

Arduino based security system using esp32 camera microcontroller with telegram notifications

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Abstract - Along with the times and technology, the need for fast information is needed in various sectors of life, thus supporting the performance of these sectors, one of which is the security aspect, especially in security at home, considering that there are many things that happen such as crimes and negligence of residents of the house that can cause problems such as fires. In this case, a system is needed that can visually monitor the condition of the room from remote location. This is useful for the surveillance process so that if there is a crime in the surveillance room, the system can monitor the state of a room via a smartphone. This study aims to create a device that is able to increase the security of the room at home by utilizing the Esp32 cam as a microcontroller and the PIR sensor as a detector of movement when crossing the corner area of the sensor. In this study, the ESP32 cam is used as the main brain of the system which will read data from the PIR sensor. The data from the sensor will be sent to the server by Esp32 cam. The test results have been running in accordance with the designed system. So that pictures can be sent to the telegram application with a 100% success percentage. **Keywords**—Passive Infrared Sensor (PIR), Esp32 cam microcontroller, Arduino (UNO), Quality of Services (QoS), telegram applications

keywords - security system, Arduino, iot, esp32 cam, telegram, bot.

I. INTRODUCTION

Security has become a very important requirement, especially for security at home, considering that there are many things that happen such as crimes and negligence of residents of the house that can cause problems such as fires. In this case, a system is needed that can visually inform the state of the room from a remote location. This is useful for the surveillance process so that if there is a crime and fire in the surveillance room, the system can inform the state of a room via a smartphone[1][2].

Camera technology has now become one of the most important technologies as a room monitoring medium. Images present information that can be easily seen by the user. In the field of security, technology in the microcontroller plays an important role for monitoring and controlling[3][4]. In practice, room monitoring technology already exists, but its application to houses that are often left out by residents has its own challenges, how to make a simple home security device that is able to monitor the state of the room and control the side of the door[3]. There is a microcontroller that can be used in terms of room monitoring is the Esp32 cam.

In practice, room monitoring technology already exists, but its application to houses that are often left out by residents has its own challenges, how to make a simple home security device that is able to monitor the room and control the side of the door[4]. Based on these problems, it is necessary to conduct research to create and program a room security monitoring system using Esp32 Cam, where photos from image shooting can be viewed through mobile devices such as laptops and smartphones that are connected to the network so as to increase home security for the owner [5][6][7]. In carrying out room surveillance and remote control of home security, certain customizations of security devices are needed so that residents of the house can manage home security facilities according to the system designed[8].

II. LITERATURE SURVEY

1. Bluetooth based home automation system using cell phones:

In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The password protection is provided so only authorized user is allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicate the status of the device.

2. Zigbee based home automation system using cell phones:

To monitor and control the home appliances the system is designed and implemented using Zigbee. The device performance is record and store by network coordinators. For this the Wi-Fi network is used, which uses the four switch port standard wireless ADSL modern router. The network SSID and security Wi-Fi parameter are preconfigured. The

message for security purpose first process by the virtual home algorithm and when it is declared safe it is re-encrypted and forward to the real network device of the home. Over Zigbee network, Zigbee controller sent messages to the end. The safety and security of all messages that are received by the virtual home algorithm. To reduce the expense of the system and the intrusiveness of respective installation of the system Zigbee communication is helpful.

3. GSM based home automation system using cell phones:

Because of the mobile phone and GSM technology, the GSM based home automation is lure to research. The SMS based home automation, GPRS based home automation and dual tone multi frequency (DTMF) based home automation, these options we considered mainly for communication in GSM. In figure shows the logical diagram the work of A. Alheraish, it shows how the home sensors and devices interact with the home network and communicates through GSM and SIM (subscriber identity module). The system use transducer which convert machine function into electrical signals which goes into microcontroller. The sensors of system convert the physical qualities like sound, temperature and humidity into some other quantity like voltage. The microcontroller analysis all signal and convert them into command to understand by GSM module. Select appropriate communication method among SMS, GPRS and DTFC based on the command which received GSM module.

