Artificial & Computational Intelligence/Published Online: March 2021
https://acors.org/ijacoi/VOL2_ISSUE1_01.pdf

Artificial & Computational Intelligence

Design And Simulation Of Crossed Walls Security Detection System

Muhammad Baballe Ahmad and Mukhtar Ibrahim Bello
Department of Computer EngineeringTechnology[1], Department of Computer Science[2]
Email ids of authors: mbaballe@kanopoly.edu.ng, mibello2@gmail.com
School of Technology, Kano State Polytechnic, Kano, Nigeria[1, 2]

Abstract

The security detection system is exactly a method by which something is secure through a system of interworking components and devices. The rate of abduction and theft in the world is growing by the day; this imbibes fears that become a menace to the economy, peace, and development of any country nowadays. It is vital to develop viable technologies that will secure the properties and lives of humans as countermeasures to tackle this kind of problem. With the aid of the latest development in technology nowadays, it is possible to secure the properties and people's lives using a security detection system that will monitor, guide, and protect the environments that need to be secure against burglars and abductors. A security detection system was developed to watch over the four (4) square walls north wall, south wall, east wall, and west wall. Each of these walls is equipped with a sensor designed using a light-dependent resistor (LDR) and light-emitting diode (LED) whenever anything crossed the walls he or she blocked the light-dependent resistor (LDR) from receiving light from a light-emitting diode (LED) that makes the light-dependent resistor (LDR) to output 0 volts to peripheral interface controller (PIC), whenever the peripheral interface controller (PIC) detects 0 volts it sends a signal to liquid crystal display (LCD) to display that, that particular wall has been crossed, and the system will immediately rotate the dc motor that carries the closed-circuit television (CCTV) camera to stop at the crossed wall to capture a real-time video and send to the buzzer, the function of the buzzer is to sound an alarm informing an intrusion has occurred in that specific wall. If the peripheral interface controller (PIC) detects 5 volts from the entire walls light-dependent resistor (LDR) it means that none of the walls are being crossed, if all wall light-dependent resistor (LDR) output 5 volts the peripheral interface controller (PIC) will display on the liquid crystal display (LCD) "All walls OK".

Keywords: Microcontroller, light crystal display, closed-circuit television, security detection system, break-in, abduction.

1. Introduction

A security detection system can be used to identify trespassers, illegal entry, or break-ins into a secure zone or buildings. These days Security detection systems are mainly used in commercial, residential, industrial, schools, universities, and hospitals. The security detection system can also be used in prisons to monitor the prisoners and their movements. Today, the security detection system and closed-circuit television (CCTV) system is an essential part of any modern programmed security detection system.

The simple design of any security detection system starts with considering the needs of the residents, measuring existing hardware and technology, reviewing the costs of the system, taking into account the watching choices, and lastly scheduling the installation. Now if we are going to look at the world's one of the richest countries which are the united states of America (USA) we can see that they are placed 6th in auto theft and 9th in the break-in. Their investigation also indicates that most of the break-in happened in banks, residential areas, as well as andoffices.

Non-Automated security detection systems were found non-reliable [1]. Doors were fitted with a lock and key system, which can be open easily. Even with the help of human presence as a security guard may not be reliable. Every system from the past is very much vulnerable. Our home is a place where security is a must need, to keep all the appliances and vulnerable safe. You as the homeowner should have the full assurance to step out from your house with the feeling that nothing is going to happened to your home or organization. This feeling will only arise when the house or organization needs to be secure is fully equipped with a reliable security detection system [2].

2. Literature Review

The development of the security detection system begins with the creation of man. To alert frightening information, man implements a form of a signal, through shouting and sound. He then later replaced it with the help of the clapping of hands and with the introduction of signals to inform society or to blowout a certain message if they are any kind of abduction or burglary, during the early periods of some African society especially in my country Nigeria. All such methods of notifications or warnings are necessary, undependable, and unmethodical. With the aid of innovation in technology nowadays, all those undeveloped methods of producing security were later changed by programmed security alarm systems in the late eighteenth period. These types of electronic security detection systems usually work without the support of any human being energy. The earliest electronic fire, a security detection system was established by a man named William .F. Channing. Late on an electrical electronics engineer, Mr. Moses G. Farmer invented the construction. This alarm system uses automatic indicator boxes to label the position of the fire outbreak and was first lunch in Boston, United States of America. The development of this alarm system by Dr. William was then followed by the improvement of various stylish and difficult fire and intruder security alarm system technology that is so many to measure. The most noteworthy among this security detection system technology is the use of remote signaling thief security alarm. This kind of security alarm system was the first design in the early 1970s [3]. This administers a fast inventive reaction to alarm calls. However, organizations and industries are based on the supply of security service apparatus that usually come in dissimilar designs to keep burgles and thugs away from the environment that are not built for them. Today, we have an innovative group of electronic security alarm systems with complexity at various levels. With the latest flow in crime rates in the world, it has become very essential to safeguard our buildings and our property with the aid of sophisticated stages of various advanced security alarm devices. The prices of such kinds of security alarm devices depend on the apparatus technology and solicitation desires. These alarm security system devices are characterized by present electronic security alarm systems. Some of nowadays-modern security alarm systems are housebreaker alarms, threat alarms, industrial alarms, speed limit alarms, and anti-theft vehicle alarms. The intruder alarm security is initiate by a cycle, from a comprehensive automated circuit loop that is close with an alarm at its output, or an indication to inform the owner of danger. They are a central control box that normally observer different gesture indicators and the perimeter protections that give an alarm or notify the owner when any of this sensor is a trigger. Some of the intruder's security alarms system normally functions delicately on the conception of a magnetic contact and others. For those types of security systems working with the sensors, these devices are usually positioned at any entering of the industries, organizations, and building. In this case, the sensor will activate an alarm if the device gets a signal above its set inception. In the case of motion detection, the ultrasonic sensor is normally used; the point indicator can be used in the concession of a criminal alarm, theft, or illegal individuals at certain points such as doors or windows. For instance, when a precise environment needs to be look over the awareness of the burglar in the protected environment is used, which is executed with the help of ultrasonic sensors and is normally fixed at an appropriate location. Designing and Implementation of Security alarm detection system for organizations, industries, and houses based on Global System for Mobile Communications (GSM) technology was a review by Govinda et al. In 2014 that administer double ways to

