

AMRITA VISHWA VIDYAPEETHAM
AMRITA SCHOOL OF ENGINEERING, COIMBATORE, 641112



BONAFIDE CERTIFICATE

This is to certify that the Open Lab project report entitled '***THEFT DETECTION USING PIR SENSOR***' submitted by **Nigil M R (CB.EN.U4ECE19136)** in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Electronics and Communication Engineering is a Bonafide record of the work carried out at Amrita School of Engineering, Coimbatore.

Chairperson ECE
Dr. M. Jayakumar

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ABSTRACT

Nowadays the need to build an affordable and effective theft detection system is a necessity with the events of intrusion or burglary on the rise and as we are approaching towards making our house a smart house in this digital era. The demand for such a system is going to increase rapidly if it comes with a feasible price to every household. In most of the prevailing intrusion detection systems, motion sensors are used to detect the presence of an intruder. In this model, the passive infrared sensor (PIR) is used to detect motion. This project aims at providing home security for theft by implementing a smart surveillance system using ESP32 and PIR sensor. Lately, the IoT technology has played a major role in many fields by automating the application. The sensor used in this paper is PIR (Passive Infrared Sensor). PIR is an electronic sensor that detects the motion of objects, by measuring the level of IR radiation. This principle is used to detect the stranger entering the house. A camera is used to capture the live action inside the house. The camera and PIR sensor are integrated in such a way that any movement in the room switches ON the camera automatically. The house owner can view the live stream of motion that takes place inside the house by the stranger. The owner is made aware about the stranger's action via telegram application. The proposed model provides a smart home automation system for theft detection.

1. INTRODUCTION

Technology has made lots of changes in the world. The next century will become more comfortable based on the bright rise in technologies. The recently emerging technology in the real world is IoT. This technology has bright growth to make the complete system a smart one. The development was the smart surveillance system. There were lots of inventions developed in the field of IoT and the most recognized one was the smart surveillance system development. There were lots of advancements in the wireless technologies such as domain, cloud and many other technologies which were included in the system to show something new. IoT will include many devices such as electronic, electrical and IT related works. Smart surveillance system consists of many systems that have to be monitored properly and must be handled carefully so that the system does not fail for any improper handling of the devices. The issue that people face after many days is the problem of connectivity. Among many IoT applications the smart surveillance system plays a vital role in realizing the smart cities. The Government of India has proposed to develop many smart cities across the country which will create a huge demand for smart home automation solutions in near future. In smart surveillance the word "smart" means context aware that can be realized using IT and IOT. This work uses the smart surveillance system to effectively monitor the movement of people outside the premises to differentiate if it's a thief or not. This can be simply done by using a Passive Infrared (PIR) Sensor to sense the motion and convey the information through a picture via a telegram bot so that the owner of the premise can come to a conclusion about the stranger (if he or she really is!). Once the owner figures it out if the person is a burglar, he or she can contact the nearby police station for an immediate action. Even this can be automated for future work.

2. DESIGN AND IMPLEMENTATION

| Components | Specifications | Quantity |
|-------------------|----------------|----------|
| ESP32 Controller | - | 1 |
| PIR Sensor | - | 1 |
| Resistors | 10 kOhms | 2 |
| USB to TTL Module | CP2102 | 1 |
| Transistor | BC547 | 1 |
| Jumper Wires | - | 4 |