4. Wi-Fi based home automation system using cell phones:

Wi-Fi based home automation system mainly consist three modules, the server, the hardware interface module, and the software package. The figure shows the system model layout. Wi-Fi technology is used by server, and hardware Interface module to communicate with each other. The same technology uses to login to the server web based application. The server is connected to the internet, so remote users can access server web based application through the internet using compatible web browser. Software of the latest home automation system is split to server application software, and Microcontroller (Arduino) firmware. The Arduino software, built using C language, using IDE comes with the microcontroller itself. Arduino software is culpable for gathering events from connected sensors, then applies action to actuators and preprogramed in the server. Another job is to report the and record the history in the server DB. The server application software package for the proposed home automation system, is a web based application built using asp.net. The server application software can be accessed from internal network or from internet if the server has real IP on the internet using any internet navigator supports asp.net technology. Server application software is culpable of, maintain the whole home automation system, setup, configuration. Server use database to keep log of home automation system components, we choose to use XML files to save system log.

5. Home automation using RF module:

The important goal of Home Automation System is to build a home automation system using a RF controlled remote. Now technology is accelerating so homes are also getting smarter. Modern homes are deliberately relocating from current l switches to centralized control system, containing RF controlled switches. Today traditional wall switches situated in various parts of the home makes it laborious t for the end user to go near them to control and operate. Even further it turns into more problematic for the old persons or physically handicapped people to do so. Home Automation using remote implements an easier solution with RF technology. In order to accomplish this, a RF remote is combined to the microcontroller on transmitter side that sends ON/OFF signals to the receiver where devices are connected. By operating the stated remote switch on the transmitter, the loads can be turned ON/OFF globally using wireless technology.

6. Home automation using Android ADK:

The devices of home are associate to the ADK and the Connection is established between the Android device and ADK. The devices of house are link to the input/output ports of the board (EMBEDDED SYSTEM) and their current situation will have passed to the ADK. The microcontroller board (Arduino ADK) is based on the ATmega2560. It has a USB host connection to associate with Android based phones, and that is based on the MAX3421e IC. The two important features of Android Open Accessory Protocol 2.0(AOAP) are as follows: It has audio output that is from the Android device to the component and it also support for the component serves as one or more Human Interface Devices (HID) to the Android device. This paper depends upon Android and Arduino platform in which both are FOSS(Free Open Source Software). Including motion sensors for safety systems will detect an unauthorized action and it will automatically notice the user through cell phone or the security system.

III. METHOD

This section describes the type of research, research design, system design, preparation of tools and materials, as well as the determination of procedures and parameters for using facilities from "Design of a Security System Based on an Esp32 CAM Microcontroller with Telegram sending image notifications".

After the literature study process is complete, it is continued with system planning, at this stage it will be carried out to start activities in planning an overview of the system to be built. The tools and materials needed are PIR sensor, Esp32 cam microcontroller, and for the software needed, namely Arduino IDE, fritzing, and the telegram application on a smartphone to display the results. Then the next process is making a system, where at this stage a program is made such as Arduino programming, and both telegram applications and mechanical tools are made and enter the program on the device to be used, with the hope of getting the desired results. The next stage is to test the system, which will test the tool made as a whole, this

test is carried out to find out whether the tool is running according to plan or not. If there are still errors or errors, repairs and re-planning will be carried out. While the data collection process is needed to measure the maximum distance that cannot be accepted by the PIR sensor, the maximum distance of objects that cannot be accepted by the PIR sensor is 5M, the object distance on the PIR sensor can also affect the delay in the PIR response. Measuring the average delay in sending remote control commands, the remote control can be said to be able to respond to orders with an average delivery delay of 4.0975 Seconds, and the delay in Quality-of-Service. For testing the Quality of Service on Delay the value obtained is 0.0597 s. While the block diagram of the system can be illustrated In Fig. 1