implementing security alarm detection system-using internet of things (IOT) [4]. Firstly is by the use of web cameras, in a case when there is any motion sensed by the camera, it will sound an alarm and sends a message to the industries, organizations, or homeowners that they are an intrusion. This technique of identifying intrusion against burglary or abduction is reasonably good, although costly because of the price of the cameras used in the development of the security system. The camera that is going to be used in the security system needs to be of great value which means it has to have a very wide range and the image quality should be good enough to identify. Likewise, if you going to work with a moving camera such as dome cameras, they are normally expensive more than the ones that are fixed in one place. Short message service (SMS) based system using Global System for Mobile Communications (GSM) was suggested by Daniel and Karri in the year 2005, they suggest using internet facilities to deliver an alert or messages to the place an intrusion took place rather than the ordinary short message service (SMS). Arvind and Jayashri 2013 have carried out a fingertip or fingerprint-based verification system to unlock a certain closed place or door. This type of security system aids users to unlock a certain place because they are the ones whose fingerprint is register to the system so if you put the unregistered fingertip it will not unlock the place or anything the finger is register to. This type of security detection system is connected with some more alarm security protection features this includes fire accidents and gas leakage sensors or detection devices. However, a great system, fingertip devices are complex and expensive, as they want amplified sensor resolution to join into the internet of things system. Some professionals likewise argue that merely depending on a fingertip sensor is not wise because it is quite simple to put someone fingertip on something and reproduce it, that is to duplicate the fingertip, that is why it is consistently considered to make use of fingertip scanners in a two ways authentication systems whereby an added layer of security system is made in the form of the passcode, PIN, or voice recognition. Some researchers suggested an idea of a powerful internet of things security system whenever a defect in one of the components used in the security system will not fail the whole security system. The knowledge of making use of numerous gadgets, which may not be directly or may be suitable with one another, however, it can be made to work in such a way that they can interchange a present item of the security detection system in case they are a failure. In a lineup with this, the prototypical can use connection among several appliances, which may result in conserving energy, therefore, making the prototypical more effective. An illustration administers of this said prototype will use a temperature sensor, Wi-Fi component, and an entrance sensor to change an unreliable system. Light-dependent resistor (LDR) and Laser rays sensor are also used to identify an invasion using the intruder's movement were suggested in the year 2016 [5]. The method the system will work is that a light ray is a face towards the light-dependent resistor (LDR) sensor and if they are an interruption between the light ray and the light-dependent resistor (LDR), the alarm linked to the sensor start alarming and sends a short message service (SMS) to the house owner or place where the intrusion takes place. This type of system will assist in solving the problems of securing the spaces, which may be out of range from your immovable cameras, but may face the same problems, which is faced with systems involving of Global System for Mobile Communications (GSM) components to send a short message service, which is that the transmission of the message is reliant on network coverage. Likewise, due to the condition of the light rays, which is a straight light beam, the intruders who knew about the security detection system and will be capable of dodging the light beams since it is only made up of one light-emitting diode and one light-dependent resistor facing each other’s, rendering the whole security system useless, since an intruder can avoid it. An innovative method of implementing and design an electronic lock security system using the internet of things technology and Morse code. The authors said that this is a unique awareness, which has never been done previously and is going to the first of its kind “optical Morse code-based electronic locking system”. This type of system makes uses Light-emitting diodes (LED) as an encipher intermediate to send signals. To make it more available to the overall community, the light-emitting diode (LED) in

our mobile phones has been made use of. On the side of the receiver a photosensitive resistor as well as a microcontroller such as an Arduino processor, which normally can crack the photosensitive signal after collecting it from the light-emitting diode (LED). Upon untangling this signal, it can then transfer the present situation of this lock to a cloud system this will be going to be from where these owners of the house, organizations, or industries can be monitoring the whole security system. This author has made an experiment on the system in real-life time and it has shown to perform underneath various brightness surroundings with all the features functioning, as they are designed to operate [6]. For this purpose, this research has focused on the upkeep of home security. In this research, the liquid crystal display (LCD) is used as a user interface. Each one of the four walls has a light beam (transmitter) and a light-dependent resistor (receiver) the light beam is pointing at the light-dependent resistor (receiver) the system also has a real-time clock that use to save the time of when last a particular wall crossed and can be view by the user when pressing the view mode button. When the system is powered on, it displays on the liquid crystal display (LCD) 'ALL 4 WALLS OK' and the motor that rotating the CCTV camera is by default located at the north wall. Whenever a wall (say east wall) is crossed by an intruder the system will alert the user (through buzzer) and display on the liquid crystal display (LCD) 'EAST WALL CROSSED' the system will also save the time at which the east-wall was crossed and will automatically control the motor to rotate and stay at east-wall to capture the real-time video of the area using closed-circuit television (CCTV) camera that is mounted on the motor. The system will remain at the east wall and keeps alarming the user with the help of a buzzer until another wall is crossed at the same time if all the walls are crossed it will still notify the house owner by displaying on the LCD the amount of the walls crossed and displaying a real-time video of the intrusion which is an advancement of the previous research mentioned in which none closed-circuit television is used and is only one light-emitting diode and one light-dependent resistor that is used. In this research, an intruder can hardly dodge the four light-emitting diodes and the four light-dependent resistors use in this research.

