PIR Motion Capture Security System

1. SYSTEM DESIGN

The sensor can detect the presence of intruders. Upon detection of IR, PIR sensor generates the output in the form of electrical signal. Although the output from the sensor is of few volts, it could be amplified to required voltage using amplifier circuit and could be used for actuating lighting system and the webcam. The lamp and webcam could be turned ON when the PIR sensor is activated and could remain OFF when the sensor is idle. This way, the energy consumed by the overall system could be minimized. Also the cost of system could be far less than the security system available in the market. With this hypothesis, we have proposed a simple low power PIR based security system. It consists of connecting lighting system and webcam to the PIR senor and software development for the recording video captured by webcam on the computer. The system works in the following steps:

i. The software developed is kept running and checks if the cam is turned ON.

ii. When an intruder comes in the detection range of the PIR sensor, the sensor generates an output of 3.3 volts.

iii. This output is further amplified and is used for activating the relay of the lighting system and the webcam.

iv. Once the lamp and webcam are actuated with the output from the amplifier, software finds the webcam is turned   ON.

v. The software starts to capture the photo by the esp32 cam

vi. After the intruder leaves the detection range of the sensor, there is no output from the sensor. Therefore, it turns   OFF the webcam. The photo captured will be sent to telegram.

vii. Every time when the intruders come in the detection range of the sensor, the above steps from step 2 to step 6 repeats.

2. Componenets

A. Hardware implementation

- ➢ TTL Programmer
- ➢ PIR Motion Sensor
- ➢ ESP32 CAM
- ➢ Breadboard
- ➢ Jumper Wires
- ➢ Battery

➢ **TTL Programmer**

The USB TTL Serial cables provide connectivity between USB and serial UART interfaces. There is a   range of FTDI cables are available. This USB to TTL Serial Converter also works on different output voltages like 5V, 3.3V.This all cables FTDI FT232R device integrated. This works within the cable USB type connector, which provides access to UART Transmit (Tx), Receive (Rx), RTS#, CTS#, VCC (5V) and GND connections.[2]
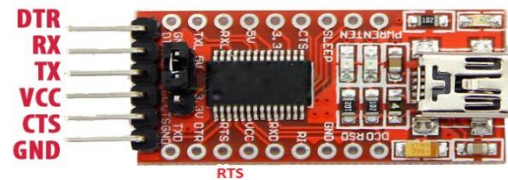
Basic Hardware of USB to TTL Serial Converter

Fig 1: TTL PROGRAMMER

Pin functionality

- o   RX – Used to receive the serial data.
- o   DTR – Reset the other hardware device
- o   TX – Used to transmit the serial data.
- o   VCC – Provides 5V or 3.3V voltage output as per the requirement
- o   CTS – Enable or disable the programming mode of the device
- o   GND – Ground pin

PIR Motion Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.PIRs are basically made of a pyroelectric sensor (which you can see below as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. act, It has a low frequency tone of 2khZ and piezoelectric material is coated with water and dust resistant material.[3]
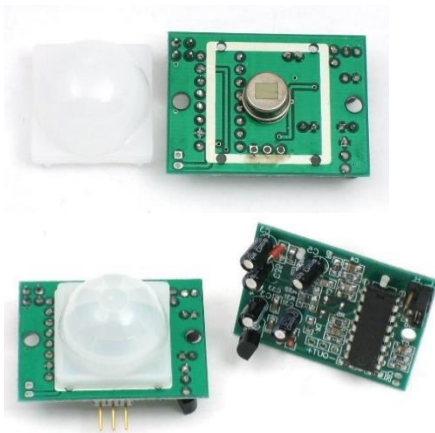

Fig 2 : PIR SENSOR

ESP32 CAM

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides 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.[4]

Features
- 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.

Fig 3: ESP32 CAMERA

Breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.

Fig 4: BREADBOARD

B. Software Requirement

- ➢ ARDUINO IDE
- ➢ TELEGRAM APPLICATION

  ➢ **Arduino IDE**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.[5]

  ➢ **Telegram Application**

Telegram is a freeware, cross-platform, cloud-based instant messaging software. The service also provides end-to-end encrypted video calling, VoIP, file sharing and several other features.
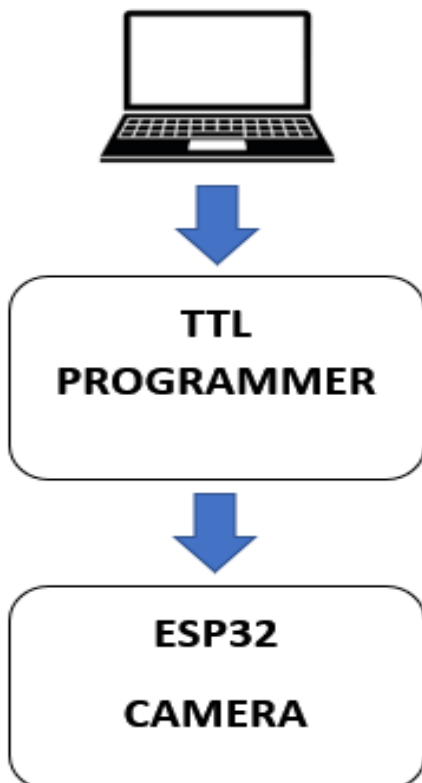
3. Methodology