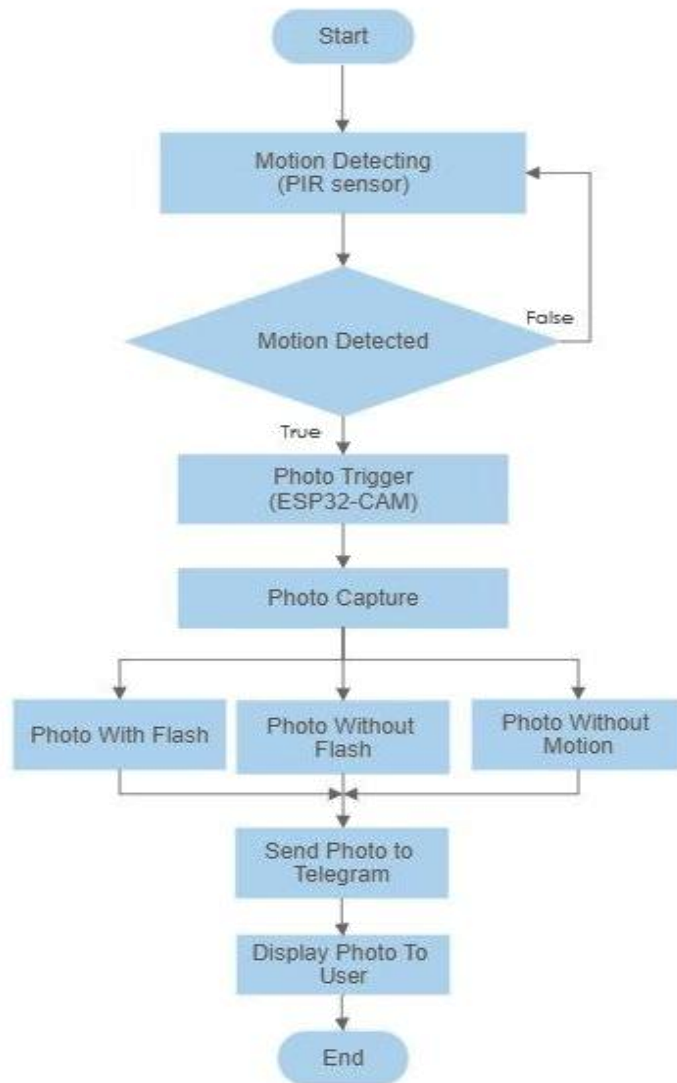


Fig. 1. Research flowchart

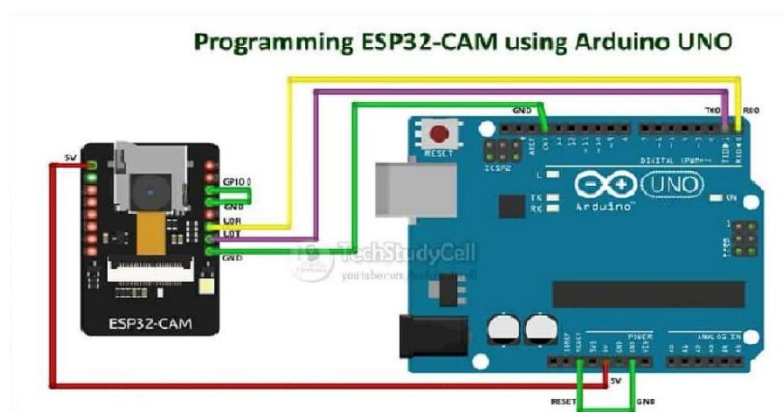


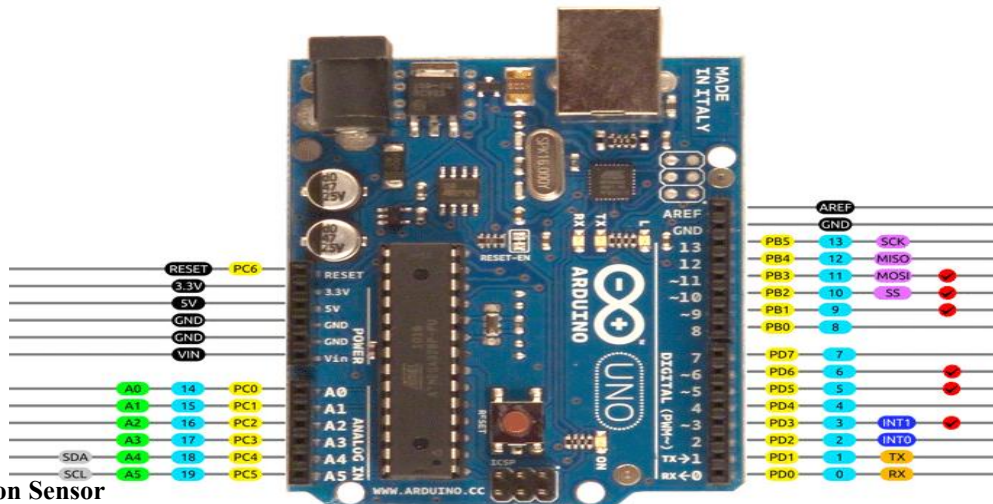
Fig. 2. System block diagram

In Fig. 2 the block diagram of the system will explain the work process of the system carried out during the study, the description of Figure 2 is as follows: first, the program will send a notification in the form of a text message to the user's telegram application. On PIR sensor serves as an active camera trigger if there is a moving object, the camera on the Esp32 cam will take pictures and then send the data to the cloud database [9]. Where the data that has been sent can be monitored remotely in real time on the telegram application, then the occupants of the house can look the door via a smartphone on the telegram application by utilizing the Esp32 cam which is connected controlled by the occupants of the house via a smartphone [11][12].

1. Arduino

