Design and Implementation of a Touch Activated GSM Base Alarm System

Enweliku David Maledo
Department of Electrical and Electronic Engineering, Petroleum Training Institute, Effurun Delta State, Nigeria.

***Abstract*— This Project focuses on detection of unauthorized access to residential and commercial buildings when the residents are far away from the access gate of the house. The system is a simple and reliable touch activated security system and uses a touch sensor technology to revolutionize the standards of living. The system provides a best solution to most of the problems faced by house owners in their daily life. Due to its simple electronic components nature, it is more adaptable and cost-effective to construct.**

***Keywords*- Alarm system, electronic circuitry, touch sensor, microcontroller, GSM.**

I. INTRODUCTION

According to [1] insecurity and crime constitute some of the major problems facing our immediate society today. People live with fear of being attacked by burglars, vandals and thieves. Despite all the effort, Resources and time that has been devoted to the development of systems that will reduce crime rates and make the world a safer place to live, these problems are still on the increase. These gave rise to the need for an increasing development in the technology of alarm systems which utilizes various principles such as infrared motion detection, light (photo) sensitive electronic devices and so on. Even with the introduction of these alarm systems which have reduced greatly the level of insecurity, there is still a problem of false alarm which needs to be minimized. In order to effectively reduce the level of insecurity and avoid false alarms which can create unnecessary unrest, a touch activated security system is required [1]. This system if properly designed will provide security and ensure alarms are activated only when an unauthorized person try to gain access to the protected area or device by touching the entrance or any other part of the device. An alarm is a loud noise or signal for alerting or informing people of danger or a problem. An alarm system is thus a security system that produces a form of sound to warn people of a particular danger. Today we have the new generation of electronic alarm system which comes in various levels of complexities and sophistication. With the recent increase in crime rates, it has become important to protect our buildings and properties with adequate safety devices with increased level of sophistication.

The Touch activated GSM Based Alarm system Gives a SMS/CALL Alert to an individual (Owner) when an intruder touches the Commodity that is been secured. It comprises of a microcontroller, GSM Module, Alarm device, a touch activated circuit and a power supply unit. Below is a block diagram presentation of the Touch activated GSM Based Alarm system.

A. Significance Of Study

The project is aimed to show the importance of using a microcontroller in level control as compared to older methods. Such importance includes:

1. The reliability of the system as measurement and control of level is performed automatically with minimal error.
2. The accuracy of the system to level measurement and control.
3. It also tends to save cost since more than one function is performed by a single major component of the project i.e. microcontroller.
4. The project also seeks to showcase efficient and modern means of level measurement and control.

B. Application of the Project

The touch activated GSM based alarm system finds application in the following arrears;

1. It can be used as a bugler alarm.
2. It can be used as an intruder alarm.
3. It can be modify for use as a tap door bell.

C. Block Diagram Representation

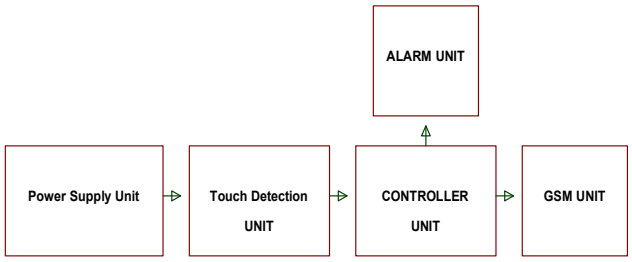

Fig 1.0: Block Diagram of the Touch Activated GSM Based Alarm System

1. Power Supply Unit

This unit employs the use of both DC Battery and Mains supply to ensure constant power supply to the circuit. It

consists of a 220V/12V Step down transformer, a bridge Diode rectifier, a filter capacitor, a voltage regulator and a 6V DC Battery.

2. The Touch Detection Unit

This simple Touch Switch is developed by using 555 timer IC operated as a MONOSTABLE vibrator. The mono-stable multi-vibrator unit generates pulse of certain pulse width when the touch point is touched or had a contact with the human body. This generated pulse is what sends signal to the Controller unit that an intruder is detected.

3. The Alarm Unit

It gives an Audible Sound/Alert when Activated, which indicates an intruder is detected. It comprises of a Buzzer and a biasing Resistor.

4. The GSM Unit

This unit is responsible for sending the GSM based SMS/CALL Alert to the individual/Owner when an intruder is detected. It comprises of a SIM800C GSM Module.

5. The Controller Unit

This unit is what implements the LOGIC of the entire Design. It receives signal from the Touch detection unit, activates the Alarm Unit and Sends a SMS/CALL alert to the owner through the GSM Module. It comprises of a Microcontroller, crystal and capacitors.

