# IoT-Based Smart Home Security and Home Automation System

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***Abstract*— Home security based on Internet of Things (IoT) is getting huge attention of mass people in recent years. Smart home eases and secures the management of the home appliances. This project's main aim is a low cost and reliable smart home system that assists the users to manage home appliances without the need of their physical presence. It can store and display information of temperature & humidity of a home, and notifies the users of switching on/off time of light, fan and other home appliances using IoT platform. The system includes gas leakage & fire alarm. It has leakage gas removing & fire extinguishing facility and notification system using IoT platform. The system uses real IP and RESTful API for controlling, monitoring and accessing the home appliances remotely from anywhere in the world using Android based smartphone app or web app. This system is user friendly and energy efficient.**

***Keywords— Arduino UNO,ESP8266,DHT11, Thingspeak cloud***

## I. INTRODUCTION

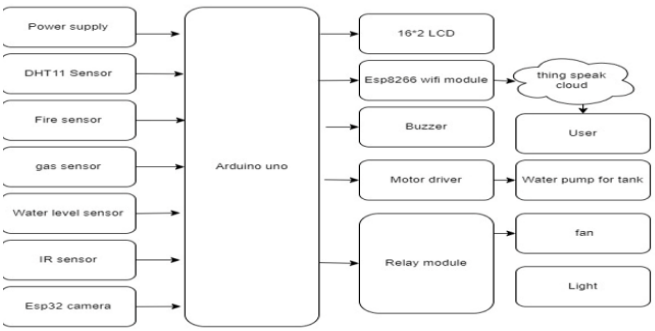
Just imagine, how beneficial it will be to be able to switch on our air condition for half an hour before we reach our home in the summertime. When we leave our home for some work without realizing that some appliances such as fans, air conditioners, and lights are on; then by using our mobile phone or internet, we are able to turn off power to those devices. It will be even more useful if the system detects unauthorized movement in the house and alerts us or sends messages on our mobile phones or we can know the status of our house anytime. Such systems provide security from natural, incidental, intended, unintended, accidental and human made problems by continuously monitoring homes with different sensory

## EXISTING SYSTEM

Wireless devices monitoring and controlling systems is a means that allows users to control electric appliances of. varying kinds. Bluetooth and RF Communications have drawbacks in that they can control 10mts to 30mts. GSM technology we can only control home appliances only net is good. IoT is system that use mobile to control basic home functions and features automatically through the Internet from anywhere around the world using mobile Internet or WIFI

## PROPOSED SYSTEM

The Internet of thing is a growing network of everyday objects, from industrial machines to consumer goods that can share information and complete tasks while you are busy with other activities Because of the advanced development in computer technology, microprocessors are not only on the desktop but also exist everywhere wireless devices monitoring and controlling Swallows us to control household appliances like light, door, fan, AC, etc. It also provides wireless devices monitoring and controlling an emergency system to be activated. wireless device monitoring and controlling not only refers to reducing human efforts but also energy efficiency and time-saving. Microprocessors are embedded in electronic appliances in our homes today. In the past, the appliances are working on standalone and cannot cooperate. But in recent years, these appliances can be monitored and controlled by embedded microprocessors and displayed on terminals.




BLOCK DIAGRAM

DESCRIPTION

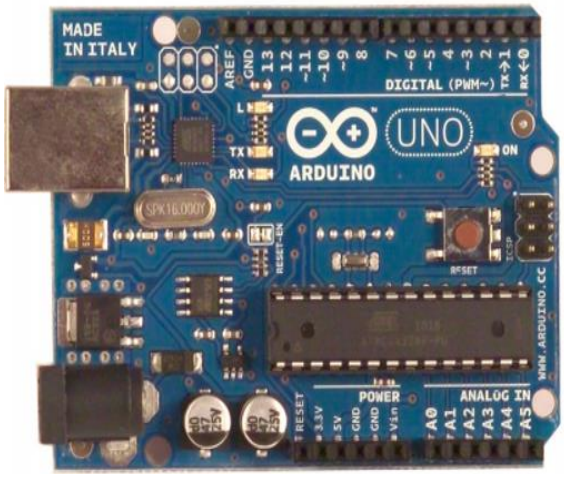
Monitoring and controlling wireless devices with IoT and Arduino involves using an Arduino board connected to sensors and actuators.