Arduino is open source electronics prototyping platform based on flexible easy to use hardware and of software its intended for artists designers hobbyists and anyone interested in creating interactive objects its physical computing platform based in simple words Arduino is a small microcontroller bord with USB plug to connect to your computer and a number of connection sockets that can be wired up to external electronics such as motor relays light sensors diodes loudspeakers microphones etc. they can either be powered through the USB connections from the computer or from a 9v battery they can be controlled from the computer or programmed by the computer and the disconnected and allowed to work independently

Anyone can buy this device through online auction site or search engine since the Arduino is an open-source hardware designs and created their own clones of the Arduino and sell them so the market for the boards is competitive an official Arduino costs about ₹900 and a clone often less than ₹800.



2. PIR Motion Sensor

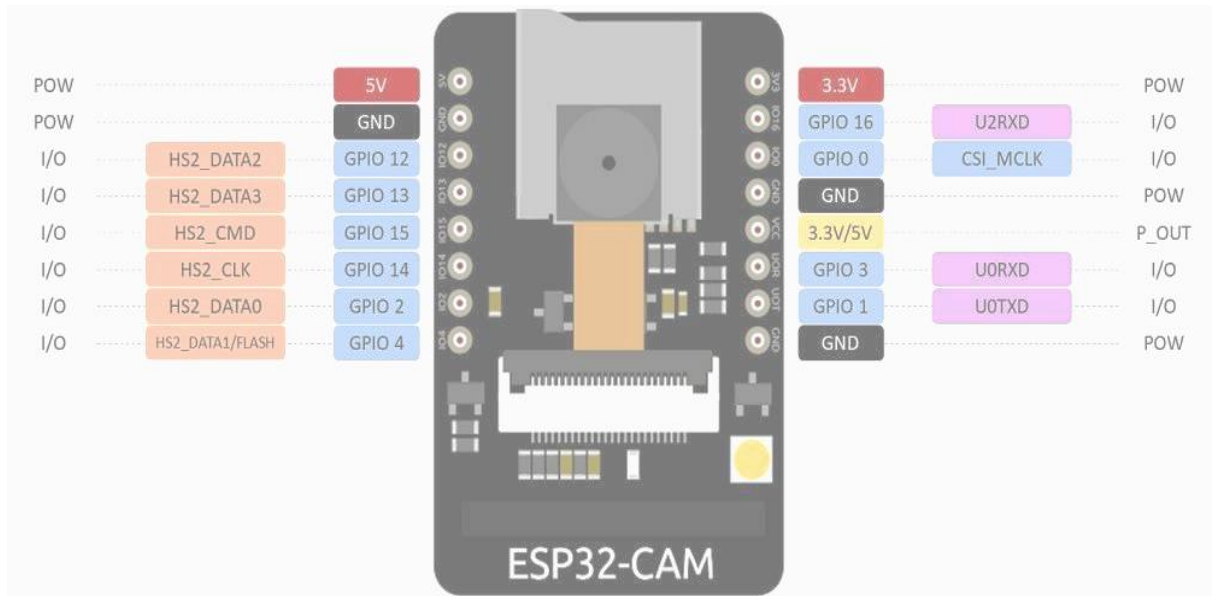
PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the



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.

