
An IoT Based Motion Detector Using MSP430

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Abstract - Attacks against homes, workplaces, businesses, and banks are becoming more common, because of the frequency and pervasiveness of burglaries, an effective and dependable intrusion detection system with an alarm has become an absolute must. Motion detection is an essential part of security systems and PIR sensor is one of the most commonly used sensor for triggering the alarms when motion is detected. The designed security system is characterized with efficient video camera for remote sensing and surveillance, featured with stream live video and offers a cost effective ubiquitous surveillance solution, efficient and easy to implement. A web based dashboard using IOT is deployed to display the monitoring result in timely manner when motion is detected. Once it detects the motion, the circuit will trigger an alarm buzzer, then automatically a message will be sent to the owner mobile like an alert about a motion is detected.

Keywords: Motion detection, PIR sensor, Live surveillance, Web based Dashboard.

I. INTRODUCTION

The degree of protection from danger, loss, and crime is referred to as security. Security is needed by everyone in the society now-a-days to protect their property or confidential information from others. People's busy lifestyles need remote control of their home equipment, which increases the need for home monitoring. Now that we have everything, we can develop something that would offer us with perfect security. The very beginning of this was a simple alarm system that included warning suspicious actions at a low cost. An embedded microcontroller system capable of detecting intruder mobility in a limited area and activating an alarm system and motion detection system. 24/7 monitoring, difficult to hack, ability to operate doors, and motion sensor are some of the common qualities of motion detection alarm and security systems. Instead of manual security, we can use PIR sensor based security system which is a wireless security and alarm based detection system for detecting human motions with Live Surveillance to provide security which reduces man power and is very cheap.

The main goal of this project is to build a system that detects human movement, buzzes an alert, and provides the live surveillance along with the feature of capturing the images of the intruder. And sending the alert through IoT to notify the owners. This system offers a low-cost security system that may be installed anywhere in the home.

II. EXISTING MODEL

- “Arduino Based Optical Proximity Sensor Using IR LEDs” is an existing method.
- Generally, Arduino is the most commonly used microcontroller, which is an 8-bit Microcontroller which requires more memory with maximum processing speed of 20MHz.
- And IR sensors are commonly used in stable obstacle detection systems, Where the emitter is simply an IR Light Emitting Diode (LED) and the detector is an IR photodiode which will be sensitive to IR light that of the same wavelength as is emitted by the IR LED.

III. PROPOSED MODEL

- The project “IOT BASED MOTION DETECTOR USING MSP430” was primarily designed for detecting intruders and sending an alert to the owner.
- Here we are using MSP430 micro-controllers which are known for its ultra-low power operation, low cost, with an high processing speed of 25MHz.
- As it is a 16-bit micro-controller it consumes less power and has a faster clock speed than an 8-bit microcontroller.

- d. This proposed method uses ESP32 CAM for remote sensing and surveillance.
- e. IR sensors supports shorter range with maximum range of 40-50 cm indoors and around 15-20 cm outdoors, and hence its performance degrades with longer distances. While PIR sensors have ranges of up to 10 meters (30 feet).
- f. IR Sensors works in a straight path whereas the PIR sensor works in the trajectory path.
- g. PIR sensors are excellent if you want to detect the general movement as they only detect infrared radiation and do not emit it from an LED.

ADVANTAGES:

- Improves security level.
- Ultra-low power consumption.
- Can work 24x7 without any problem.
- Whole system will work automatically, reduces the work for humans.
- Ideal choice for detecting motion in home, office, and factory surveillance systems to improve public safety.