3. COMPONENTS

3.1. Passive Infrared Sensor (PIR)

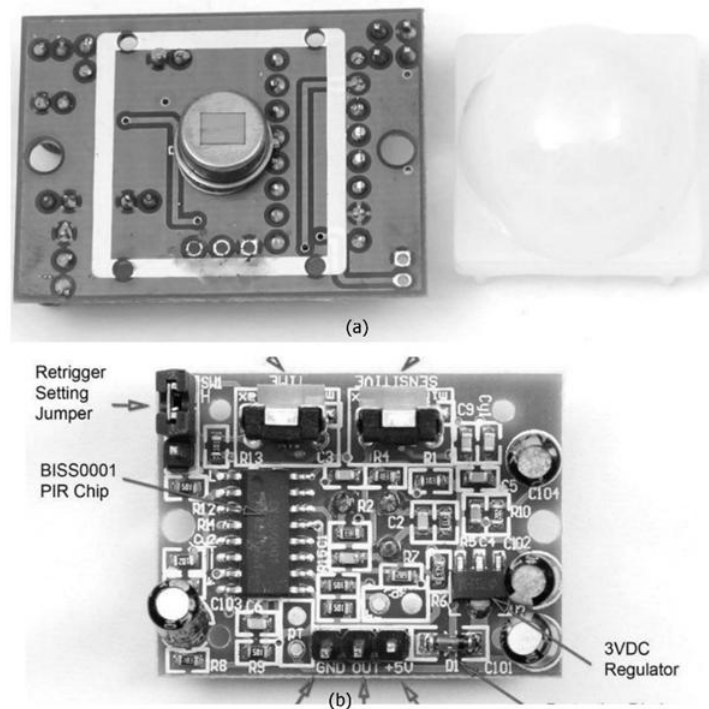


Figure 1. PIR sensor top view

(a) PIR sensor bottom view along with (b) BISS0001 PIR chip

PIR sensor allows to sense motion. Usually implemented to detect the motion of humans in or out of the range of the sensor range. They are small, inexpensive, low power, easy to use and don't wear out. Due to their long-lasting capabilities, these PIR sensors are commonly found in appliances and gadgets used in home and business. These PIR sensors are sometimes called Pyroelectric (heat) or IR motion sensors.

PIR sensors detect the low-level IR radiation emitted. The sensor is covered in a domelike structure as shown in **Figure 1a** which is used to converge the IR from the source such that when there is a change in gradient, the sensor detects the motion.

The sensor in motion detection of the PIR is split in two halves because the objective of the sensor is to detect the motion, not the average IR levels. Along with the pyroelectric sensor bunch of circuitries as shown in **Figure 1b** make up the bottom of the PIR sensor. It is integrated with BISS0001 (Micro Power PIR Motion Detector IC), an inexpensive chip that takes the output of the sensor and

does ADC processing, so that the output is a digital output pulse from the analog sensor. PIR sensor has a digital pulse high output of 3V when triggered and digital low when no motion is detected. The resistors and capacitors in the implementation model determine the pulse length of the digital output.

The sensitivity range of the PIR sensor extends up to 20 feet (6 meters) and 110° x 70° detection range. It is operated in a 5-12V input voltage, which is converted using voltage regulators to 3.3V. The PIR sensor module also contains various other components like RE200B which is the infrared sensing element, NL11NH is the Fresnel lens (covering dome).

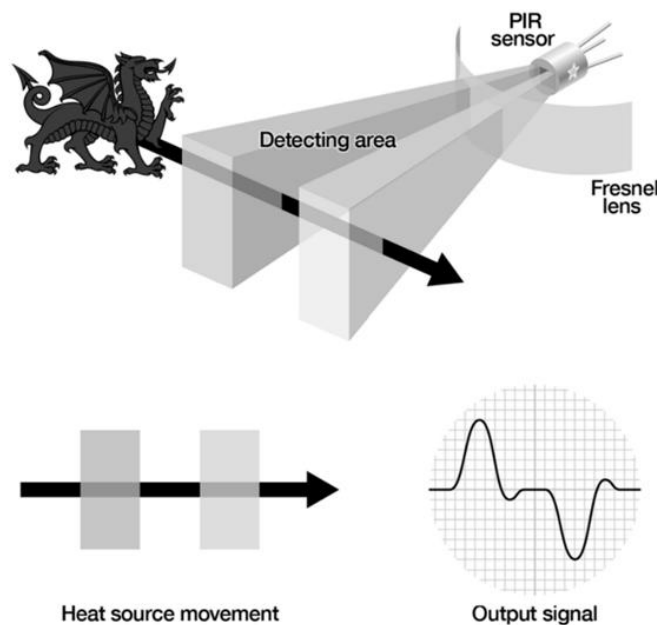


Figure 2. Working of PIR sensor and analog output

PIR sensors are more complicated when compared to other optics and pyro sensors because they are multivariable that affects the sensor input and output. The PIR sensor has two slots in it, each slot is made of special material that is sensitive to IR.

When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room. When a warm body which emits IR like human or animal passes by, the sensor first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens. Whereby the sensor generates a negative differential change. These change pulses are the detected motion. This is shown in **Figure 2**.

3.2. ESP32 CAM Controller

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides an onboard TF card slot. The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.