3. Esp-32 cam



ESP
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low-cost ESP32-based development board with onboard camera, small in size. It is an ideal solution for IoT application, prototypes constructions and DIY projects. The board integrates Wi-Fi, traditional Bluetooth and low power BLE, with 2 high performance 32-bit LX6 CPUs. It adopts 7-stage pipeline architecture, on-chip sensor, Hall sensor, temperature sensor and so on, and its main frequency adjustment ranges from 80MHz to 240MHz. Fully compliant with Wi-Fi 802.11b/g/n/e/i and Bluetooth 4.2 standards, it can be used as a master mode to build an independent network controller, or as a slave to other host MCUs to add networking capabilities to existing devices ESP32-CAM can be widely used in various IoT applications.

It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals and other IoT applications. It is an ideal solution for IoT applications. Power supply for the module should be at least 5V 2A, otherwise maybe there would be water ripple appearing on the image. ESP32 GPIO32 pin is used to control the power of the camera, so when the camera is in working, pull GPIO32 pin low. Since IO pin is connected to camera XCLK, it should be left floating in using, and do not connect it to high/low level. The product has been equipped with default firmware before leaving the factory, and we do not provide additional ones for you to download. So, please be cautious when you choose to burn other firmware's.

IV. PROPOSED SYSTEM

The proposed system, presents the advancement of Internet technology in day to day life. The our system is suitable for real time monitoring and controlling applications. Proposed module implemented on ESP32, one of the best solutions to implement lot applications. The module outline was tried, actualized and the accuracy and working of the system was verified.

It uses the New concept of IOT (Internet of Things) where each devices is connected to a single Network it take input from sensor and process the data send it to other device for further use. It uses the Arduino, PIR Motion sensor, ESP32-CAM. To program these hardware Arduino IDE is used. Arduino is used for power purpose only PIR is used for detecting/capturing motion ESP32-CAM is used for capturing images. Then captured image is send to Telegram account of users. It working is simple for Implanting to room or offices.

First PIR detects the motion and sends a pulse of signal to ESP32 then ESP command its self as per programming to take the picture and then sends that picture to the Telegram account for the users uses.

Benefits of our system:

- Portable & Easy to implement
- Reduced storage cost
- No need for backup or storage
- Ease of maintenance.

