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DETECTION OF CROSSED WALLS SECURITY ALARM SYSTEM AGAINST INVASION

ABSTRACT

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A security detection system was developed to secure any of the walls that were crossed. These walls are the north, east, south and, west wall. These walls are designed to be in a square environment, each of these walls has a Light Emitting Diode (LED) that functions as a transmitter and a Light Dependent Resistor (LDR) that function as a Receiver. A closed-circuit television (CCTV) was used to capture the real-time video of any of the crossed walls. A Liquid Crystal Display (LCD) was used to display the status of these walls and display the name of the crossed walls. A magnetic buzzer is also used to alert the security personnel after a system has displayed the name of the crossed wall on the LCD. A Microcontroller (PIC16F877A) is used as the brain of the developed security system. The Personal Computer (PC) is also used to display the system status through personal computer Parallel Port, to display the real-time video captured by the CCTV camera, saving the video on personal computer hard drive, and to control the developed system from the personal computer (PC) such as activating, deactivating and resetting the developed system. 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.

Contribution/Originality: It is to create awareness of the security alarm system and to prevent intrusion and abduction.

1. INTRODUCTION

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 [1]. 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 burglars 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 initiated 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 observes 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 looked 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. 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-ins happened in banks, residential areas, as well as offices. Non-Automated security detection systems were found non-reliable [2]. Doors were fitted with a lock and key system, which can be opened 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 happen 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 [3].

1.1. Related Works

Designing and Implementation of Security alarm detection systems for organizations, industries, and houses based on Global System for Mobile Communications (GSM) technology was administered as double ways to implement security alarm detection system-using the 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. A short message service (SMS) based system using Global System for Mobile Communications (GSM) was suggested, the system is using internet facilities to deliver an alert or messages to the place an intrusion took place rather than the ordinary SMS. In 2013 another design was developed to implemented 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 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 be the first of its kind "optical Morse code-based electronic locking system". This type of system makes uses LED as an encipher intermediate to send signals. To make it more available to the overall community, the LED in our mobile phones has been made use of. On the side of the receiver is 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 LED [6]. 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. For this purpose, this research has focused on the upkeep of home security. In this research, the home security is only showing concerns on the four walls of the building. Each wall has a set of LEDs as a transmitter and LDR as the receiver. The LED is to transmits a beam of light directly to

the LDR receiver. If there is no wall cross the PIC detects 5v but If anything crossed the light beam then the PIC will detect a 0v that allow the PIC to display on the LCD the name of the wall that was crossed and sets the magnetic buzzer on at the same time set the motor that carrying the CCTV camera in action that is to capture the real-time video and also the PIC communicates with the PC via parallel port to display the video and the name of the crossed wall. The system is capable of displaying more than one name of the crossed walls both on the LCD interface and PC Graphical User Interface (GUI).The user has to activate the system from the PC by clicking an activate button and can easily deactivate the system by clicking the deactivate button. The user can also reset the system from the PC by clicking the reset button and make surveillance from the PC by clicking the rotate motor button. If no walls were crossed, the system will display on both LCD and PC that ALL THE FOUR WALLS ARE OK.

2. MATERIALS AND METHOD

The materials used in this research are shown in Table 1.

Table-1. Materials.

S/N	Components	Number of used
1	Graphical user interface (GUI) software	1
2	Liquid crystal display (LCD)	1
3	Peripheral interface controller (PIC)	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
10	Parallel port	1
11	Resistor	11
12	Personal computer	1

3. METHOD

This section of the research handled the calculation and theoretical part of the design of a personal computer (PC) based wall crossed detecting security system against abduction or intrusion. The system block diagram that is shown below in Figure 1 of this research shows the mode of operation of the whole system. If the system is power on it, display on the LCD that “please activate the device” so the user has to click a button from the graphical user interface (GUI) on the Personal Computer screen, which is being, developed using visual basic. if the system is being activated from the personal computer the system LCD will display “system activated” at that time the system will be able to detect any crossed walls. Each wall has a set of LDR and LED. The LED is to send a light beam to the LDR, in the presence of light the LDR will send 5 volts to the PIC16F877A microcontroller that means the wall is not being crossed and if the wall was crossed the LDR will be in darkness and it will send zero volts to the PIC16F877A the microcontroller will automatically display the name of the wall that has been crossed on the LCD and then send a signal to a personal computer through parallel port displaying on the personal computer that the wall has been crossed and the personal computer will display on the screen name of the wall that has been crossed while the microcontroller set the DC motor on that to carry the CCTV camera to capture the real-time video. The video will be sent to the personal computer and will be saved in the personal computer in a particular drive. If none of the four walls was cross the microcontroller, will display on the LCD that “all the four walls are ok” and send a signal to the personal computer displaying that none of the walls is being crossed and the personal computer will display that information on its screen. The system will be reset from the personal computer by a simple click on the reset button located on the GUI. The system can also be deactivated from the GUI by clicking the deactivating button.

