

IOT BASED HOME SECURITY SYSTEM

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ABSTRACT

We are living in the fourth industrial revolution. Our life is becoming more comfortable and smarter with the help of rapid upgrade of technology. Internet of things (IOT) is playing a massive role in this. One of the major sides of IOT is a smart Electrical Appliances. As we are in the era of never-ending growth of the internet and its application, smart home system or home automation system is highly increasing to provide comfort in life and improving the quality of life. In this project, we present an IOT based low-cost smart electrical equipment automation system. This system is based on a web portal which controlled by an ESP32 WI-FI module. Also, a custom-made private web server is developed for maintaining the current states of electrical devices appliances.

KEYWORDS: ESP32 Cam , IOT, Web Server , Adaptor.

1. INTRODUCTION

Internet of things (IOT) platform based smart device/system has entered into a golden era of rapid growing technology in the field of home security. The Internet of Things is a concept to make every device/system such as Internet TV's, smart phones and sensors connected with the Internet can be controlled and monitored from anywhere and anytime. There are various existing systems that are used for home security purposes such as Microcontrollers- based wired and wireless security systems, CCTV system etc., but they are much expensive and having limitation in range and accessibility to the user [1]. In this research work, cost effective Raspberry Pi based home security system using pi cam and motion sensing feature.

We are moving towards to world of Internet. Where every physical object will be controlled and communicated with the internet. A research shows that, Internet of Things (IOT) connected devices installed base worldwide from 2015 to 2025 will be 75.44 billons. With the advent of vocal recognition software, such as Amazon Alexa, there is a large demand for electrical devices automation. Our main goal is to develop a way to efficiently and affordably transform pre-existing electrical devices into smart electrical devices. In this project we proposed a low cost, less power consumption IOT based system. By using this system, the registered person can control his/her electrical devices appliances from anywhere anytime. Also, the registered person can monitor his/her electrical appliances.

An Electrical Load Control System (ELCS) is a system which is controlled by a remote system. Wireless System is the need in the Markets. This System is IOT (Internet of Things) based. The Electrical Equipment's will be control Wirelessly through IOT Techniques. IOT is the new idea and are used in every field, like Industries, Offices, Education Institutions, Homes, etc.

Introduction to embedded systems

Embedded systems are electronic devices that incorporate microprocessors with in their implementations. The main purposes of the microprocessors are to simplify the system design and provide flexibility. Having a microprocessor in the device helps in removing the bugs, making modifications, or adding new features are only matter of rewriting the software that controls the device.

Embedded systems are self-contained programs that are embedded within a piece of hardware. Whereas a regular computer has many different applications and software that can be applied to various tasks, embedded systems are usually set to a specific task that cannot be altered without physically manipulating the circuitry. Embedded systems designers usually have a significant grasp of hardware technologies. They use specific programming languages and software to develop embedded systems and manipulate the equipment.

Embedded systems technologies are usually fairly expensive due to the necessary development time and built in efficiencies, but they are also highly valued in specific industries.

Classification of Embedded Systems

- Stand Alone Embedded Systems
- Real Time Embedded Systems
- Network Information Appliances
- Mobile Devices

Characteristics of an Embedded System

- 1) Single-functioned – An embedded system usually performs a specialized operation and does the same repeatedly. For example: A pager always functions as a pager.
- 2) Tightly constrained – All computing systems have constraints on design metrics, but those on an embedded system can be especially tight. Design metrics is a measure of an implementation's features such as its cost, size, power, and performance. It must be of a size to fit on a single chip, must perform fast enough to process data in real time and consume minimum power to extend battery life [4].
- 3) Reactive and Real time – Many embedded systems must continually react to changes in the system's environment and must compute certain results in real time without any delay. Consider an example of a car cruise controller; it continually monitors and reacts to speed and brake sensors. It must compute acceleration or de-accelerations repeatedly within a limited time; a delayed computation can result in failure to control of the car [5].
- 4) Microprocessors based – It must be microprocessor or microcontroller based.
- 5) Memory – It must have a memory, as its software usually embeds in ROM. It does not need any secondary memories in the computer.
- 6) Connected – It must have connected peripherals to connect input and output devices. HW-SW systems – Software is used for more features and flexibility. Hardware is used for performance and security.