3. Materials and method

3.1. Materials

The materials used in this research are shown in Table I.

S/N	Components	Number of used
1	Resistor	11
2	Liquid crystal display(LCD)	1
3	Peripheral interface controller	1
4	Light dependent resistor(LDR)	4
5	Light emitting diode(LED)	4
6	Buzzer	1
7	Transistor	5
8	Oscillator	1
9	Connections	21

3.1.1 The PIC16F877A Microcontroller

The PIC16F877A microcontroller is an enormously collective device, which includes one chip, all, or most of the parts needed to perform an application control function. The (PIC) peripheral interface controller is an integrated circuit (IC) that was created to control peripheral devices, improving load from the central processing unit (CPU). The microcontroller also has a low memory capacity; it can also be used in performing calculations and is control by software just like the central processing unit (CPU). It is used in the designs where a local resolution needs to be taken. The PIC16F877A microcontroller is a high-performance, low-cost CMOS, 8-bit microcontroller with RISC (Reduced instruction set computer) architecture as it has been mention earlier before, and there are about 40 pins of this microcontroller (IC). It consists of two 8 bit and one 16 bit timer. Compare and capture modules, serial ports, parallel ports, and five input/output ports are also present in it. Figure 1 shows the pin configuration of the pic16f877a microcontroller.

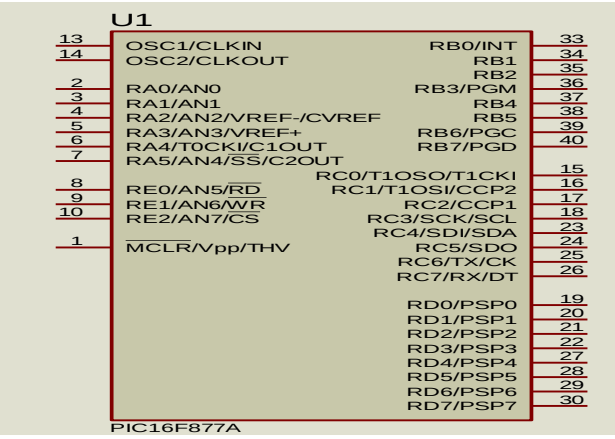

Figure1: Microcontroller PIC16F877A

3.1.2 The Pin description of the PIC16F877A microcontroller

1. Vss and Vdd

Pins 11 and 12, 31 and 32 respectively are the Vss and Vdd pins. There are the power supply pins. The Vss is the negative supply pins while the Vdd is the positive supply pins.

2. OSC1/CLKIN and OSC2/CLKOUT

The OSC1/CLKIN and OSC2/CLKOUT external clock are connected to these pins 13 and 14. This clock provides the required timing for the PIC16F877A microcontroller.

3. The master clear reset pin (MCLR)

The master clear reset pin (MCLR) is used to erase memory locations inside the microcontroller whenever you need to reprogram it again or make some important changes. The master clear reset pin (MCLR) is connected to the positive power supply in normal use.

4. The Input/output PORTS

These are a group of pins that can be simultaneously accessed. The microcontroller PIC16F877A has five ports; namely port A, port B, port C, port D, and port E, these ports act as the physical connection of the central processing unit (CPU) to the outside world. On power-up and reset, all the pins are configured as input pins by default. They can be however be reconfigured by the program.

i. PORTA

It is a 6 bits wide bi-directional port. RA0 – RA5 are purely bi-directional Inputs/output pins while RA0 – RA3 can be used as an analog to digital conversion pins. RA4 – RA5 can be used as free run timers or counter in addition to the Input/output function.

ii. PORTB

This has 8 bits wide bi-directional port. RB0 – RB7 are bidirectional Input/output pins. RB0 has an interrupt-on-change feature. RB1 to RB3 are purely bi-directional Input/Out pins while RB4 – RB7 also has the interrupt on change feature. The interrupt on change feature can be enabled only when the given pin is configured as an input pin.

iii. PORTC

This is an 8 bits wide bidirectional port. RC0 – RC7 is bidirectional Input/output pins.

iv. PORTD

This is an 8 bits wide bidirectional port. RD0 – RD7 is bidirectional Input/output pins.

v. PORTE

This is a 3 bits wide bi-directional port. RE0 – RE2 are bidirectional Input/output pins.

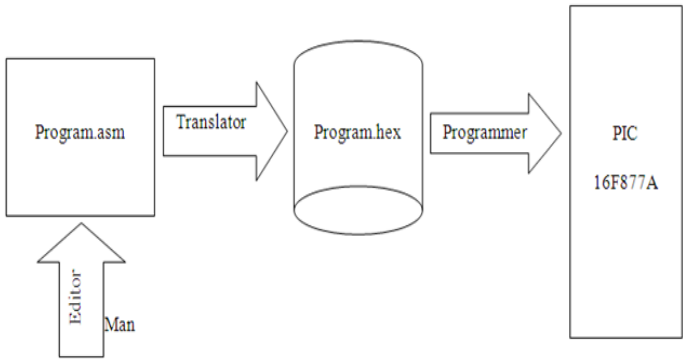

Figure 2: Microcontrollerprogramming process

Figure 2: Microcontroller programming process

3.2 Method

This area of this study handled the theoretical and calculation parts of the crossed wall security detection system against intrusion.