Figure 3. ESP32 Controller module schematics

This module has some features which includes:

- Onboard ESP32-S module, supports WiFi + Bluetooth
- OV2640 camera with flash
- Onboard TF card slot, supports up to 4G TF card for data storage
- Supports WiFi video monitoring and WiFi image upload
- Supports multi sleep modes, deep sleep current as low as 6mA
- Control interface is accessible via pin header, easy to be integrated and embedded into user products

3.3. CP2102 USB to TTL Module

This is an USB2.0 to TTL UART Converter module which is based on CP2102 Bridge by SiLabs. This module can be used with Laptop's which don't have standard serial port. This module creates a virtual COM port using USB on your computer which can support various standard Baud Rates for serial communication. You just need to install the driver using a setup file which automatically installs correct driver files for Windows XP/Vista/ 7.

After driver installation, plug the module into any USB port of your PC. Finally, a new COM port is made available to the PC. The feature which makes it more convenient is the TTL level data i/o. So you don't need to make a RS232 to TTL converter using chips like MAX232. The Rx and Tx pin can be connected directly to the MCUs pins (assuming 5v in/out).

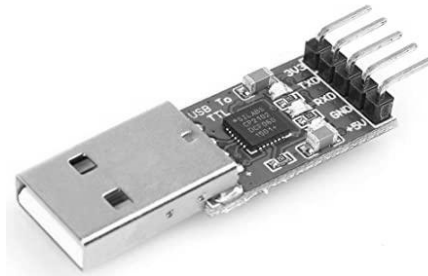


Figure 4. USB-TTL UART Module - CP2102

4. BLOCK DIAGRAM

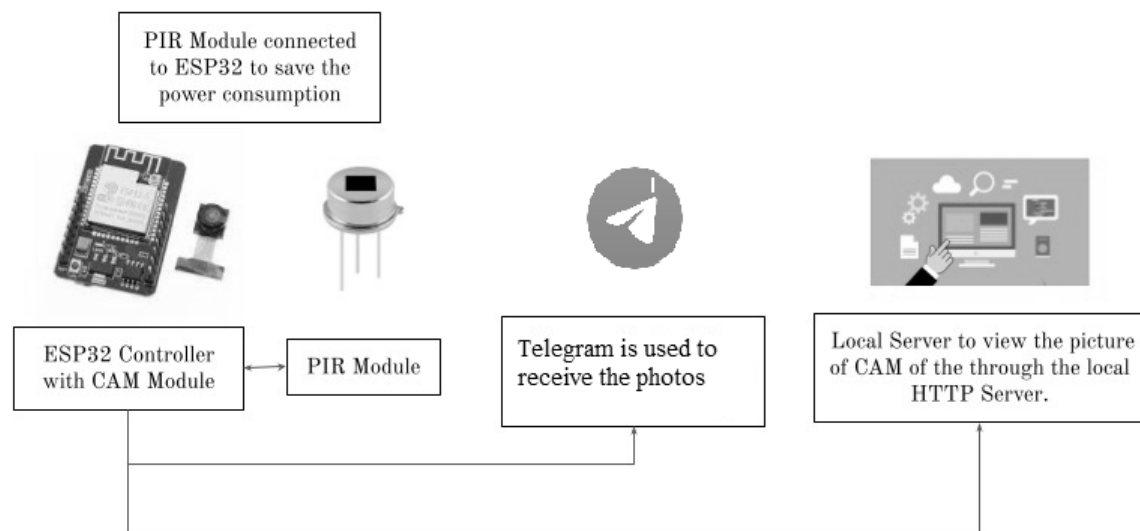


Figure 5. Block Diagram