A Home Security is needed to be designed for the safety, this is controlled with help of internet using the ESP32 CAM module. It have PIR Motion sensor fixed to it in order to detect the motion. When PIR Sensor produces warning alert to the ESP32 CAM and immediately it take the photos and it will send to the telegram application with the help of internet. An Overall block diagram is shown in Fig 5, Now let's see how photo is sent to telegram, In telegram I created an TELEGRAM BOT and I got an API KEY and with the help of that api key, I created a Code.I uploaded the code to ESP32 module using TTL programmer. An block diagram is shown in Fig 6.

When Motion detected the pir sensor send a signal to ESP32 module and esp32 take photo and send to telegram user

I created using API key over internet. It can send to telegram application no matter where we are in the world. An block diagram is shown in Fig 6. An Overall block diagram is shown in Fig 1 and 2 and the system consists of various electronic parts. The

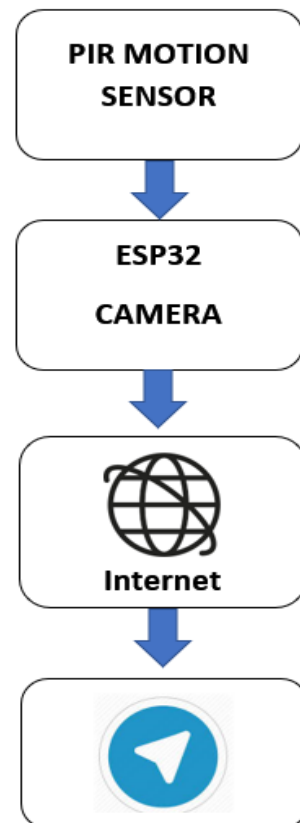system includes the brain of the robot, ESP32 Cam, PIR Sensor sensor, TTL Programmer.

Fig 5

Fig 6

4. Results and discussion

In this PIR Sensor Based Security System, we have used low power, low cost PIR sensor that are 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 webcam in our project which could only capture the area facing to it. The system may not work if the intruders enter from other side. The software developed for the recording of the video captured by the webcam is experimented only with a webcam connected to the system also there was some delay in recording video captured by the webcam. Considering all above points, followings are our future works set to improve the system:
• Work on to reduce the delay time in recording the video captured by webcam.
• Use more than one webcam and integrating these webcams with the system.
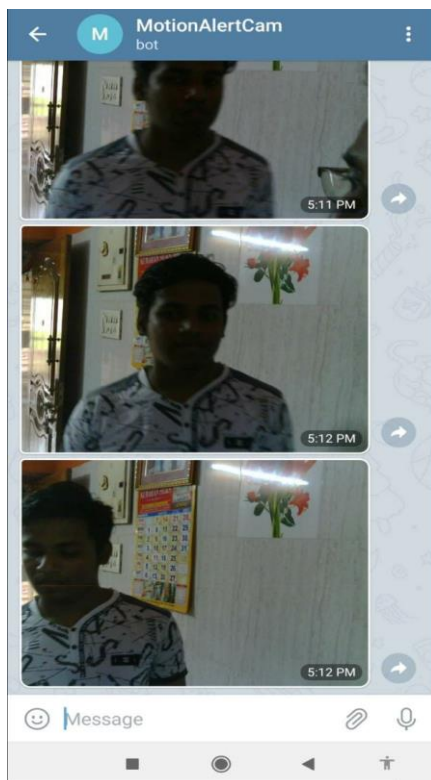• Work on the software to record videos from many webcams installed.

Fig 6 - PROJECT   SETUP

5. Conclusion

Advancement in innovation and technology has significantly improved security in our regular day to day existence. This research focuses on how to configure a simple home security framework using a PIR sensor (Passive Infra-Red) in light of a microcontroller. This safety will work if the PIR (Passive Infra-Red) sensor recognizes any individual that would not like to go into the house, and afterward the micro-controller process and instructs a mobile phone to send an alarm signal in the form of Short Message Service (SMS) to the telegram. This work has shown that utilization of Sensors ought to be utilized in shops and homes in Nigeria and African nations in this way. This task can be of acceptable use and be mass produced economically to be applied in different houses, shops, and even in vehicles.

Fig 7 - OUTPUT