPIO.BOARD)
GPIO.setwarnings(False)

a = 12 # IR Sensor
c = 36 # Buzzer

GPIO.setup(a,GPIO.IN) # Receive input from IR sensor
GPIO.setup(c,GPIO.OUT) # Output to buzzer

running = False

def action(msg):
    global chat_id
    chat_id = msg['chat']['id']
    command = msg['text']

    global running

    if 'help' in command or 'start' in command:
        message = """\
Hi there, welcome to Intruder Detection System user interface
These are the commands:
/help
/on
/off\
"""\
        telegram_bot.sendMessage(chat_id,message)

    if 'on' in command:
        running = True
        telegram_bot.sendMessage(chat_id,'Turned On')
```

```

    if 'off' in command:
        running = False
        telegram_bot.sendMessage(chat_id, 'Turned Off')

MessageLoop(telegram_bot, action).run_as_thread()

state = False

while True:
    if running:
        inputSensor = not GPIO.input(a) #Input from sensor
        print(inputSensor)
        GPIO.output(c, inputSensor)    #Output to buzzer
        if state != inputSensor:        #Check for different input
            state = inputSensor
            if state:                    #If state is true once output Telegram
message                                telegram_bot.sendMessage(chat_id, 'Intruder detected!')
    else:
        GPIO.output(c, False)           #Turn off buzzer
        print('waiting for start command...')

```

9. Conclusion

In conclusion, the intruder detection system was designed to demonstrate the principles of sensor technology and how it can be used to detect and alert against potential security breaches. The project consisted of motion sensors, alarms, and a raspberry PI that were used to simulate an intruder detection system. The system was tested in a controlled environment and was able to detect motion and trigger the alarm, as intended.

This project helped to provide an understanding of how sensor technology works and how it can be used to improve security. The project also highlighted the importance of proper installation and maintenance of an intruder detection system in order to ensure its effectiveness. Furthermore, this project could also be used as a starting point for further experimentation and improvement of the system. Since this intruder detection system is cost-effective to other commercially available security detection systems. The materials and components used in the project are relatively inexpensive and widely available, making it an accessible and budget-friendly option for small businesses. This can be especially beneficial for those on a tight budget who still want to improve their security measures.

Overall, this intruder detection system project helped to demonstrate the basics of sensor technology, the importance of proper installation and maintenance, and how an intruder detection system can be used to improve security. It also gave an opportunity for students to use their imagination and creativity to come up with a solution.

10. References

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- Dinakar, R. D. (2018). IoT based home security system using Raspberry Pi. *International Journal of Innovative Research in Computer and Communication Engineering*, 3835-3842.
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