2. REVIEW OF LITERATURE

In the IoT platform-based home security system, the main emphasis on protecting our loved ones and our belongings at home. Today numbers of IoT based home security systems are available in market. According to the literature and market survey, the common parameters of IoT enabled home security system are 24 hours monitoring and detection of the intruder, real time, cost effective and precise notification system suggested by various researchers. Following are the contributions of various researcher done in IoT domain [6].

Rani et al. (2018) explains the IoT based home security using Raspberry Pi which give SMS alert to authorize person through WAY2SMS and image of the unauthorized person via g-mail.

Dinakar et al. (2018) proposed IoT based automated home security system using Raspberry Pi which gives intruder detection alarm and notification to the owner.

Ghodke et al. (2017) explains in their paper how the IoT network-based system send the information of any person image coming close to the door for home security to the owner.

Anwar et al. (2016) explains the IoT based door accessibility and voice alerting through smart phone for home security system.

Tanaya and Kishore (2016) explains the up-gradation of home security system with face detection technique using haar algorithm in open CV for the detection of authorized or design and build unauthorized person.

Chowdhury et al. (2013) describes IoT based remote access control system for authorized person at door using raspberry Pi.

In [1] the author has come up with the technology for home automation and security by using a Bluetooth based system. The home appliances that are to be controlled are connected to the input/output ports of the Arduino BT board via relays. Passwords are provided for the purpose of protection so that only the authorized users can

access the home appliances. The python script is used for programming purpose as it is portable and can run on any platform. A feedback circuit is used to indicate the status of the home appliances after receiving a command from the phone. The disadvantages include: Less Range (<50) for controlling Devices, Pairing Process, and Requires Human Involvement for control. No Remote Control or Monitoring.

In [2] the author's implements home automation system using Arduino board that comes along with various sensors such as PIR motion sensor etc. and uses a GSM technology. The status of all the devices connected is sensed by the Arduino board for further processing. This system ensures home automation and security. Arduino board is an advanced version of microcontroller. It has various disadvantages similar to microcontrollers: Less Friendly Environment for development, Less Flexible, Maintenance Overhead.

In [3] the author's has proposed a home automation system using Arduino board based on IOT domain. This particular system uses an internet protocol-based communication. This system makes use of three operating modes: manual mode, automated mode and security mode. The manual mode is based on web supporting device, automated mode is based on sensor reading and security mode is based on safety. The simple execution is provided by Arduino microcontrollers that are used in this project as compared to other controllers. This particular prototype also uses Wi-Fi routers. The shortcomings are: Less Friendly Environment for development, Less Flexible, Maintenance Overhead.

In [4] the author presents the implementation of WIFI based home automation system. Wi-Fi technology is used for connecting various parts of the infrastructure. The proposed system includes a server where the status of each connected device is updated anytime it changes so that the user or system administrator can remotely control as well as monitor the system. It also includes hardware interface modules for connecting various sensors and actuators. This system provides power management and security. The disadvantages are: since WIFI usage involves a range, it is not possible for remote monitoring. It is not much reliable since the WIFI may go down at any point of time.

In [5] the author has designed a PIC microcontroller using ZigBee technology. The home appliances are controlled by using two technologies namely GSM network technology and speech recognition. In case smoke is detected in the house the SMS is sent to the mobile by using a GSM modem which is connected to the PIC controller. The ZigBee and GSM technologies are used for wireless communication among various modules. The microcontroller senses the accidents. It has disadvantages such as: use of Microcontroller – Requires Burning of Code for every Changes, Interface Problems, Maintenance overheads, Low processing power, Less Flexible due to complex architecture.