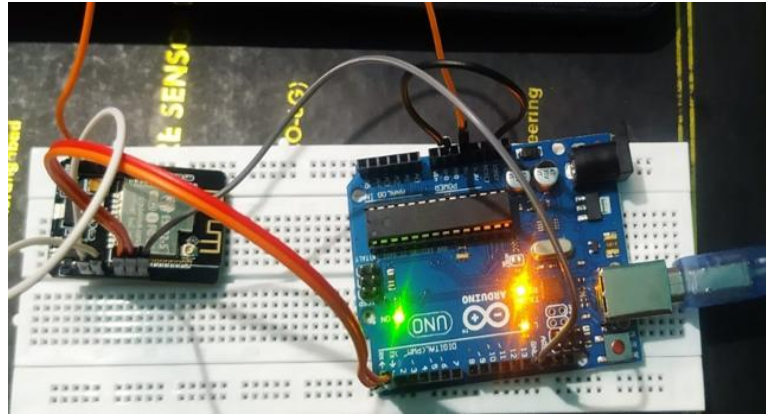


Fig. 3. Configuration of ESP-32 cam



Fig. 4. ESP-32 taking images when commanded

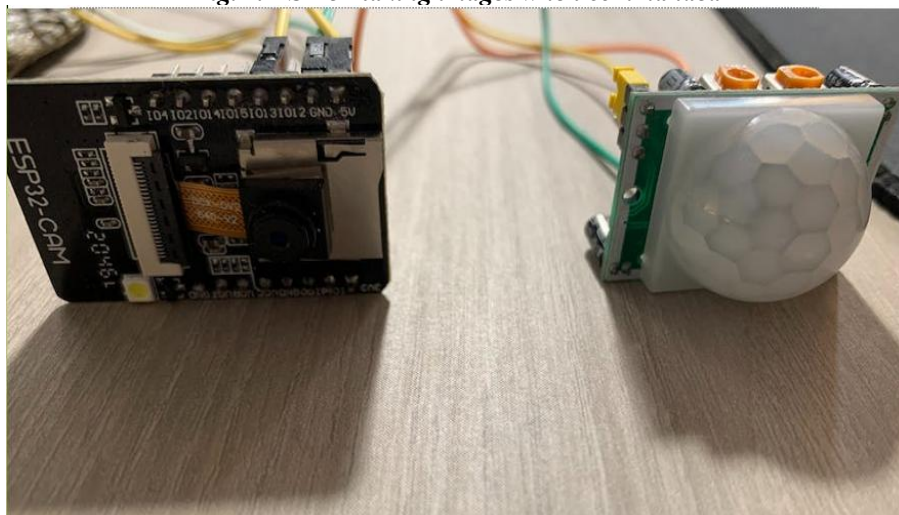


Fig. 5. ESP-32 take photo with PIR sensor and send photos to telegram



Fig. 6. ESP-32 taking photos when motion is detected from PIR sensor

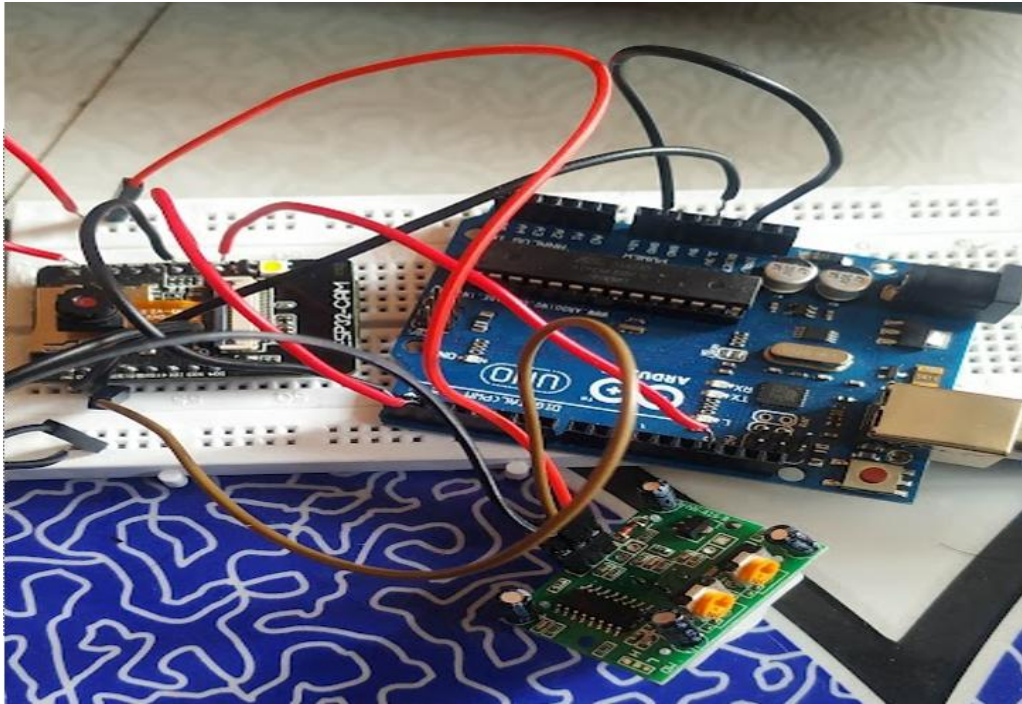


Fig. 7. All components (interfaced)

V. FUTURE SCOPE

Our Aim is to design and prototype a system to keep an eye on kids, pets, and older people. This system is used in other applications like theft monitoring using Telegram. The device can monitor the field all the time. In this way, this system helps in- home & office monitoring. After Survey of different home & office automation system future scope shows that there are various kinds of technologies used to implement this type of system. But for the future we have decided to implement various types of sensors to add more security in most affordable price.

- Monitor Doors Sensor (to detect any Forced/Unauthorized Entry)
- Detect Motion Sensor- (for intruder Alert)
- Sense Smoke/Fire/Flame Sensor- (to detect fire in house)
- Detect Gas leak Sensor

VI. CONCLUSION

The design of the security system uses the Esp32 Cam microcontroller which is connected to the PIR sensor runs very well with an average delay value of 3.37 seconds. Data transmission is transmitted via the internet by utilizing the wi-fi module on the Esp32 Cam microcontroller. If the smartphone is connected to the internet network, the system can send data to the Telegram application. For testing the Quality of Service on Delay, the average result is 0.0597s in the good category, while for packet loss testing the value obtained is 7.0% including the good category.

This proposed technique is Designed to operate a security Camera Using PIR motion sensor to Detect person. The motion sensor sends a pulse of signal to ESP32CAM and it takes image and send it to Telegram application for user.

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