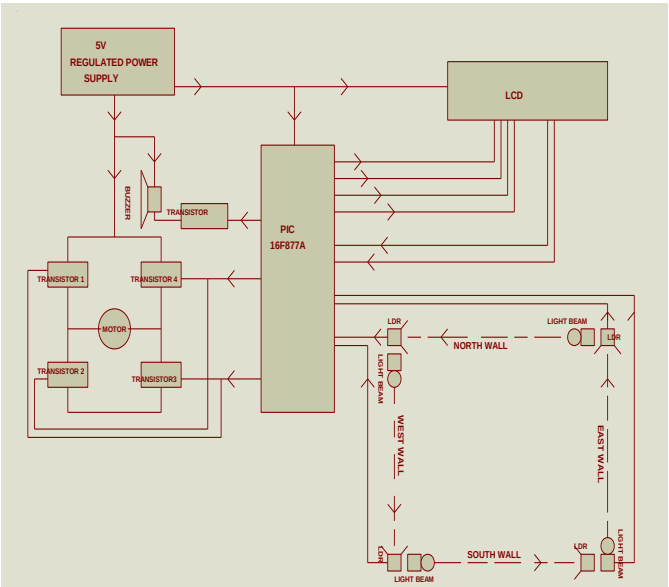

Figure 3: System block diagram

The above figure 3 is the system block diagram of this research, showing the method of operation. If the system is power on, it will display the time and calendar on the liquid crystal display (LCD) and also display on the liquid crystal display (LCD) that all four walls are ok none of it is crossed, That is if none of the four walls was crossed, but

if one of the walls was crossed that is if they are interruption between the light-dependent resistor (LDR) and the light-emitting diode(LED) or light beam the system will immediately display the name of the crossed wall and rotate the motor that is carrying the closed-circuit television (CCTV) camera to start a real-time video recording while the buzzer will be on for alarm alerting the house owner until the system was reset. If all the walls were crossed at the same time, the system will be able to display them on the liquid crystal display (LCD) screen the walls are breached. In this simulation, the positive sign of the light-dependent resistor (LDR) light beam means no intruder (wall not crossed) that is if the light-dependent resistor is closed to the light beam and is not move away from it and the negative sign means intruder in between the light-dependent resistor (LDR) and the light beam that is the light beam is moved away from the light-dependent resistor by pressing the negative sign of the light beam (torch).

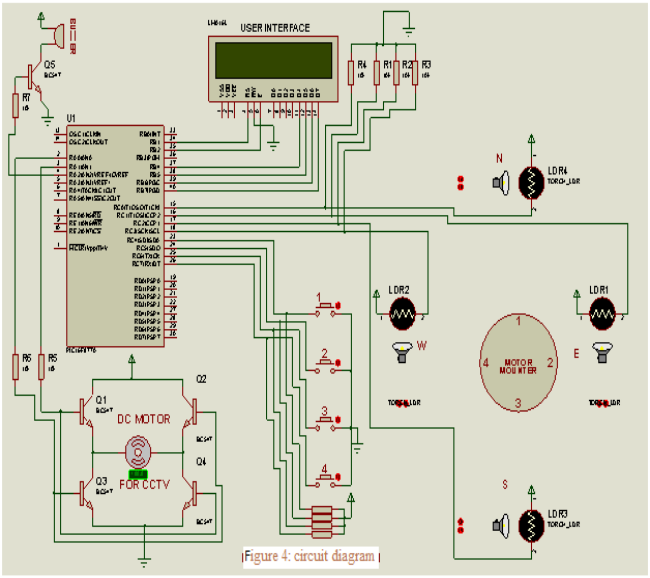

Figure 4: Circuit diagram

Above figure 4 is showing the complete circuit diagram of this study. Here the (PIC16F877A) microcontroller has five ports. Port A, Port B, Port C, Port D, and Port E. Every port has eight pins such as B0- B7 similarly C0-C7, D0-D7, except Port E, which has 3-pins E0-E2, and port A which has 6 pins A0-A5. Pin 2 is connected to transistor base Q2 and Q3 through 10 kΩ resistors R5 to rotate the motor clockwise if the base of transistor Q2 and Q3 were biased. Pin 3 is also connected to the base transistor Q1 and Q4 through 10-kΩ resistor R6 to rotate the motor anticlockwise if the base of transistor Q1 and Q4 were biased. These two pins, 2 and 3 of the microcontroller are responsible for turning the motor clockwise or anticlockwise since the closed-circuit television is mounted on the motor in case they are intrusion or interruption between the light-dependent resistors (LDR) and its light beam (LDR TORCH). Pin 4 is connected to the transistor Q5 through a 10-kΩ resistor, which is responsible for switching the buzzer for notifying of an intrusion through the 10-kΩ resistor R7. Pin 15, 16, 17, and 18 are connected to the light-dependent resistor (LDR) through a pull-down resistor of 10 kΩ on each line Pin 23, 24, 25, and 26 are connected to buttons 1, 2, 3, 4 respectively to function as a dc motor stopper through 10 kΩ pull-down resistor. They were just a contact that the motor has to stop when making a contact at one of the walls that crossed. The push-button 1 is allocated to the north (LDR), 2 to the east (LDR), 3 to the south (LDR), and 4 to the west (LDR). If the closed-circuit television is pointing in the south direction and the north wall is crossed the motor will rotate the (CCTV) camera until it has contact with push button 1 which is allocated to the north wall and stop and take real video and images. Pin 34 and 35 are connected to the (LCD) control line. Pin 40, 39, 38, and 37 are connected to the liquid crystal display (LCD) data line that is responsible for displaying alphanumeric characters on the liquid crystal display when you press the play button in the simulation or if any wall is crossed.

3.2.1 Design equations

The below formula is used in designing the whole system and their values obtained

$$I_B = \frac{I_C}{\beta} \quad (1)$$

I_B Is the current of the base transistor

I_C Is the current of the collector transistor

β Is the transistor gain

$$V_C = I_B R_B + V_{BE} \quad (2)$$

V_{BE} Is the transistor base-emitter voltage = 0.7v, for silicon

R_B Is the transistor base resistor

$$\beta = \sqrt[2]{\beta_{max} \times \beta_{min}} \quad (3)$$

$$I_{sinking} = \frac{V_{CC}}{R_{pull-up}} \quad (6)$$

3.2.2. C945 is selected and use for switching. The following values were obtained from the data of the transistor shown in table II below.