II. DESIGN METHODOLOGY

The design analysis of this research work entails, calculations, component selection and design specification. The design was divided into the following units for simplicity and efficiency. Below are the following units of the project:

I. The Power Supply Unit

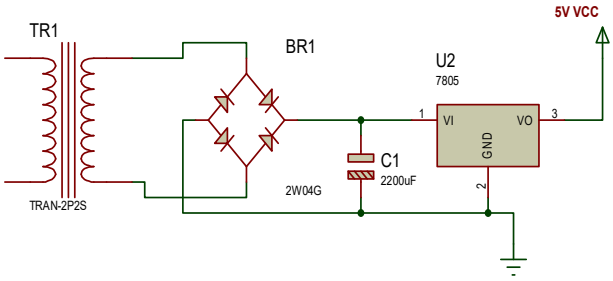

Fig 2: The Power Supply Unit

The power supply unit outputs 5V DC required by the circuit from the 240 AC Mains input, it consists of a 240/12v Step down transformer, bridge rectifying diodes, filtration capacitor and a voltage regulator.

1. Transformer Stage

This stage consists of a 240V/12V, step down transformer. It converts the 240V (A.C) voltage supply from mains to 12V (A.C). The 18V (A.C) supply is then passed to the rectifier stage. A 220V/12V step down transformer was chosen because the regulator used required more than 12V for its operation.

2. Rectifier Stage

In this stage, the rectifier converts the 12V (A.C) supply from the transformer into a pulsating D.C voltage. A full bridge rectifier was used for this purpose. It consist of four diodes (IN4001 series) arranged as shown in Fig. 3.1. During the positive half cycles diodes D2 and D3 are forward biased and current flows through the terminals. In the negative half cycle, diodes D1 and D4 are forward biased. Since load current is in the same direction in both half cycles, full wave rectifier signal appears across the terminals.

3. Filter Stage

The pulsating D.C voltage that comes out from the rectifier stage is converted into constant D.C voltage with the aid of a filter capacitor (C1). This capacitor is large value electrolytic capacitor. It charges up (i.e. store energy) during the conduction half cycle thereby opposing any changes in voltage. The filter stage therefore filters out voltage pulsations (or ripple).

4. Regulator Stage

The output of the filter stage varies slightly when the load current or output voltage varies and it is a 12V D.C supply which is higher than the circuit requirement. For these reasons, an LM7805 Regulator was used to stabilize the voltage and also reduce it from 12V to a 5V steady D.C supply.

II. The Touch Detection Unit

This unit generates a signal when it detects a touch event. It was implemented with a Digital Touch Sensor. The sensor outputs a 5V DC signal when its surface is touched, this signal also triggers the controller. The touch sensor is directly connected to the controller unit. It was powered with 5V DC from the power supply. Below is the interface between the touch sensor and the controller unit.

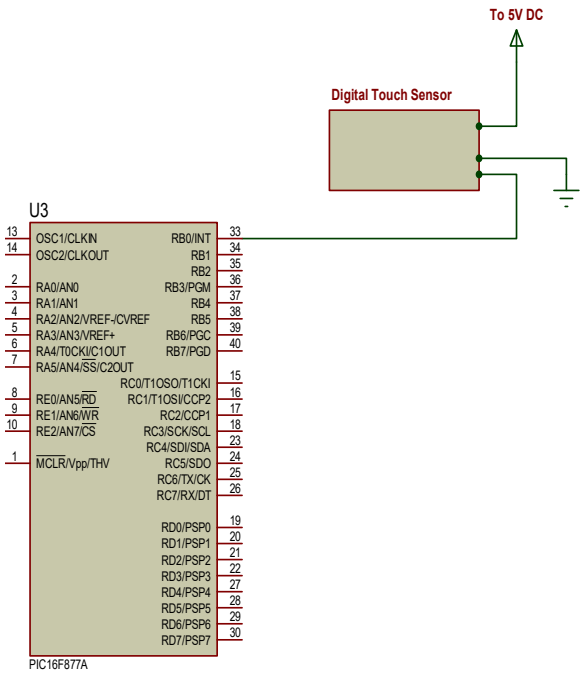

Fig 3: The interface between the Microcontroller and The Digital touch Sensor

III. The Alarm Unit

This unit gives an audible alert when a Touch event is detected. It is directly triggered/ activated by the controller unit. it was implemented with a 5-12V DC Buzzer. The buzzer was biased with a NPN transistor and a resistor. This unit is also directly connected to the controller unit. Below is the interface between the alarm unit and the controller unit.