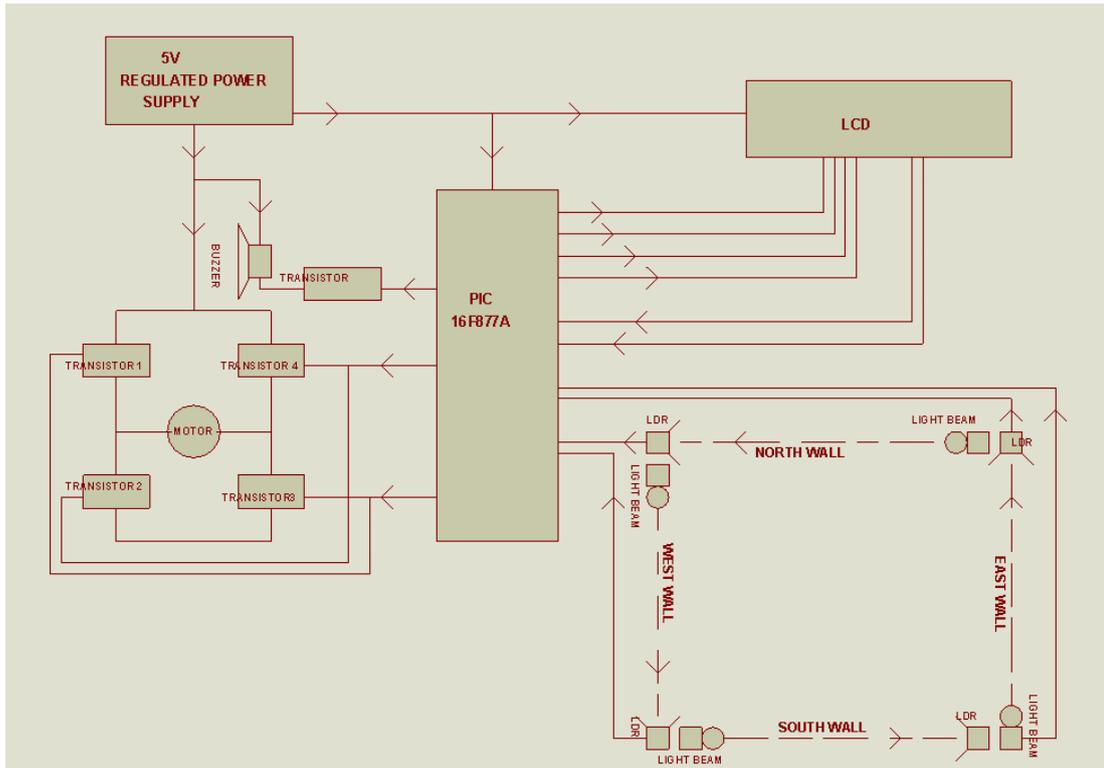


Figure-1. System block diagram.

