Implementation of Intruder Detection System Using Passive Infrared Sensor on PSoC

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Abstract:

The objective of the paper is to implement Intruder detection system using PSoC. Many methods are existed for detection of thief or Intruder which are available in market. But, this paper concentrates on reduction of memory and power wastage which are lagging in developed methods. In this paper PIR sensor helps to reduce the wastage in terms of power and memory space which are in traditional CCTV (Closed Circuit Television System) system. Because of this system we can get better and efficient detection since the PIR sensor activates when there is a change/hear sensed in its vicinity.

Key Words: *PIR Sensor, PSoC, Fresnel lens, Pyroelectricity.*

I.INTRODUCTION:

The Motion in any living object due to its body temperature can be figured out in any direction with or without speed in the field of view. This can be achieved either by mechanical devices that physically interact with the field or by electronic devices that observe and measure changes in the given environment. Motion sensors are often used in indoor spaces to control electric lighting. A motion detector i.e. Passive Infrared sensor (PIR sensor) is an electronic device that is being used to measure the infrared (IR) light radiating from objects in its field of view. PIR sensors are often used in the construction of PIR-based motion detectors. Apparent motion is detected when an infrared source with one temperature, such as a wall. All objects above absolute zero emit energy in the form of radiation. Usually infrared radiation is invisible to the Human eye but can be detected by electronic gadgets designed for such a purpose[1]. The term passive in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. "Infra" means below our ability to detect it visually and "Red" is because of its Color representation which shows the lowest energy level of the color RED and applies to many sources of invisible energy. Electromyogram (EMG) is a technique for evaluating and recording the activation signal of muscles, even medical applications also PIR sensor useful [2].

In this paper we are going to develop a new security system based on the PIR sensor. And when the sensor detect the motion controller activates the camera through serial communication using MATLAB programming. Intruder's image will capture and saved in to database. Using the blob analysis here we track the position of intruder and crop and save the image of intruder in database. it is very use full for identifying the intruder to owners.
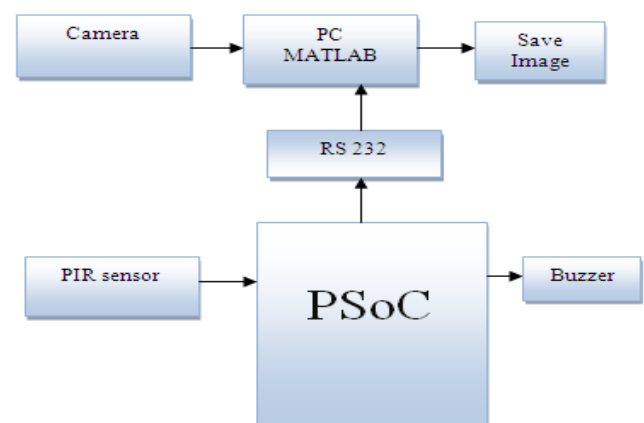

Fig.1 Block diagram Of Proposed System

The proposed system basically consists of two parts. Hardware and software:These two parts are interfaced to work with each other according to the response of the PIR sensor.

II.SYSTEM DESIGN
A. Hardware Parts

The hardware part consists of PIR sensor, power supply, amplifier, detection circuit, camera and the computer.

PIR Sensor: The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high Signal on a
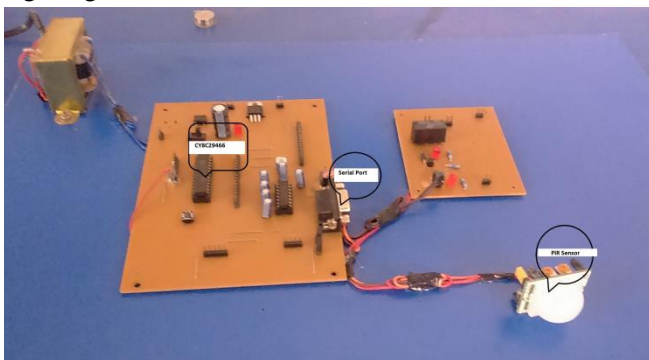

Fig.2 Hardware Implementation

Fig.3 A Typical PIR Sensor

Single I/O pin: Pyroelectric devices, such as the PIR sensor, have elements made of a crystalline material that generates an electric charge when exposed to infrared radiation. The changes in the amount of infrared striking the Element change the voltages generated, which are measured by an on-board amplifier. The device contains a special filter called a Fresnel lens, which focuses the infrared signals onto the element. As the ambient infrared signals change rapidly, the on-board amplifier trips the output to indicate motion [3], [5].