Table II: Datasheet of the C945 transistor

Parameter	Symbol	Test condition	Min	Max
Collector-base breakdown voltage	$V_{(BR)CBO}$	I_C=1mA, I_E = 0	60	
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	I_C = 100uA, I_B = 0	50	
Emitter-base breakdown voltage	$V_{(BR)EBO}$	I_E = 100µA, I_C = 0	5	
Collector cut-off current	I_{CBO}	$V_{CB = 60v}$, I_E = 0		0.1
Collector cut-off current	I_{CEO}	$V_{CE = 45v}$, R = 10MΩ		0.1
Emitter cut-off current	I_{EBO}	$V_{EB = 5v}$, I_C = 0		0.1
DC gain	$H_{FE(1)}$	$V_{CE = 6v}$, I_C = 1 mA	70	700
DC gain	$H_{FE(2)}$	$V_{CE = 6v}$, I_C = 0.1mA	40	
Collector-emitter saturation voltage	V_{Cesat}	I_C =100mA, I_B = 10mA		0.3
Base-emitter saturation	V_{BE}	$I_C = 100mA, I_B = 10mA$		1
Collector output capacitance	C_{ob}	$V_{CB} = 10V, I_E = 0, f = 1MHZ$		3.0
Transition frequency	Fr	$V_{CE = 6v}$, I_C=10 mA F = 30MHz	200	

The values below are obtained from the datasheet of the transistor C945.

$\beta_{min} = 70$ (4a)

$\beta_{max} = 700$ (4b)

$I_C = 100mA$ (5)

3.2.3. Light-dependent resistor (LDR)

The light-dependent resistor (LDR) is used to detect the crossing body, that is anything that will interrupt or block the light beam which is also known as the light-emitting diode (LED) that makes the light-dependent resistor (LDR) to be in darkness. Therefore, the calculation is going to be in two parts.

- When the LDR is in darkness, it sees no light that is the light beam is blocked or moved away from it.
- When the LDR is in light that is they are no interruption between the light beam and light-dependent resistor.

In the presence of light.

$$I_{LDR} = \frac{V_{LDR}}{R_{LDR}}$$

$I_{LDR} = \frac{5}{200}$= 25mA is the expected current passing through the light-dependent resistor (LDR) and 5volts is the voltage supplied by the microcontroller and 200 ohms is the resistor of the light-dependent resistor provided by the manufacturer. The light-dependent resistor will be active at this stage indicating no walls crossed if all the walls are having a follow of such currents.

In the absence of light

$$I_{LDR} = \frac{V_{LDR}}{R_{LDR}}$$

$I_{LDR} = \frac{5}{20000000}$= 0.000025mA, very low value, if the light-dependent resistor sees this current is showing that is not active it will output 0 volts which is a sign of interruption between the light-dependent resistor (LDR) and the light beam (LED).

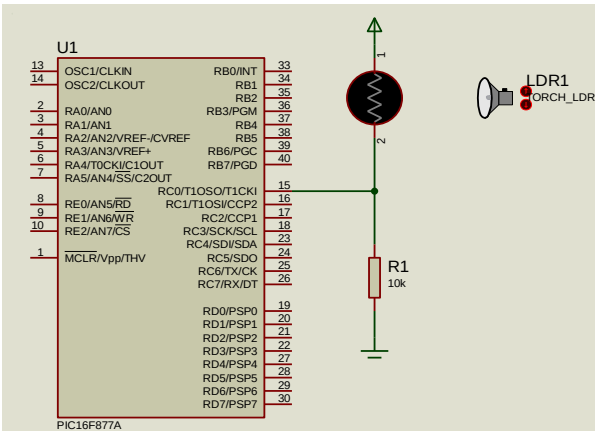

Figure 5: Is one of the lights dependent resistor (LDR) interface and how is calculated

3.2.4 Light-emitting diode (LED)

The bellow data's are gotten from the datasheet of the LED

I_{LED} = 25mA, which is the current of the LED from the datasheet

V_{LED} = 1.8v, which is the voltage of the LED also obtained

from the datasheet

$R_{LED} = \frac{V_{CC} - V_{LED}}{I_{LED}} = \frac{5-1.8}{25\times10^{-3}} = \frac{3.2}{0.025}$ =128Ω, is the resistor obtain using the above values of the LED.

3.2.5. Transistor driven buzzer

Substituting Equation (4a) and (4b) in Equation (3) to obtain the DC gain of the transistor (β)

$\beta = \sqrt[2]{(700 * 70)} = 221.4$

Substituting β and equation (5) in equation (1)

Therefore,

$I_B = \frac{I_C}{\beta}$ (1)

$I_B = \frac{I_C}{\beta} = \frac{100\times10^{-3}}{221.4} = 0.0004517 = 451.7\mu A$

And

$V_{BE} = 0.7$ (for voltage drop across a silicon transistor)

Substituting the above values in equation (2)

$V_C = I_B R_B + V_{BE}$ (2)

$5 = 299\times10^{-6}\times R_B + 0.7$

V_C It is the voltage supplied to the microcontroller, which is 5 volts.

$R_B = \frac{5-0.7}{451.7\times10^{-6}} = \frac{4.3}{0.0004517} = \frac{9519.59}{1000}$ = 9.52kΩ is the base resistor obtained.