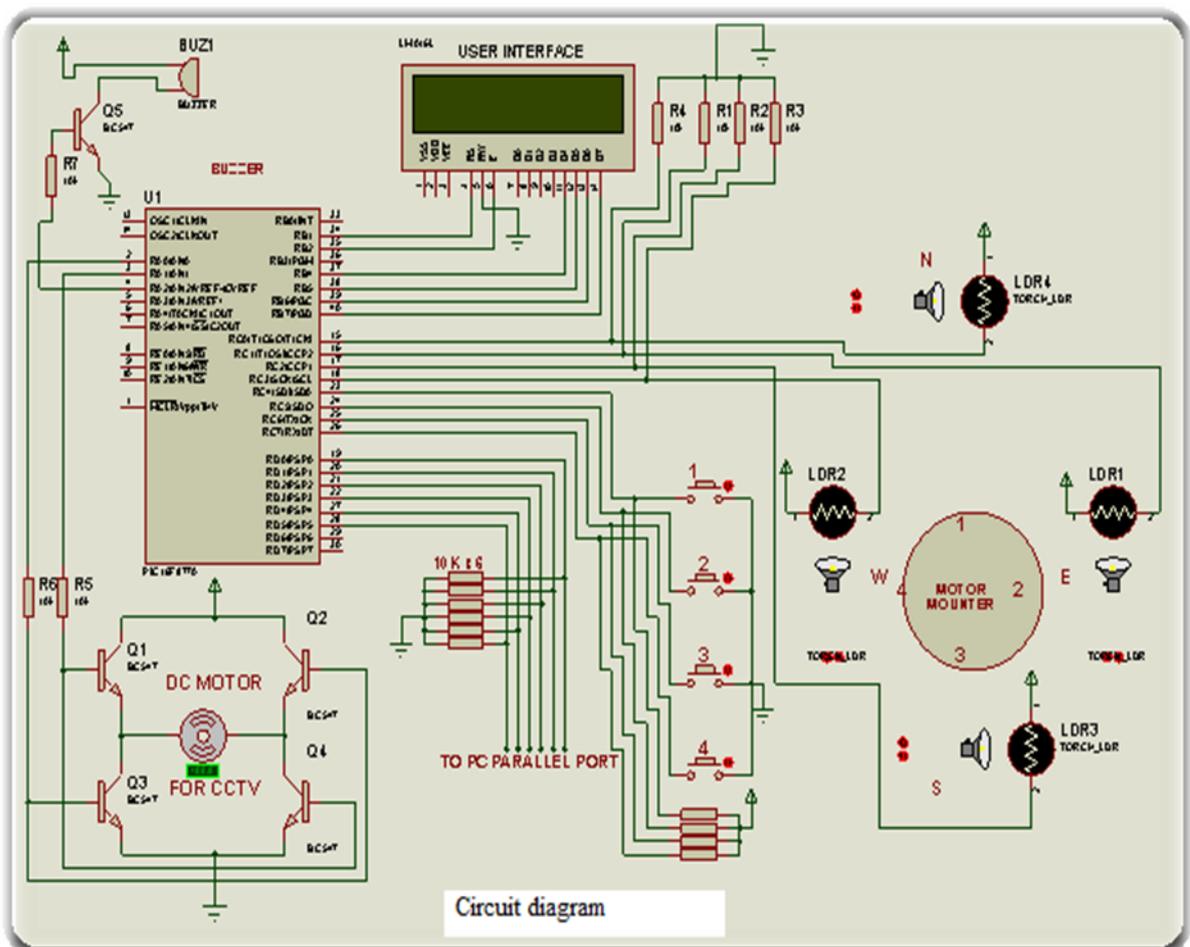


Figure-2. Circuit diagram.

Figure 2 above shows the system circuit diagram. The pin assignment of the whole system connection is as follows:

1. Pin 2 is connected to the base of transistors Q3 and Q2 through a 10kΩ resistor to rotate the motor clockwise if the base of transistors Q2 and Q3 were biased.
2. Pin 3 is connected to the base of transistor Q1 and Q4 through a 10kΩ resistor to rotate the motor anticlockwise if the base of transistor Q1 and Q4 were biased.
3. Pin 4 is connected to the base of transistor Q5 through a 10kΩ resistor to switch on/off the magnetic buzzer.
4. Pin 40, 39, 38, and 37 connected to the LCD data line.
5. Pin 34 and 35 are connected to the LCD control line.
6. Pin 15, 16, 17, and 18 were connected to a light-dependent resistor (LDR) of the north, east, south, and west respectively through 10kΩ pull-down resistor on each line.
7. Pin 23, 24, 25, and 26 are connected to the buttons 1, 2, 3, 4 respectively to function as a dc motor stopper through 10kΩ pull-down resistor.
8. Pin 19, 20, 21, 22, 27, and 28 connected to personal computer parallel port through 10kΩ pull-down resistors.

3.1. The Below Formula is Used in Designing the Whole System and the 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

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

$$I_{sinking} = \frac{V_{CC}}{R_{pull-up}} \quad (4)$$

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

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

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

$$I_C = 100mA \quad (5)$$

The below 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

$R_{LED} = \frac{V_{CC} - V_{LED}}{I_{LED}} = \frac{5 - 1.8}{25 \times 10^{-3}} = \frac{3.2}{0.025} = 128 \Omega$, is the resistor obtain using the above values of the LED. 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 6

Therefore,

$$I_B = \frac{I_C}{\beta} \quad (6)$$

$$I_B = \frac{I_C}{\beta} = \frac{100 \times 10^{-3}}{221.4} = 0.0004517 = 451.7 \mu A \text{ And}$$

$V_{BE} = 0.7$ (for the voltage drop across a silicon transistor) Substituting the above values in Equation 7

$$V_C = I_B R_B + V_{BE} \quad (7)$$

$$5 = 299 \times 10^{-6} \times R_B + 0.7$$

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

$$R_B = \frac{5 - 0.7}{451.7 \times 10^{-6}} = \frac{4.3}{0.0004517} = \frac{9519.59}{1000} = 9.52 k\Omega, \text{ is the base resistor obtained.}$$

$$I_{BUZZER} = \frac{V_{BUZZER}}{R_{BUZZER}} = \frac{5}{8} = 625 \text{ mA}, \text{ 5 volts is voltage and 8 ohms is the resistor of the buzzer that comes with it.}$$

Moreover, 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 LDR and its light beam.