2. Working of PIR Sensor: The PIR sensor always monitor for heat source i.e. human, animal etc. Whenever the heat source is picked up by sensor it produces the digital output "1" to indicate something is sensed. Then motion sensor can pick up the IR radiation until the human (or) animal within the range of sensor then only it can sense. They are small, inexpensive, low-power, easy to use and don't wear out. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR Motion" sensors.

Hardware Working:
- Turn on the Hardware and Pc.
- The PIR sensor check the intruder if it is detected it intimates the camera to turn on the camera.
- Then camera on otherwise it in OFF state.
- The image capturing section and storage is in category of software section.

PSoC Controller: PSoC is the world's only programmable embedded System-on-Chip integrating an MCU core, high-performance Programmable Analog blocks, PLD-based programmable Digital blocks, Programmable interconnect and routing, and Capesense.PSoC offers sophisticated 32-bit ARM based or 8-bit8051 based CPU subsystems with SRAM,EEPROM,and Flash memory, multiple core options and a variety of essential system resources:
- Internal main and low-speed oscillator.

- Connectivity to external crystal oscillator for precision, programmable clocking.
- Sleep and watchdog timers.
- Multiple clock sources that include PLL.
- PSoC devices also have dedicated communication interfaces like I2C, Full-speed USB 2.2, can 2.0and Serial wire debug (SWD).

All new PSoC devices feature the industry standard ARM Cortex, ARM Cortex-M3 and ARM Cortex-M0.

3. Power Supply: The power supply circuit involves the Conversion of 230 volts, 50Hz AC into 16 volts DC. This is achieved by using step down 16-0-16 centre tapped transformer full wave rectifiers. The AC ripples are eliminated using the passive filter i.e. capacitor.
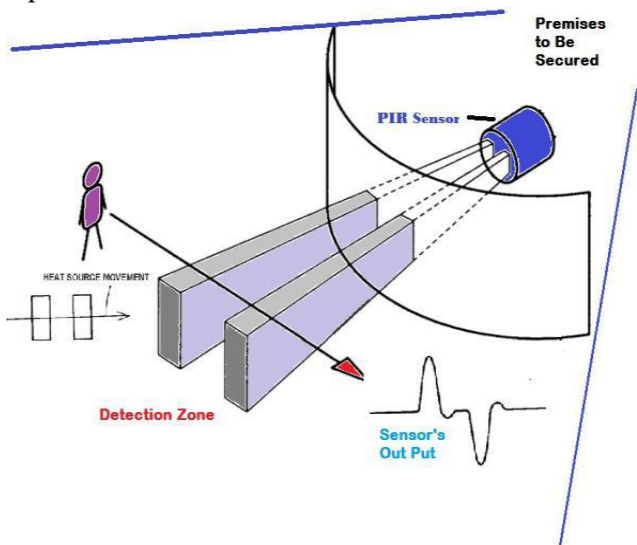

Fig.4 Schematic View of Detection

4.Camera: The camera can capture the pictures when the control signal received by the PSoC from the PIR sensor.The control signal can transferred by using serial communication with the help of RS-232.

5. Buzzer: The buzzer circuit here indicates the whenever intruder is present in the range of PIR sensor, it is helpful to owner to sense pickup the intruder.

B. Software parts

6. PSoC Tool: For programming of software code we have to use software tool PSoC Designer and Creator.

6.1 PSoC Designer: PSoC Designer is a revolutionary Integrated Design Environment (IDE) that enables you to customize PSoC 1 devices to meet your application requirements. PSoC Designer accelerates system bring-up and time-to-market by providing a library of pre-characterized analog and digital peripherals, called User Modules, in a simple, drag-and-drop design environment. This helps in customizing your design by leveraging the dynamically generated API libraries of code [8].