3.2.5. For 8 ohms buzzer

$I_{BUZZER} = \frac{V_{BUZZER}}{R_{BUZZER}} = \frac{5}{8}$ = 625mA, 5 volts is voltage and 8 ohms is the resistor of the buzzer that comes with it. And 625mA is the value of the current obtained from the calculations and is the current passing through the buzzer that is going to make the buzzer active in case they are any interruption between the light-dependent resistor (LDR) and its light beam.

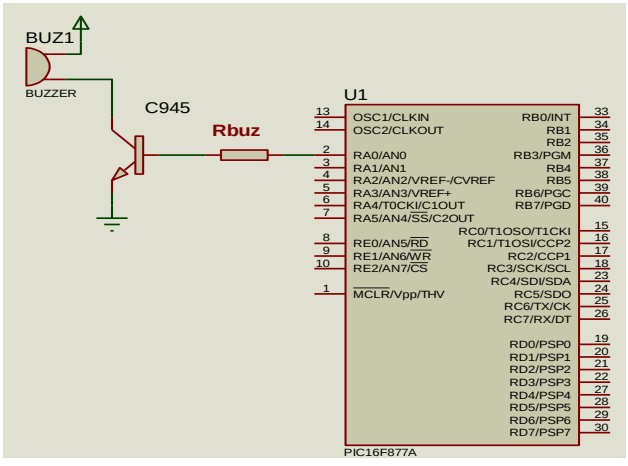

Figure 6: Transistor driven Buzzer

3.2.6. Push-button

The pushbuttons are not physically to be used in the main simulation. They were just a contact that the motor has to stop when making a contact at one of the walls that crossed, that is if you want the motor to stop rotating you have to press the specific switch attached to that wall. The maximum sinking current of PIC is 25mA; therefore, we need to calculate the sinking current to be much less than the maximum sinking current.

$I_{sinking} = \frac{V_{CC}}{R_{pull-up}}$ (6)

$I_{sinking} = \frac{V_{CC}}{R_{pull-up}} = \frac{5}{10} = 0.5mA$

Therefore, a 10-kΩ resistor was used to meet the requirements set by the microcontroller manufacturers on the microcontroller sinking current.

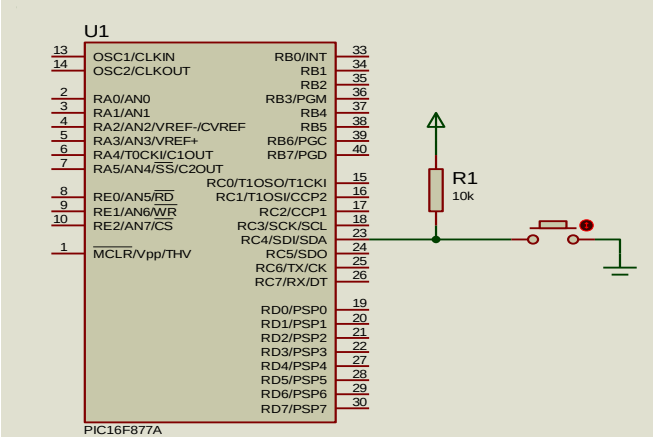

Figure 7: Push Button Sinking current

3.2.7. Dc motor

$I_{motor} = \frac{V_{motor}}{R_{motor}} = \frac{5}{8}$ = 625mA

I_{motor} Is the current drawn by the motor

V_{motor} Is the voltage of the motor, which is 5v

R_{motor} Is the resistance of the motor 8Ω

The calculation of the transistor-driven motor is the same as the transistors driven buzzer.

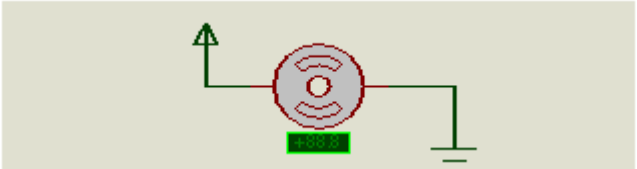

Figure 8: shows the current passing through the dc motor

4. Result and Discussion

This section is to deal with the description of the test performed on the various sections of the overall system

and their corresponding result as well as the result of the overall system. The system is purposely made to improve the effectiveness and reliability of a wall-crossed detecting security system. Being something on which human life will depend on. The test was carried out on the system as a whole and during the simulation process, the results were obtained. The program for the wall-crossed detecting security system was written using MPLAB IDE. After the program was written, it was simulated using the MPLAB SIM that is part of the MPLAB software. This was done to ensure that the program performed as expected and to detect any bugs that exist in the program. The circuit diagram was drawn using Proteus ISIS, which is an electronics design software, and the respective programs for the peripheral interface controller (PIC) were loaded into the designed diagram. The circuit was then simulated to see if it performed the desired function. All necessary corrections were made to the software at this stage until the desired results are obtained.

Table III: Shows the simulation testing and results obtained

S/ No	***Test Conducted***	***Result obtained***
1	Press the play button	Ports, LCD, sensors initializing & LCD "time and date &"ALL WALLS OK"(shown in figure 9)
2	If the north light-dependent resistor blocked from the light beam or moved away from it by pressing the negative sign of the LDR torch	LCD "north wall crossed" system rotate the motor until when it makes contact with the north point (north button pressed) it then stops to capture a real-time video by CCTV(shown in figure 10)
3	If the south light-dependent resistor blocked from the light beam or moved away from it by pressing the negative sign of the LDR torch	LCD "south wall crossed" system rotate the motor until when it makes contact with the south point (south button pressed) it then stops to capture a real-time video by CCTV(shown in figure 11)
4	If the west light-dependent resistor blocked from the light beam or moved away from it by pressing the negative sign of the LDR torch	LCD "west wall crossed" system rotate the motor until when it makes contact with the west point (west button pressed) it then stops to capture a real-time video by CCTV(shown in figure 12)
5	If the east light-dependent resistor blocked from the light beam or moved away from it by pressing the negative sign of the LDR torch	LCD "east wall crossed" system rotate the motor until when it makes contact with the east point (east button pressed) it then stops to capture a real-time video by CCTV(shown in figure 13)