BLOCK DIAGRAM:

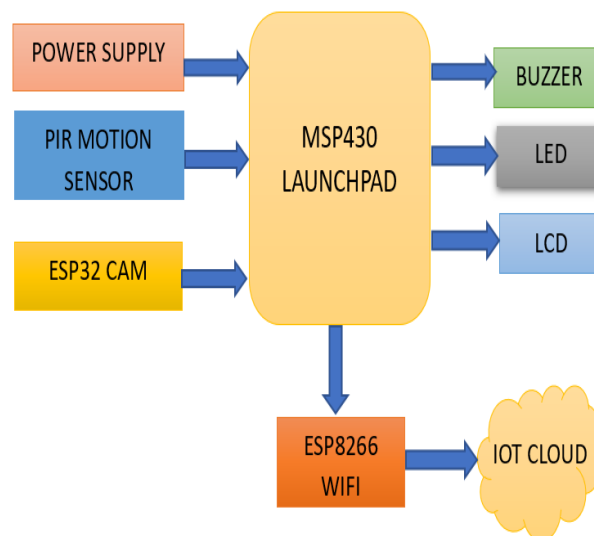


Fig 1: Block Diagram of Proposed Model

IV. RELATED WORK

a. **MOTION DETECTION AND ANALYSIS WITH FOUR DIFFERENT DETECTORS** by Ching Yee Yong, Rubita Sudirman and Kim Mey Chew

The authors define motion as a change in the speed or vectors measurement of an item or objects in the field of vision. Motion detection can be accomplished through the use of electronic or mechanical devices that interact with or measure changes in the supplied environment. A monitoring system is developed in this study by merging motion detection technology with modified commonly known algorithms written in C sharp and Matlab. The outcomes of this study are expected to be informative and beneficial in aiding users with motion detection and analysis. Four unique motion detectors' performance is being compared. The Morph filter provides a more accurate and smooth detection in three trials at three different rates of motion. In conclusion, an effective motion assessment and monitoring system has been developed for the improvement of the motion detection ability.

b. **PIR SENSOR BASED SECURITY SYSTEM** by Sanikommu Umamaheswari

This paper describes a security system based on passive infrared sensors (PIRs). Using this sensor, we can save power, have effective management at a cheap cost, and only need a little amount of memory space. When an intruder or person passes through the system or site where it is installed, the PIR sensor

detects a change in infrared radiation levels. Changes in voltage are induced by changes in radiation levels, and the signal is amplified with this voltage, resulting in the generation of sound. As a result, it is useful in a number of applications and industries. When compared to the present system, this sort of technology offers various advantages.

Several criteria have been used to select a security system required to safeguard a facility. The chief among all these has been the cost of implementation, remote monitoring and efficiency. The MSP430 as a microcomputer has immense functionality. The choice of the MSP430 gives fast, reliable, cost-effective and remote surveillance system. One distinguished feature of this research work over all other systems is the access to the video and sending the alert to the owner. Two of those being internet based and remote access from anywhere in the world.

The system, on intrusion alerts the owner by sending alert through IoT, buzzes the alarm located at a convenient distant by blinking LED. The system is characterized with efficient video camera for remote

sensing and surveillance, featured with stream live video which be accessed in distinct ways

This section introduces a brief description of the system.

design major components which include (a) MSP430 Controller (b) PIR motion sensor, (c) ESP32 CAM

(f) Web server

(a) MSP430 Controller

For the microcontroller (MSP430) based security system using motion detector to be utilized for effective monitoring and alerting. The MSP430G2553 series are ultra-low-power mixed signal microcontrollers with built-in 16-bit timers, up to 24 I/O capacitive-touch enabled pins, a versatile analog comparator, and built-in communication capability using the universal serial communication interface. In addition, the MSP430G2553 family members have a 10-bit analog-to-digital ADC.

FEATURES:

- Low supply-voltage range: 1.8 V to 3.6 V
- Ultra-low power consumption
 - Active mode: 230 μ A at 1 MHz, 2.2 V
 - Standby mode: 0.5 μ A
 - Off mode (RAM retention): 0.1 μ A
- 16-bit RISC architecture, 62.5 ns instruction cycle time
- Ultra-fast wake-up from standby mode in less than 1 μ s
- 16-bit RISC architecture, 62.5 ns instruction cycle time
- Basic clock module configurations
 - Internal frequencies up to 16 MHz with four calibrated frequency
 - Internal very-low-power low-frequency (LF) oscillator
 - 32 kHz crystal
 - External digital clock source



Fig2: MSP430 Launch Pad

(b) Passive Infrared motion sensor

All objects, whether it is living or not, whose temperature is anything above absolute zero emits infrared radiation. This radiation (energy) is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The word behaviour of the detector, which receives infrared radiation passively. The sensors could gather data relative to the acceleration, velocity, and position of the object.