6.2 PSoC Creator: PSoC Creator is a free Windows-based IDE that includes:

- Hardware design with complete schematic capture
- Over 120 pre-verified, production-ready PSoC Components
- Full communications library including I2C, USB, UART, SPI, and Bluetooth Low Energy.
- Tools to develop custom components in Verilog or via state machine diagram
- Dynamically generated API libraries
- Integrated C source code compiler and editor
- Built-in debugger

Fig.5 Software Implementation

Fig.6 PSoC Designer

Fig.7 PSoC Creator

7. Design of a Flowchart: The flowchart is one which shows step by step procedure of program execution. In our project the steps are listed here. The flowchart describes the complete execution of application by sequential manner.
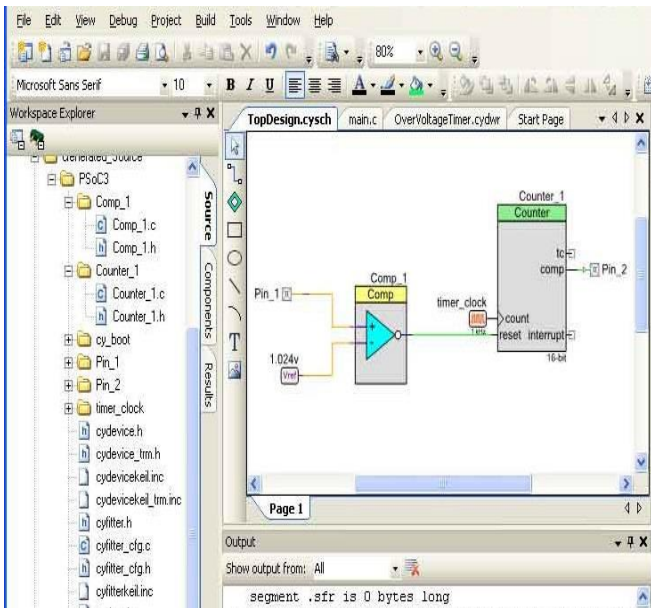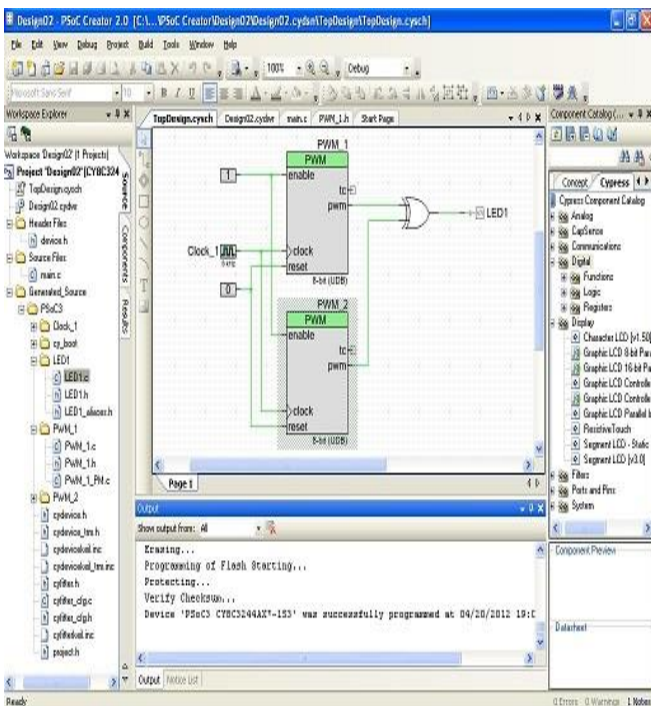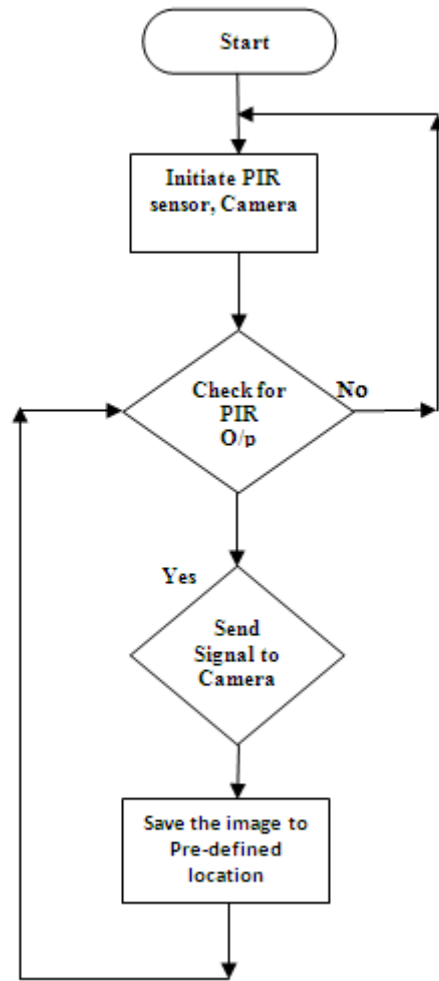