3.2. A Parallel Port

In a port in a computer, a port is a set of signal lines that the microprocessor, or CPU, uses to exchange data with other components. Typical uses of ports are communicating with printers, modems, keyboards, and displays, or just about any component or device except system memory. Most computer ports are digital, where each signal, orbit, is 0 or 1. Parallel port transfers multiple bits at once, while serial port transfers a bit at a time. Figure 8 shows the pin configuration of the parallel port. The parallel port of the computer uses a DB-25 female connector with 25 pin contacts, located on the rear panel of the computer. Of the 25 contacts, 17 are used as signal lines and 8 are ground lines. The signal lines are divided into three groups:

Control lines (4 lines).

Status lines (5 lines).

Data lines (8 lines).

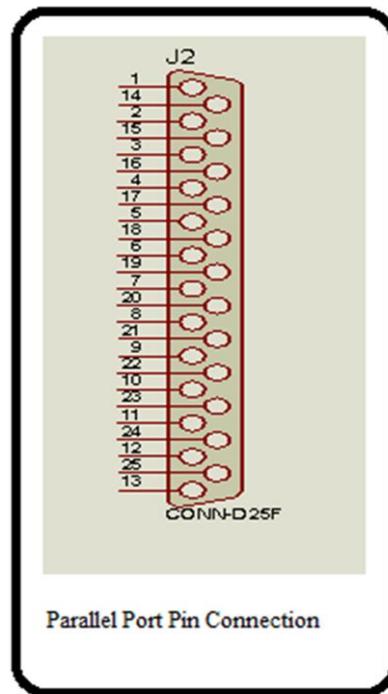


Figure-3. Parallel port pin connection.

3.3. Personal Computer (PC) Activating the System

The personal computer (PC) would send a signal via a parallel port to pin 19 of the microcontroller through a pull-down resistor.

$$I_{sinking} = \frac{V_C}{R_{pull-down}} \frac{5}{10} = 0.5mA$$

0.5mA is the sinking current.

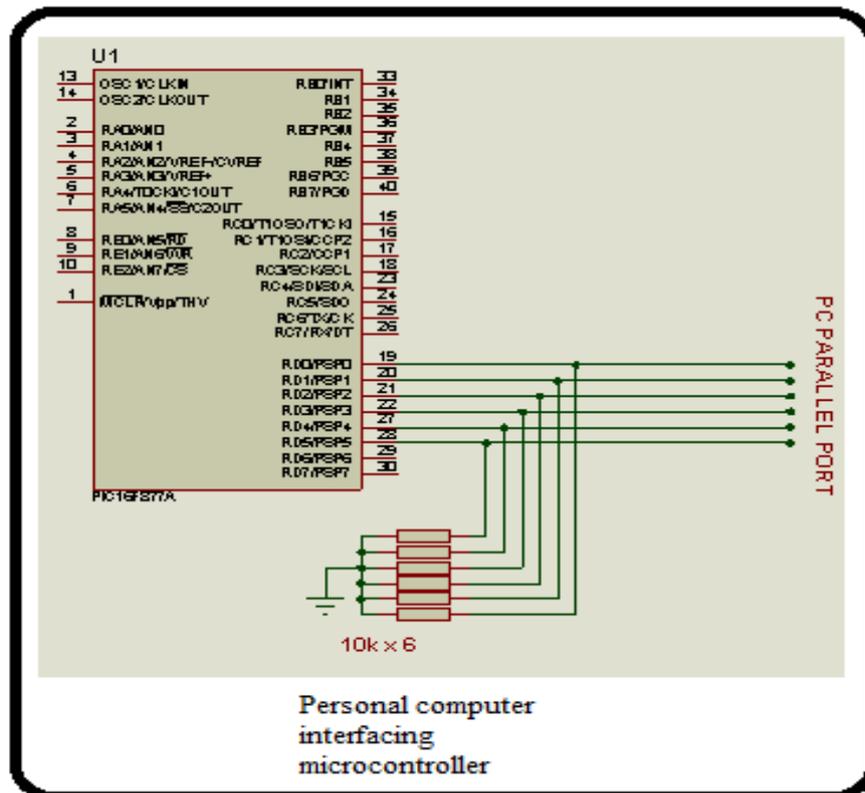


Figure-4. Personal Computer interfacing the PIC16F877A.