3. PROJECT DESCRIPTION

Block diagram

In our project totally we have 4 main blocks those are

- 1) Power supply
- 2) ESP 32
- 3) Smoke Sensor
- 4) Finger Sensor
- 5) ESP32 Cam
- 6) GSM module

Technology and Software Details

- 1) The IOT technology is used to controlled the home devices through website
- 2) The Security for door locking system is through finger recognition technology
- 3) The Sensors like smoke sensors , fire sensor, etc. is used for automation for the home safety
- 4) The GSM Technology is used for SMS for controlling the devices as well as for alerting the concerning the peoples by calling.

What is IoT? The Internet of things describes physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. A typical IoT system works through the real-time collection and exchange of data. An IoT system has three components

: • Smart devices This is a device, like a television, security camera, or exercise equipment that has been given computing capabilities. It collects data from its environment, user inputs, or usage patterns and communicates data over the internet to and from its IoT application.

IoT application An IoT application is a collection of services and software that integrates data received from various IoT devices. It uses machine learning or artificial intelligence (AI) technology to analyse this data and make informed decisions. These decisions are communicated back to the IoT device and the IoT device then responds intelligently to inputs. •

A graphical user interface The IoT device or fleet of devices can be managed through a graphical user interface. Common examples include a mobile application or website that can be used to register and control smart devices.

Software Details

- 1) Android Studio is used for developing application for the security system
- 2) PHP language is used for developing the website for the system
- 3) ARDUINO IDE compiler is used and programmed with C++ for developing the firmware for the hardware system

Android Studio is the official Integrated Development Environment (IDE) for android application development. Android Studio provides more features that enhance our productivity while building Android apps.

Android Studio was announced on 16th May 2013 at the Google I/O conference as an official IDE for Android app development. It started its early access preview from version 0.1 in May 2013. The first stable built version was released in December 2014, starts from version 1.0.

Since 7th May 2019, Kotlin is Google's preferred language for Android application development. Besides this, other programming languages are supported by Android Studio.

Features of Android Studio

- It has a flexible Gradle-based build system.
- It has a fast and feature-rich emulator for app testing.
- Android Studio has a consolidated environment where we can develop for all Android devices.
- Apply changes to the resource code of our running app without restarting the app.
- Android Studio provides extensive testing tools and frameworks.
- It supports C++ and NDK.
- It provides build-in supports for Google Cloud Platform. It makes it easy to integrate Google Cloud Messaging and App Engine.

PHP Language.

PHP (recursive acronym for PHP: Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML.

ARDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Hardware Used

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.

It is suitable for home smart devices, industrial wireless control, wireless monitoring, and other IoT applications.

This module adopts a DIP package and can be directly inserted into the backplane to realize rapid production of products, providing customers with high-reliability connection mode, which is convenient for application in various IoT hardware terminals.

ESP integrates WiFi, traditional Bluetooth, and BLE Beacon, with 2 high-performance 32-bit LX6 CPUs, 7-stage pipeline architecture. It has the main frequency adjustment range of 80MHz to 240MHz, on-chip sensor, Hall sensor, temperature sensor, etc.

Pin Diagram



Features:

ESP32-CAM:

1. The smallest 802.11b/g/n Wi-Fi BT SoC module.
2. Low power 32-bit CPU, can also serve the application processor.
3. Up to 160MHz clock speed, summary computing power up to 600 DMIPS.
4. Built-in 520 KB SRAM, external 4MPSRAM.
5. Supports UART/SPI/I2C/PWM/ADC/DAC.
6. Support OV2640 and OV7670 cameras, built-in flash lamp.
7. Support image WiFi upload.
8. Supports TF card.
9. Supports multiple sleep modes.
10. Embedded Lwip and FreeRTOS.
11. Supports STA/AP/STA+AP operation mode.
12. Support Smart Config/AirKiss technology.
13. Support for serial port local and remote firmware upgrades (FOTA).

Specifications:

1. Wireless Module: ESP32-S WiFi 802.11 b/g/n + Bluetooth 4.2 LE module with PCB antenna, u.FL connector, 32Mbit SPI flash, 4MBit PSRAM.
2. External Storage: micro SD card slot up to 4GB.
3. Camera
 - FPC connector.
 - Support for OV2640 (sold with a board) or OV7670 cameras.
 - Image Format: JPEG(OV2640 support only), BMP, grayscale.
 - LED flashlight.
4. Expansion: 16x through-holes with UART, SPI, I2C, PWM.
5. Misc: Reset button.
6. Power Supply: 5V via pin header.
7. Power Consumption.
 1. Flash LED off: 180mA @ 5V.
 2. Flash LED on to maximum brightness: 310mA @ 5V.
 3. Deep-sleep: 6mA @ 5V min.