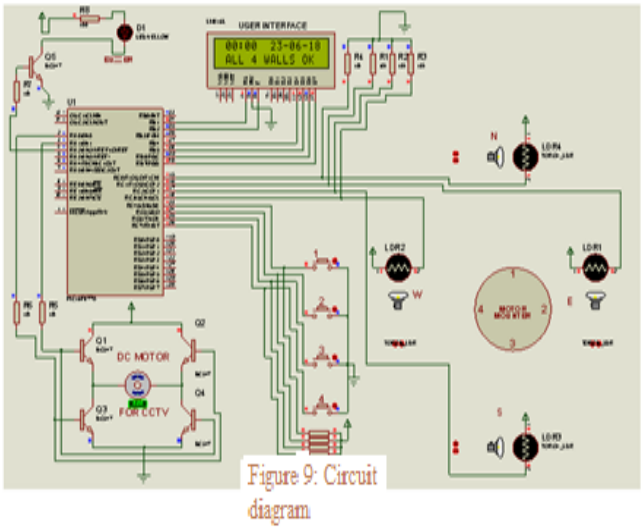

Figure 9: Showing the simulation result display on the liquid crystal display "All 4 walls ok

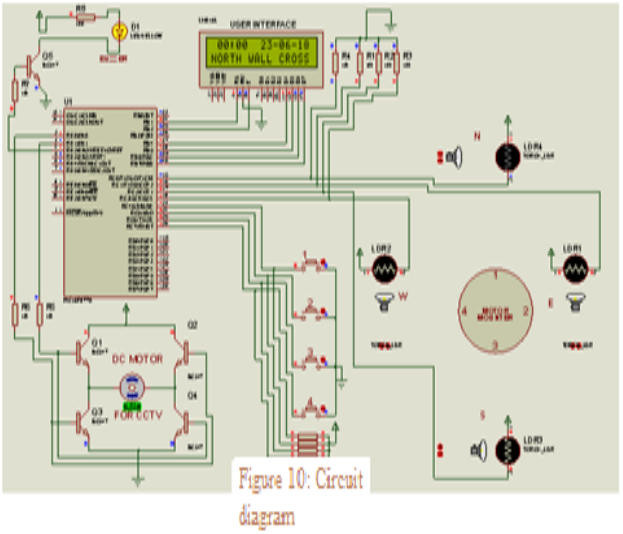

Figure 10: showing the simulation result displayed on LCD that north wall is cross-interrupted

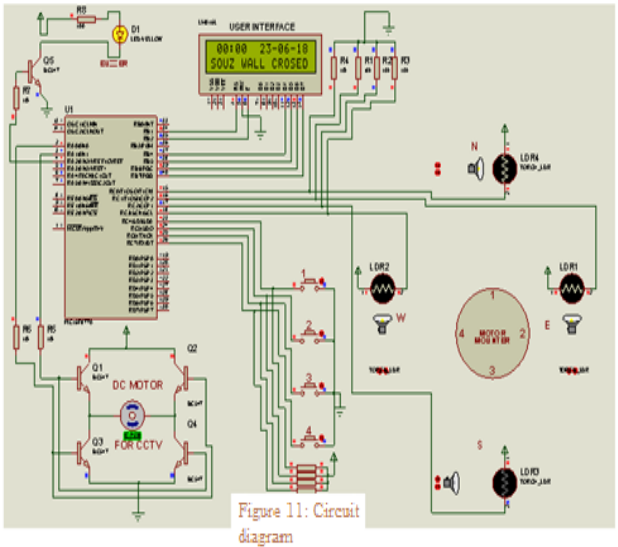

Figure 11: Circuit diagram

Figure 11: showing the simulation result displayed on LCD that the south wall is cross-interrupted

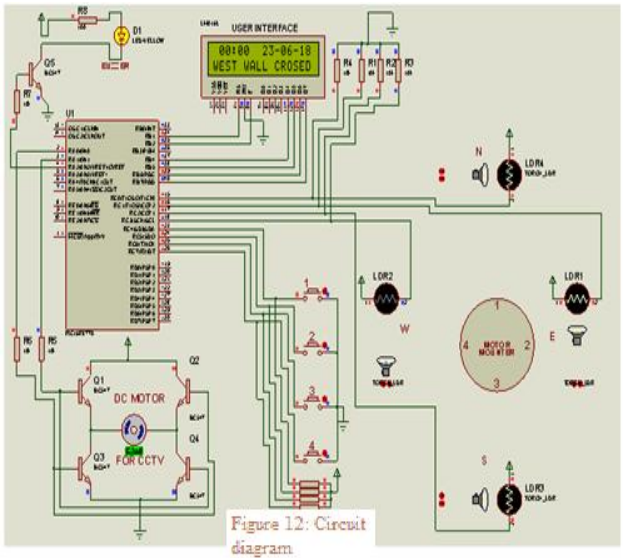

Figure 12: Circuit diagram

Figure 12: showing the simulation result displayed on LCD that west wall is cross-interrupted

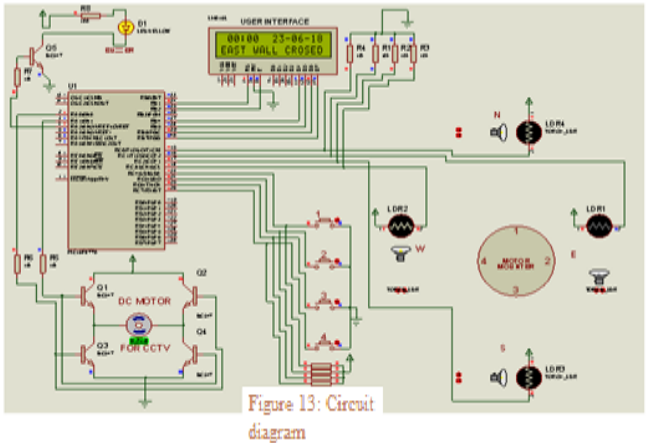

Figure 13: Circuit diagram

Figure 13: showing the simulation result displayed on LCD that the east wall is cross-interrupted

Reliability testing

The reliability of every system is very important. Especially a system like the one under consideration on which human life developed. This section of the report will deal with how reliable this system will be seen. The reliability of a system falls within the range of zero and 1or if calculated in percentage, within the range of 0% to 100%. It is not likely to have the extreme values of either zero or one but lies between two extreme values.