3.4. Personal Computer Graphical User Interface Software

Visual Basic is a tool that allows u to developed windows graphical user interface applications. The applications have some familiar concepts for the user. Is also called event-driven, meaning code remains idle until called upon to respond to some event (button pressing, menu selection). The visual is governed by an event processor. Nothing happened until an event is detected. Once an event is detected, the code corresponding to that event is executed.

4. RESULT AND DISCUSSION

This section is to deals 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. 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 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-2. Shows the simulation testing and results obtained.

S/No	Test Conducted	Result obtained
1	Press the play button on both Proteus (circuit) and visual basic (application)	PIC ports, LCD, sensors, PC parallel Port initializing. LCD “activate the system from the PC”
2	If the activate button was pressed from the visual basic application	LCD “system activated” for 3 seconds. Then LCD and application display “all four walls are OK” (Figure 5)
3	If the North wall was blocked (crossed) from receiving the light beam	PC display “North wall was crossed” (Figure 6)
4	If the South wall was blocked (crossed) from receiving light	PC display “South wall was crossed” (Figure 7)
5	If the West wall was blocked (crossed) from receiving light	PC display “West wall was crossed” (Figure 8)
6	If the East wall was blocked (crossed) from receiving light	LCD and PC display “East wall was crossed” (Figure 9)
7	If the reset button is clicked from a PC VB application	The whole system will be reset
8	If the exit button is clicked from a PC VB application	The application will be closed
9	If the rotate motor button is clicked from a PC VB application	The PC will rotate the motor for 90 degrees (as surveillance and if pressed again it rotates to the next 90 degrees)

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, $R = e^{-\lambda t}$ (%/1000hrs). The rating factor W_r is taken for operation in a normal office, laboratory, or home.

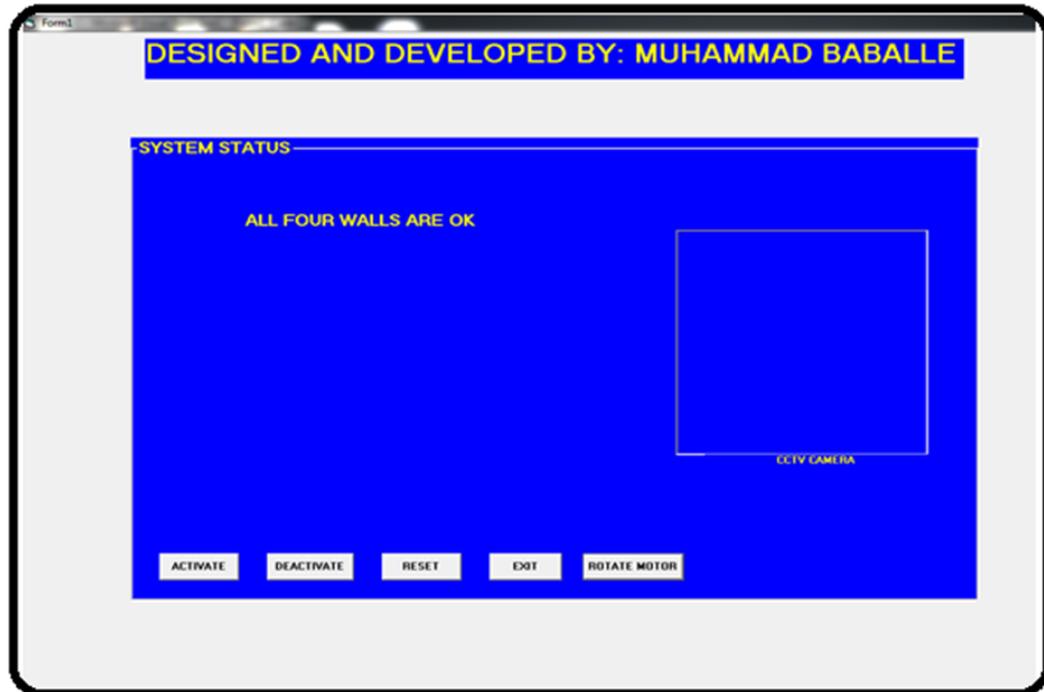


Figure-5. Showing the simulation result display on the PC All 4 walls OK.