4. Modem-sleep: 20mA @ 5V min.
5. Light-sleep: 6.7mA @ 5V min.
8. Dimensions (ESP32): 40 x 27 x 12 (LxWxH) mm.
9. Temperature Range: Operating: -20 °C ~ 85 °C; storage: -40 °C ~ 90 °C @ < 90%RH.

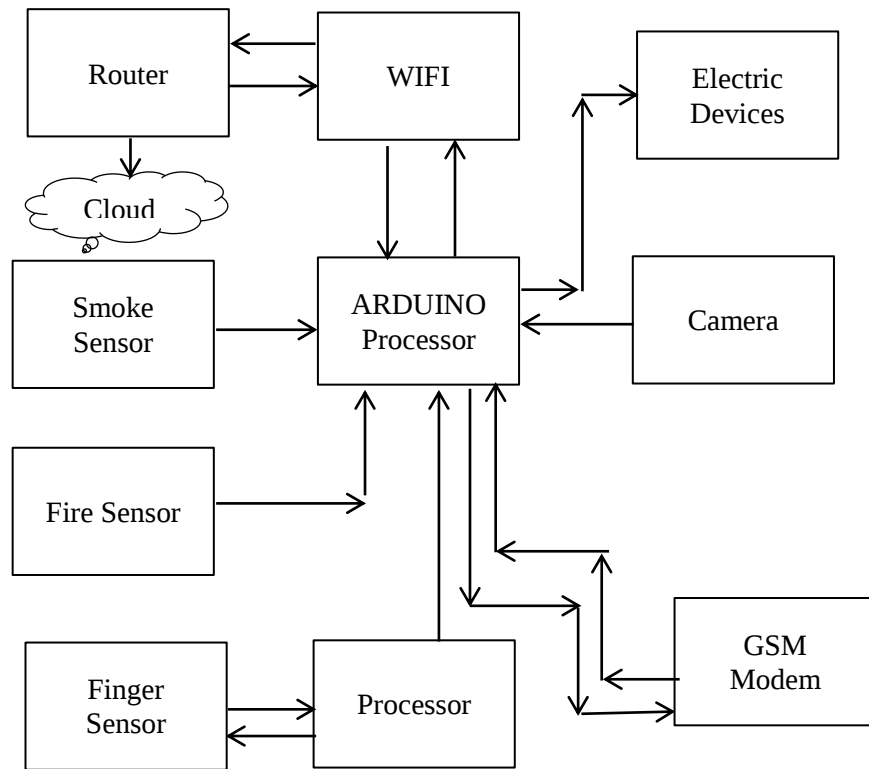
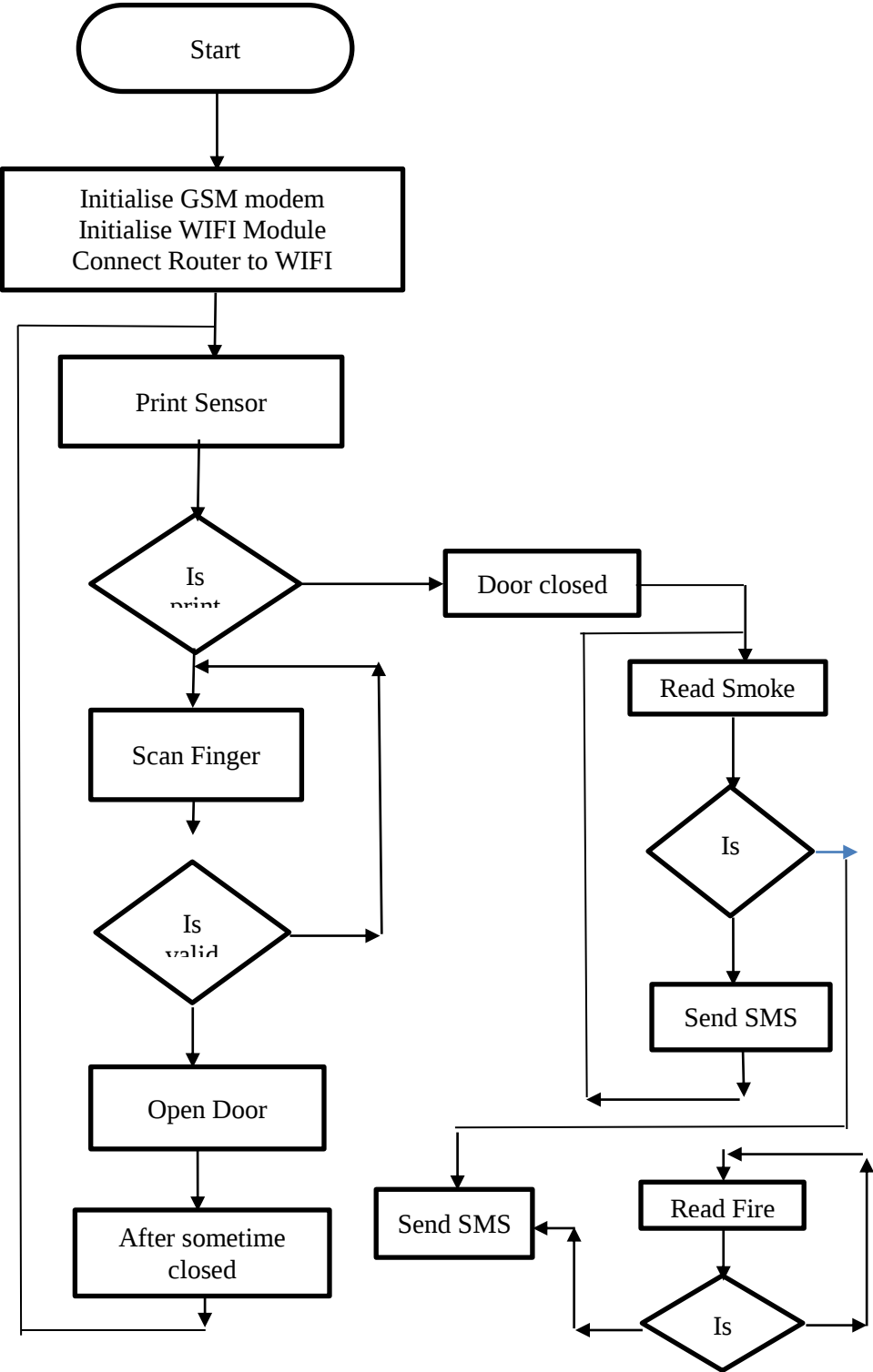


Fig. 1 Block diagram

Research Methodology

- 1) This Device Control through Internet of Things (IOT) Methodology
- 2) The Zero Crossing Method used to Control the AC energy through PWM (Pulse Width Modulation)
- 3) The WI-FI device used to communicate with the electrical equipment and to control it.
- 4) The IP address method is used to communicate through Client Server methodology.
- 5) The System will Manually as well as wireless based
- 6) Android application through Software based methodology

Flow of the System



The project have multiple modules likes , smoke detection, finger printer based door locking system, video streaming, electric home appliances controls through website and mobile. The IOT technology is used to integrate the all modules. The WIFI Module is used to control the devices and security devices. The WIFI module will be connected with WIFI router. The data will be sending to the server or the client will accept the data from the server. The electric devices will be control through website. The buttons likes kitchen room devices, living room devices, etc. will be on the website. This button be used to control the electric devices online.

ADVANTAGES

- 1) The home automation and security system will maintain home safety.
- 2) Contactless switches will have safety for human beings
- 3) The System can be used by anyone. No training is required for this.
- 4) The System will be cost effective
- 5) It will safe home from intruders or from thefts

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