“passive” in the term “passive infrared” refers to the

A PIR motion detector consists of a passive IR receiver that measures ambient temperature. If this temperature changes rapidly, like when a person walks across its field of view, an alarm condition is sent to the controller. This functionality is quite distinct from active infrared detector in the sense that the passive infrared detector doesn't emit the infrared ray; it receives the infrared ray that is emitted by objects. PIR Motion detector is very easily interfered by the variation of heat sources and sunlight, on that note, PIR Motion detector is considered to be more suitable for the indoor movement detection, which is characterized of closed environment. Figure 3 illustrates a typical schematic diagram of the passive infrared motion sensor.

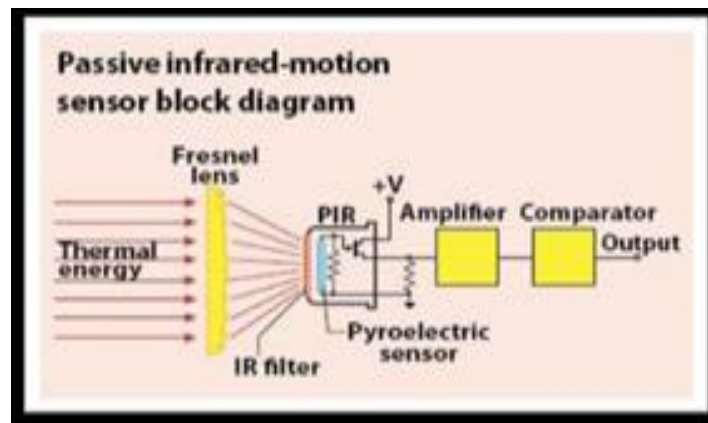


Fig 3: Schematic diagram of the passive infrared motion sensor.

(c) ESP32 CAM

The ESP32 CAM WiFi Module Bluetooth with OV2640 Camera Module 2MP For Face Recognition has a very competitive small-size camera module that can operate independently as a minimum system with a footprint of only 40 x 27 mm; a deep sleep current of up to 6mA and is widely used in various IoT applications.

(d) Web server

A web server is a system that delivers content or services to end users over the internet. A web server consists of a physical server, server operating system (OS) and software used to facilitate HTTP communication

- **Energia Tool - Software**

Energia is an forerunner and communal- focussed software and applied to the computer network framework in all the platforms. It is Sustained for the Installing the computer software. It compromises an high-tech and authorize the environment which is easy of use. It is applicable to all the API's & default and lending library files for encoding. It aids a help for the working of diversity of TI workstations.

- **The Open IoT Platform-THINGSPEAK**

Thing Speak is an IoT analysis tool that analyse the information, to data set and get the visualization of the data. It reside information streams with cloud. That shipped information to factor state out of your devices, make on the spot visualizations of reside data, and ship indicators utilizing web products and enjoy twitter.

V. RESULTS

Step 1: power on the controller and wait for about 50-60 seconds for PIR sensor to calibrate and ESP32CAM to turn on, that provides live surveillance. Figure 4 shows the calibration of PIR sensor.

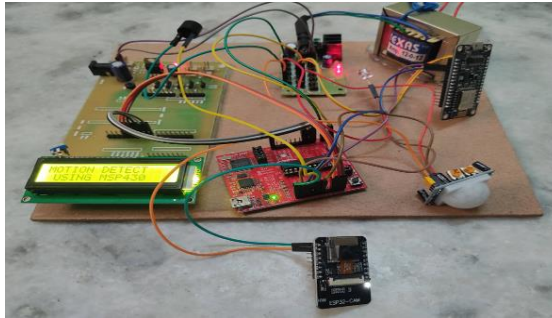


Fig 4: Waiting for PIR sensor to calibrate

Step 2: when NO motion is detected by PIR sensor, then the buzzer and LED is off indicating that no motion is detected and LCD displays a message " safe zone " as shown in figure 5.