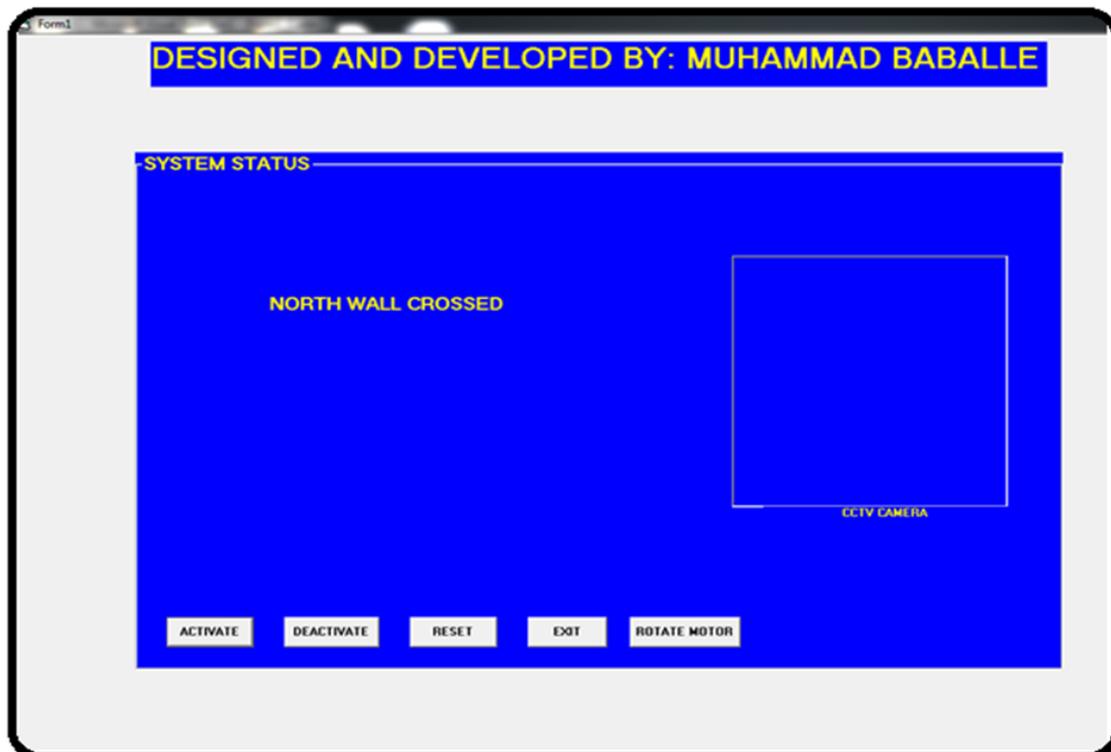


Figure-6. Showing the simulation result displayed on the PC that the north wall is cross-interrupted.