The reliability assessment procedure consists of the following:

1.List of parts of the equipment,

2.State the basic failure rate for each part,

3.Multiply by the number of similar parts,

4.Multiply by all available weighting factors,

5. Add up all the products from steps (1) through (4) to give the overall failure rate,

6. Determine the equipment reliability R, for a given operating time t, using the expression, $R = e^{-\pi t}$

Table IV: Gives the reliability assessment of the research at 40℃ operating temperature. The failure rate is given in percentage per 1000hours (%/1000hrs). The rating factor Wr is taken for operation in a normal office, laboratory, or home.

Component	Number used	Basic failure rate, λi (%/10^{-3}hrs)	The weighting factor due to the environment	Weighting factor due to temperature	Weighting factor due to W_r	Overall failure rate, λoi
Resistor	11	0.003	1.0	1.5	1.0	0.0495
LCD	1	0.02	1.0	1.5	1.0	0.03
PIC	1	0.02	1.0	1.5	1.0	0.03
LDR	4	0.002	1.0	1.5	1.0	0.012
Buzzer	1	0.002	1.0	1.5	1.0	0.003
Transistor	5	0.03	1.0	1.5	1.0	0.225
Oscillator	1	0.005	1.0	1.5	1.0	0.0075
LED	4	0.01	1.0	1.5	1.0	0.06
Connection	21	0.001	1.0	1.5	1.0	0.0315

The overall failure rate of the system is the summation of the failure rates, λoi is given by

$\sum \lambda oi = \lambda T = 0.0495 + 0.03 + 0.03 + 0.012 + 0.003 + 0.225 + 0.0075 + 0.06 + 0.0315 = 0.4485\%/1000hrs = 0.4485 \times \frac{1}{100000} = \frac{0.4485}{100000} = 4.485 \times 10^{-6}$

For the operating time of one year, that is 365 days

t = 24hrs x 365 = 8760

Therefore, the failure rate of the device for a year, $\lambda_T \times t = 4.485 \times 10^{-6} \times 8760 = 0.03929$

The reliability, R (t) =e^(-λ_T×t)=e^(-0.03929)= 96%. From the value obtained, it can be seen clearly that the system would be quite reliable under favorable conditions and is going to be dependable for its operation.

5. Conclusion

The purpose of this research was to generate awareness concerning the security actions people can perform in day-to-day life in response to the rise in burglary and abduction in the world today. This study reviewed some studies relating to the security detection system using the internet of things. This paper also filled the gap regarding the need for a home alarm system for security against intrusion, for a burglar to be appropriately identified without a security guard, which is easier, more peaceful, and stress-free. This research also reviewed some studies on the security alarm system from how it is originated which has not been done in most of the research papers and its advancement in technology and the problems encountered by many authors. Also in this work, we have seen the impact of deploying the four light-dependent resistors and four light-emitting diodes in the simulation and the design of the security detection system, and how reliable the system is.

References

[1] [1] M. B. Ahmad, M. Cavas, "Design and Simulation of Four Walls Crossed Security System against Intrusion Using PIC Microcontroller," *American Journal of Engineering Research*, vol. 7, no. 12, pp. 233-244, December 2018.

[2] M. B. Ahmad, M. Cavas, "Design and Simulation of personal computer base Walls Crossed Security System against Intrusion Using PIC Microcontroller", International Journal of Engineering Science Invention, vol. 8, no. 03, pp. 59-74, March 2019.

[3] M. B. Ahmad, A. B Abdullahi, A. S. Muhammad, Y. B. Saleh, U. B. Usman, "The Various Types of sensors used in the Security Alarm system," International Journal of New Computer Architectures and their Applications, vol. 9, no. 2, pp. 50-59, September 2019.

[4] M. B. Ahmad, M. Cavas, "A Review Advancement Of Security Alarm System Using Internet Of Things (IoT)", International Journal of New Computer Architectures and their Applications, vol. 9, no. 2, pp. 38-49, September 2019.

[5] M. B. Ahmad, A. S. Muhammad, A. A. Abdullahi, A. Tijjani, A. S. Iliyasu, I. M. Muhammad, I. Ibrahim, S. Tijjani, Y. Idris, I. K. Dahiru, A. A. Umar, J. Sulaiman, A. L. Musa, S. A. Mohammed, S. I. Abdullahi, A. H. K. Naisa, M. Surajo, S. A. Muhammad, B. A. Imam, S. H. Ayagi, K. M. Sani, "Need For Security Alarm System Installation And Their Challenges Faced " International Journal of New Computer Architectures and their Applications, vol. 9, no. 3, pp. 68-76, 2019.

[6] M. B. Ahmad, A. S. Muhammad, A. S. Iliyasu, A. A. Umar, B. A. Imam, S. H. Ayagi, "Gabor Based Band Selection For Multispectral Palmprint Recognition System Using Feature Fusion", i-manager's Journal o Image Processing, vol. 6, no. 2, pp. 14-19, April - June 2019.