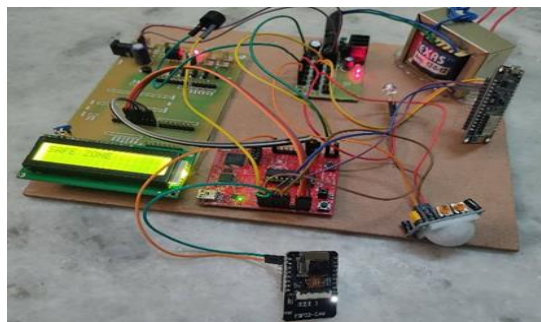


Fig 5: Indication of LED when no motion is detected by PIR sensor

Step 3: when motion is detected by PIR sensor, the the buzzer will get triggered by blinking the LED to indicate the motion detection and LCD displays a message "motion detected" as shown in Figure 6.

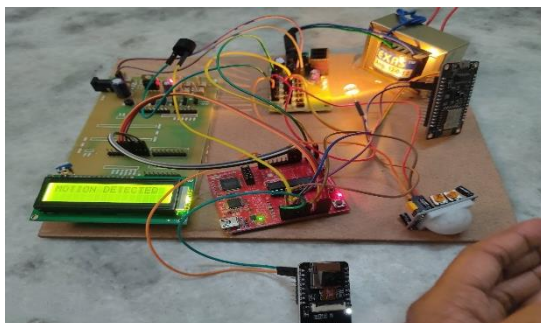


Fig 6: Indication of LED when motion is detected by PIR sensor

The ESP32 CAM is connected to WIFI to provide live surveillance. This provides 3 features. These includes: start streaming, get still, stop streaming. Figure 7 and 8 shows the output of ESP32 CAM.

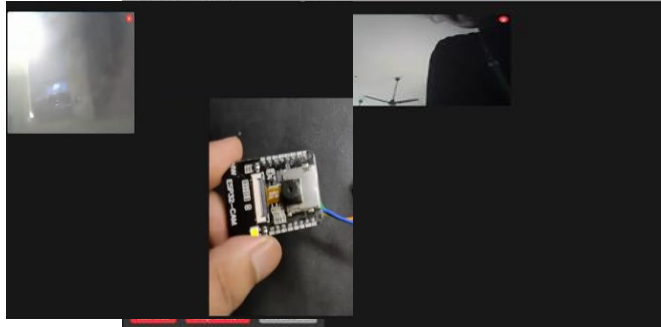


Fig 7: The output of ESP32CAM on clicking start streaming



Fig 8: The output of ESP32CAM on clicking get still

Once the motion is detected by PIR sensor, then automatically an alert will be sent to the owner through Think Speak IoT Platform, which helping authorities in case of any suspicious moment or activity. Figure 9 shows the alerts received by owner when motion is detected.

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{\"created_at\": \"2023-02-16T10:02:08Z\", \"entry_id\": 13, \"field1\": \"SOME_ON E_TRY_TO_ENTER_INTO_HOUSE\"},  
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Fig 9: Received alerts on intruders detection.

VI. CONCLUSION

With an ever improving awareness of the importance of security in both residential and commercial buildings, homeowners, employers and workers are on the lookout for an efficient surveillance system which is cost-friendly. Detection of intrusion into the home or office is made possible using passive infrared sensors. Here by we come to the end of the paper “AN IOT BASED MOTION DETECTOR USING MSP430” which helps us to detect the motion in restricted areas or homes or offices. The proposed system is recommended for security applications due to its efficiency and effectiveness in surveillance application.

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