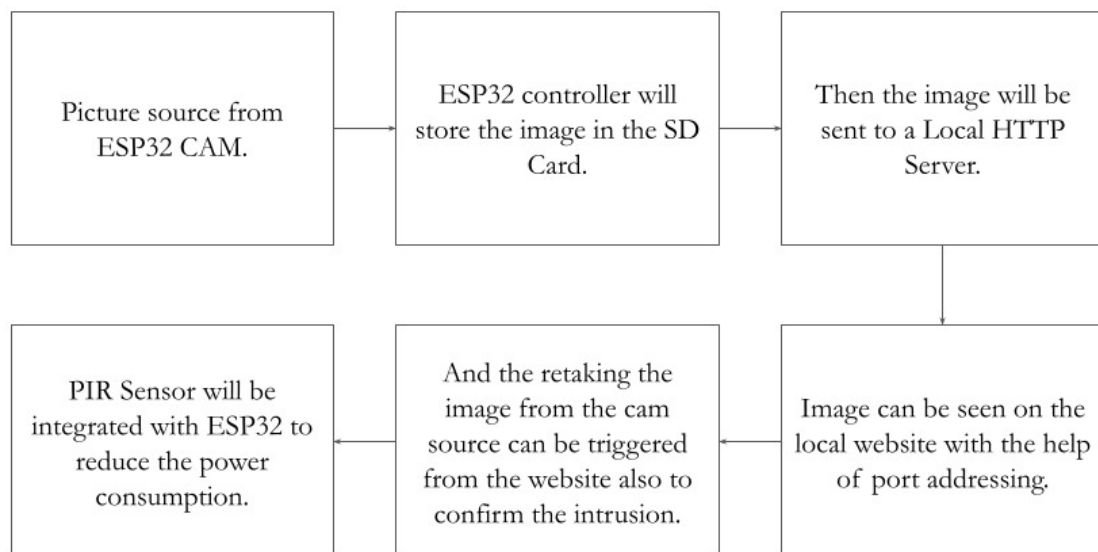


Figure 6. Flowchart

5. RESULT

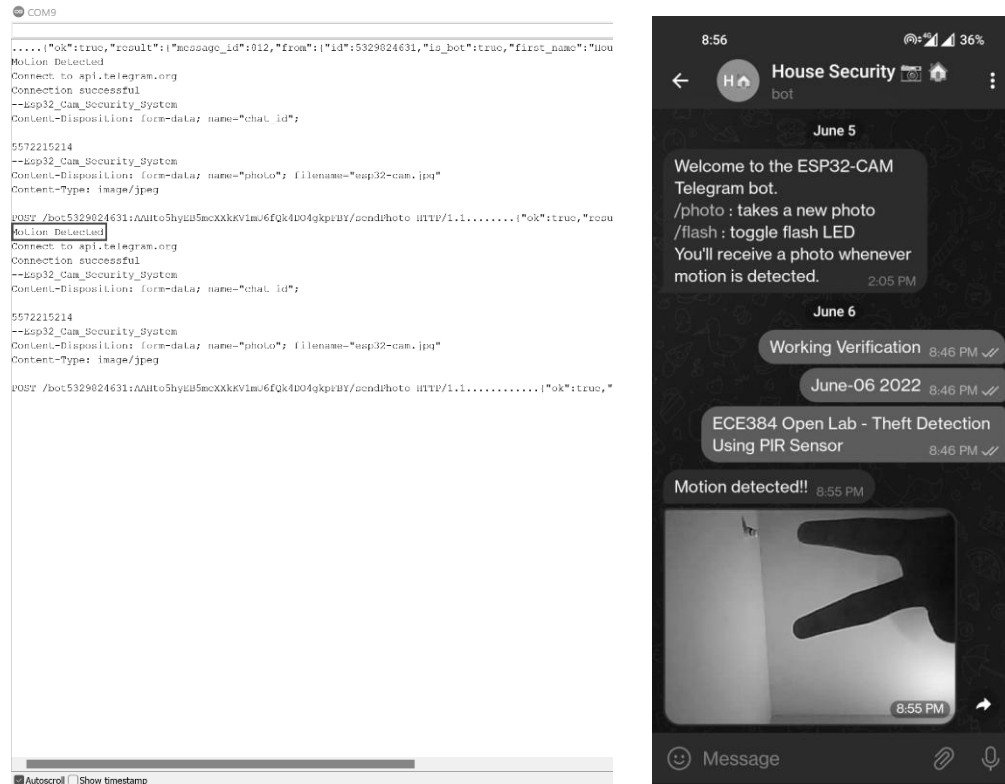


Figure 7. Results in serial monitor and photographic output when motion is detected.

From **Figure 7** it can be seen that whenever there is a motion in the proximity of the theft detection device, the camera automatically photographs the intruder and sends the photograph to the owner. Therefore, the implemented theft detection system is working fine.

6. CONCLUSION

The project has been designed as a smart surveillance system capable of capturing video, images, recording it and transmitting to a mobile phone. It will provide a safer environment for the owner to avoid being lost. It is encrypted and authenticated on the receiver side, so that it will offer only the owner so that he could view the details. Necessary action could be taken within some part of time in the case of any burglary activities taking place. In Future a copy will be sent to the owner and to the police station simultaneously and implementation of automatic iron gate lock will be implemented. This system consumes less power, is of low cost, easily operable and easy to install in comparison to existing intrusion detection systems. Finally, when the user receives the text alert via telegram, he can use the IP camera to access the live feed remotely. This smart system is implemented in cities where WI-FI technology and internet access are available.