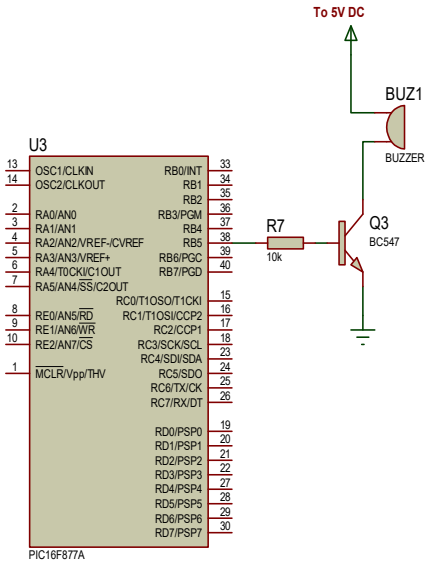

Fig 4: The interface between the Controller and the Alarm Unit

IV. The GSM Unit

This unit is responsible for sending the GSM based SMS/CALL Alert to the individual/Owner when an intruder/touch is detected. It was implemented with a SIM800C GSM Module. The GSM module is directly interface to the controller and communicates with UART serial communication protocol based on "AT" sets of commands. The module is powered with 5V DC from the power supply unit.

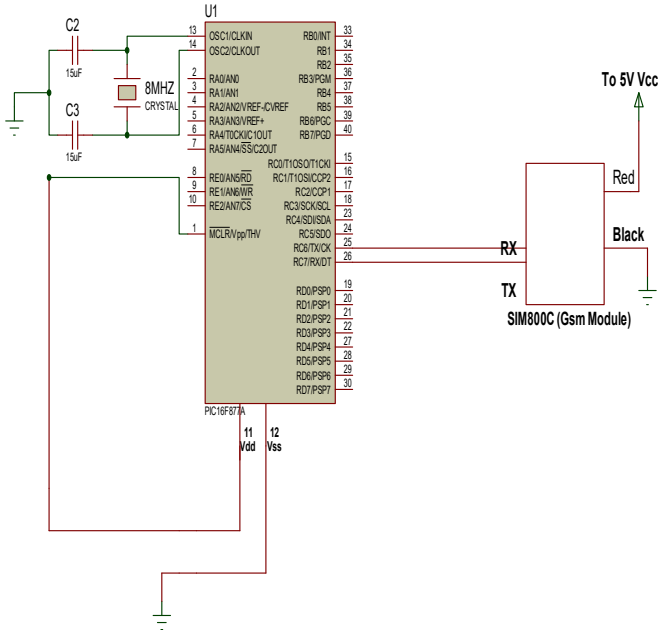

Fig 5: The GSM and the Controller Unit interface.

V. The Controller Unit

This unit is the heart of the system. It performs the entire logic of the design. It was implemented with a PIC16F877A microcontroller from Micro-chips Corporation. Below is a sequential flow of the Logic performed by the microcontroller in this research?

- Wait for the 5V signal from the digital Touch sensor upon detecting a touch event.
- On receiving the 5V signal, the microcontroller activates the Alarm unit for audible Alert.
- Commands the GSM unit to Send SMS/CALL alert to the Admin designated phone number. It will continue to perform this as long as the touch sensor retain the trigger signal.

A 8MHz crystal oscillator is connected to XTAL1 and XTAL2 pins (13, 14) of the microcontroller, biased with two 15pf capacitor as specified in the datasheet that determines the speed of execution. A low pulse on RST pin (pin 1) while the oscillator is running resets the microcontroller. In this circuit, this pin is connected to Vcc.