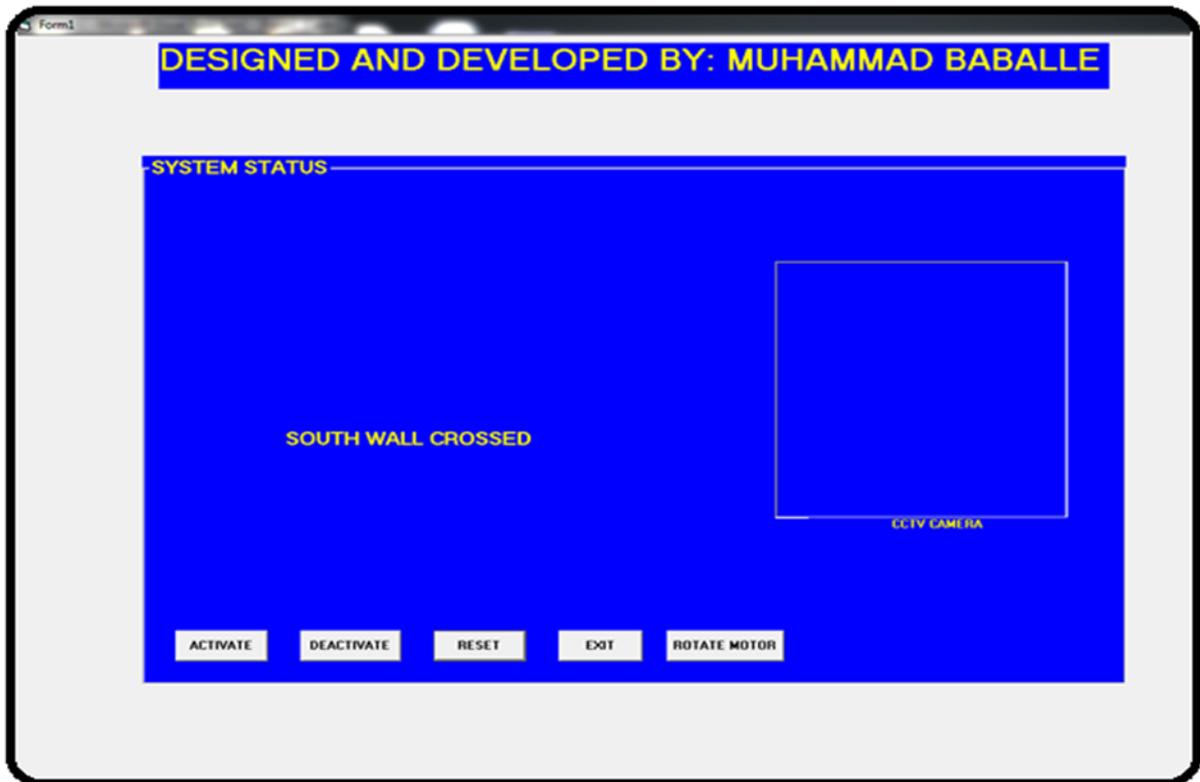


Figure-7. Showing the simulation result displayed on PC that the south wall is interrupted.

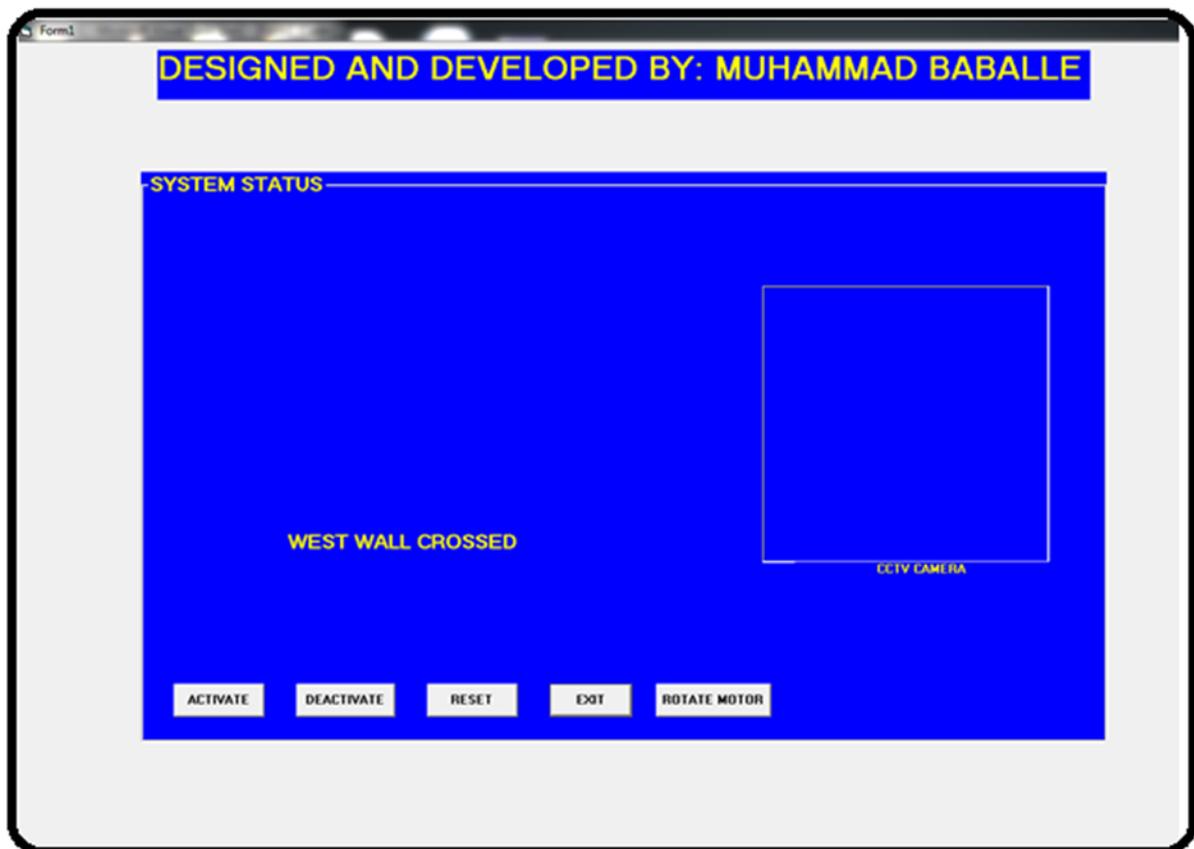


Figure-8. Showing the simulation result displayed on the PC that the west wall is cross-interrupted.