Fig.8 Flow chart

8. Algorithm:

The program is written based on the following algorithm. The program executes in the following

Steps:

1) Start the program,
2) Check the PIR sensor status,
3) If it is high enable Camera
4) Check if the Camera is ON,
5) If the Camera is ON, start capturing the Picture until, the intruder is away from detection range,
6) Disable the check if the camera until PIR is high.
7) Repeat the loop.

9. MATLAB:

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming [4]. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems.

An image is a rectangular array of values (pixels). Each pixel represents the measurement of some property of a scene measured over a finite area. Specific applications are collected in packages referred to as toolbox. There are toolboxes for signal processing; symbolic is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available computation, control theory, simulation, optimization, and several other fields of applied science and engineering. In this project we use MATLAB for image capturing and processing purpose.

An image is a rectangular array of values (pixels). Each pixel represents the measurement of some property of a scene measured over a finite area. The property could be many things, but we usually measure either the average brightness (one value) or the brightnesses of the image filtered through red, green and blue filters (three values). The values are normally represented by an eight bit integer, giving a range of 256 levels of brightness.

The resolution of an image is defined by the number of pixels and number of brightness values. A raw image

will take up a lot of storage space. Methods have been defined to compress the image by coding redundant data in a more efficient fashion, or by discarding the perceptually less significant information. MATLAB supports reading all of the common image formats.

In this paper MATLAB is used to capture the images and save it predefined locations. The MATLAB can able to turn on the camera by means of signal received from serial communication only. Then only it can turn the camera otherwise it can disable the camera.

III. FUTURE WORKS

In this PIR Sensor Based Security System, it uses Low power [6], low cost PIR sensor that is easy to interface with other components. By using this system we were able to reduce the power consumed and memory space of the system currently, we have used only one USB camera in our project. This system may not work when intruder place only hands or other equipment to theft.

Considering all above points, followings are our future Work set to improve the system:
1. Work on the reducing delay time in recording the picture.
2. Use more than one camera and replace it by face recognition technology to identify who is attempted to theft.
3. Work on the software to record picture from many Cameras installed in remote places.
4. Increase the No. of cameras in different areas of required area for good security mechanism.
5. Use moving cameras in all direction (i.e. 360°) to pick up the picture of intruder clearly.
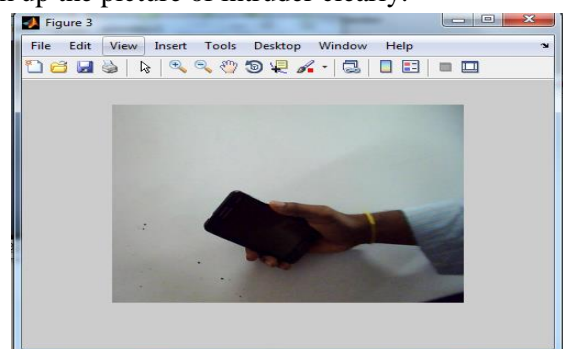

Fig.9 Detection of intruder

IV.CONCLUSION

The detection of human motion is done by developing an embedded system. This embedded system can be used for various applications like the home security system and home automations with slight modifications in software coding according to the requirements.

This project helps to reduce electricity power consumption and also disk space of recording picture or video in commercial application like CCTV'S (Closed Circuit Television System). No hardware modifications are required. This concept not only ensures for this project work but will be suitable to cater for future requirements with flexibility to adapt and extend, as it needs change

V.ACKNOWLEDGEMENTS

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