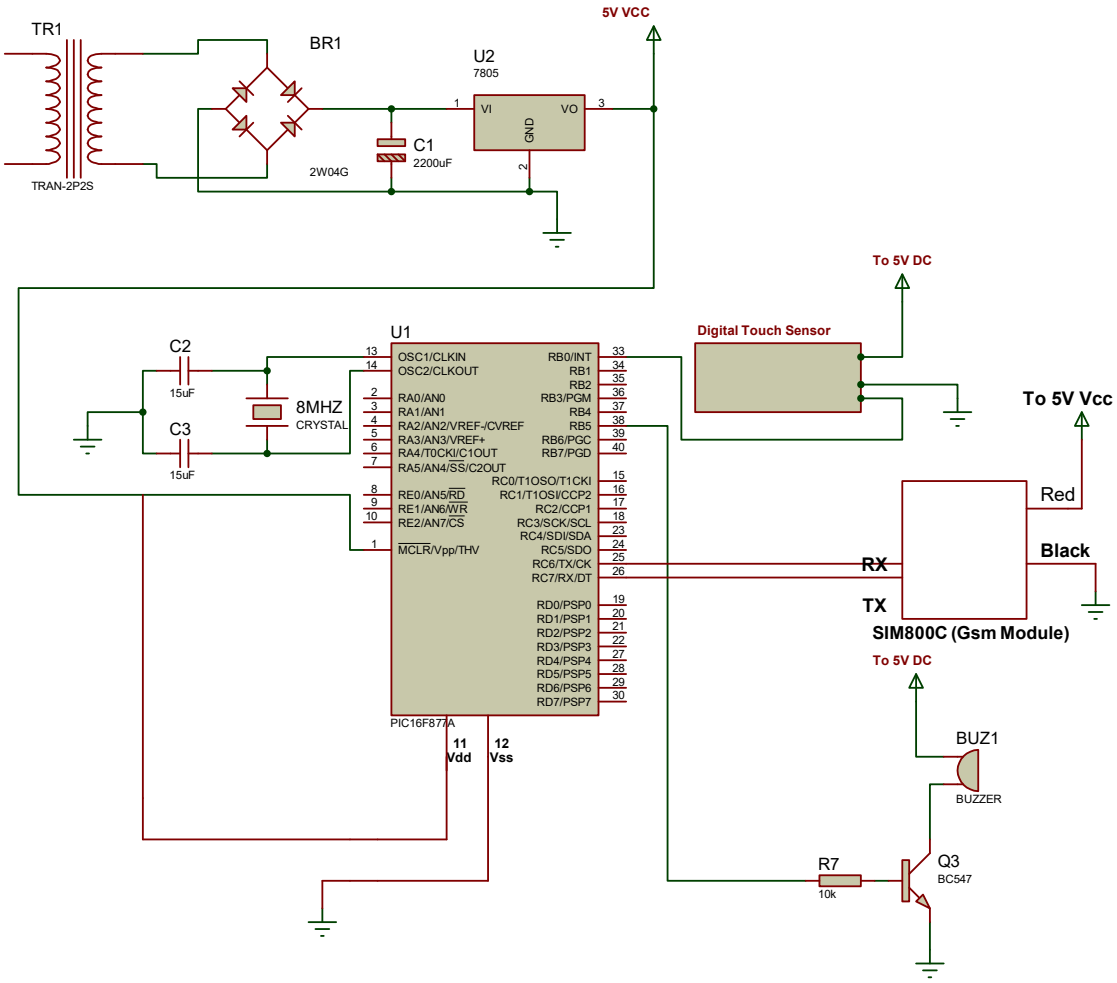

Fig 6: Touch Activated GSM Base Alarm System

III. RESULT

When the switch is turn ON, the power supply unit supplies 5V DC to the circuit, the pic16f877a (microcontroller) initializes its internal registers, configures Pin 29 to 30 as digital input pins that connects directly to the US-100 Level sensor, when done, initializes the HMI display and sends a value of "000" to the displays.

Whenever a user input SET point through the HMI unit, the controller outputs High (5V) at PIN33 to activate the FCE, then it also outputs 5V at pin 29 connected to the US-100 Ultrasonic sensor, the sensor then sends the 40 KHZ sound wave, the controller then activates its internal timer and also waits for the echo pin of the sensor to come high (5V), when the PIN30 outputs high, the microcontroller computes the distance, then update the HMI display. the microcontroller then compare the distance with the SET distance, if it is equal, the controller deactivate the FCE, then output high at PIN19, to activate the ALARM Unit

IV. PRINCIPLE OF OPERATION

When the power switch is turned ON, the power supply unit supplies 5V DC to the circuit, the microcontroller initiates its internal variables, then enters into a loop to wait for the 5V DC trigger signal from the digital touch sensor. Upon receiving the signal, the microcontroller activates the buzzer, hence gives an audible alarm indicating the commodity has been touched. The microcontroller also activates the sim800C GSM module to sends the CALL/SMS alert to the owner. Below is the circuit diagram of the entire project.

V. CONCLUSION

It can be concluded that the sole aim of carrying out the construction of a touch activated alarm with SMS/CALL Alert system was achieved, in that the aim was to develop a cheap, affordable, reliable and efficient security system, which was successfully realized at the end of the design process. One factor that accounts for the cheapness of the product was the proper choice of components used. The ones

that were readily available were used, while a close substitute was found for those that were not readily available. The efficiency of the entire system was put into consideration by the use of transistor in the common collector mode to couple the output of the circuit to the speaker. The system was tested and found to be working to specifications and predictions.

ACKNOWLEDGEMENT

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