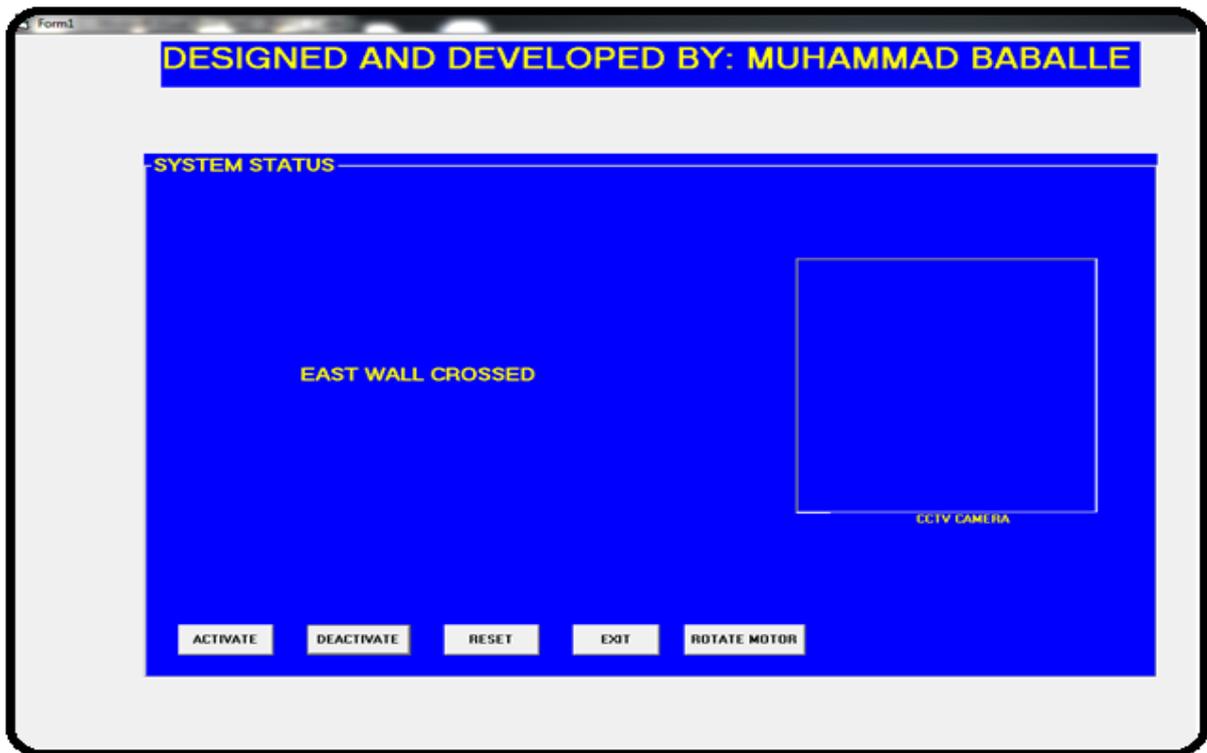


Figure-9. Showing the simulation result displayed on the PC that the east wall is cross-interrupted.

The overall failure rate of the system is the summation of the failure rates, λ_{oi} is given by

$$\sum \lambda_{oi} = \lambda_T = 0.0495 + 0.03 + 0.03 + 0.012 + 0.003 + 0.225 + 0.0075 + 0.06 + 0.0315 = 0.4485\%/1000\text{hrs} =$$

$$0.4485 \times \frac{1}{100000} = \frac{0.4485}{100000} = 4.485 \times 10^{-6}$$

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

$$t = 24\text{hrs} \times 365 = 8760$$

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, $R(t) = e^{-(\lambda_T \times t)} = e^{-0.03929} = 96\%$. 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

In this research, it has been seen that the simulation model of both the personal computer and Proteus works successfully without any basic error. Therefore, this research can be applied in the practical field. Besides the cost of this research is not too expensive and the whole system is found to be reliable. Here the one closed-circuit television has provided utmost security than using four closed-circuit television mounted on each wall, so you can see no intruder can enter the secured environment without concern of the house owner. Some features can still be added for further research like a triangular security system instead of using four LDR and LED you can use three in other to minimize the cost, SMS notification can also be added in case if an intruder enters the secured environment instead of sound an alarm it will automatically send an SMS to the house owner. The operation of the complete research was simulated and expected results were obtained. Also after conducting reliability tests, the system was seen to be sufficiently reliable and capable of performing its function. With the introduction of the personal

computer, you can activate, deactivate, reset and rotate the closed-circuit television of the whole simulation without only using the Proteus circuit.

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