The Arduino collects data from sensors and communicates with the IoT platform over the internet using Wi-Fi or other wireless modules. The IoT platform processes and stores the data, allowing remote monitoring through a web or mobile app. Control signals can also be sent to the Arduino to actuate devices. Security measures are implemented to protect data and ensure the system's reliability.

## HARDWARE DESCRIPTION

### ARDUINO

Arduino is open source physical processing which is based on a microcontroller board and an incorporated development environment for the board to be programmed. Arduino gains a few inputs, for example, switches or sensors, and controls a few multiple outputs, for example, lights, engines, and others. Arduino programs can run on Windows, Macintosh, and Linux operating systems (OS) opposite to most microcontrollers' frameworks which run only on Windows. Arduino programming is easy to learn and

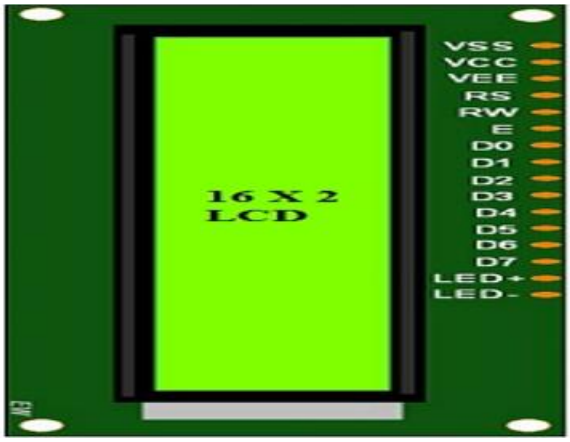



### LCD

Nowadays, we always use devices that are made up of LCDs such as CD players, DVD players, digital watches, computers, etc. These are commonly used in the screen industries to replace the utilization of CRTs. Cathode Ray Tubes use huge power when compared with LCDs, and CRTs are heavier as well as bigger. These devices are thinner as well power consumption is extremely low. The LCD 16×2 working principle is, it blocks the light rather than dissipates it. This article discusses an overview of LCD 16X2, pin configuration, and it's working.

### FEATURES OF LCD 16X2

- It includes two rows where each row can produce 16
- Every character can be built with a 5×8 Pixel box
- The alphanumeric LCDs alphabets & numbers
- Is display can work on two modes like 4-bit & 8-bit
- These are obtainable in Blue & Green Backlight
- It displays a few custom-generated characters




### RELAY

A relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not

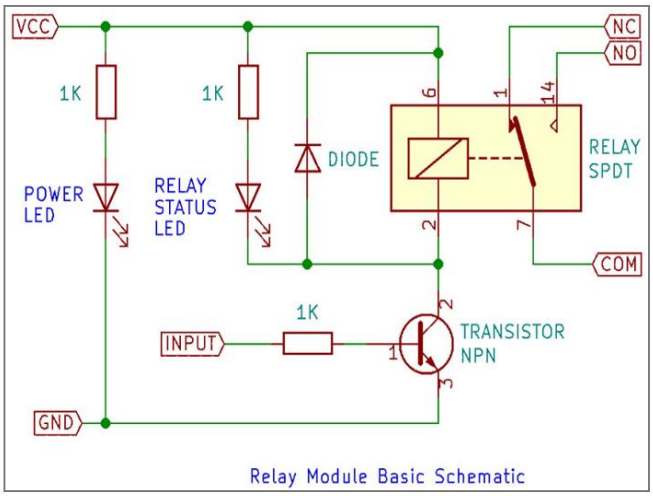
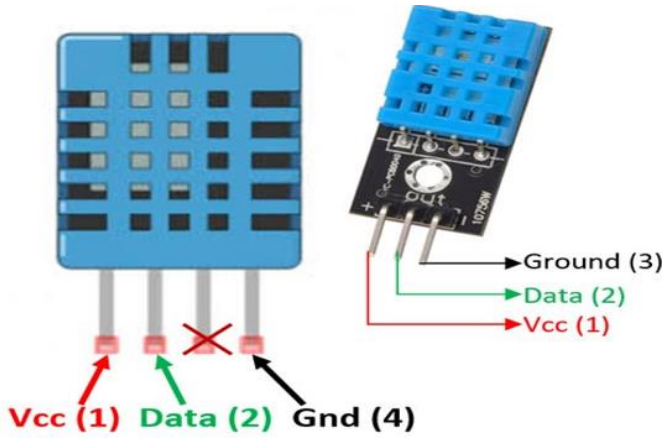



Fig.3.3(e) Internal Circuit of Single-Channel Relay

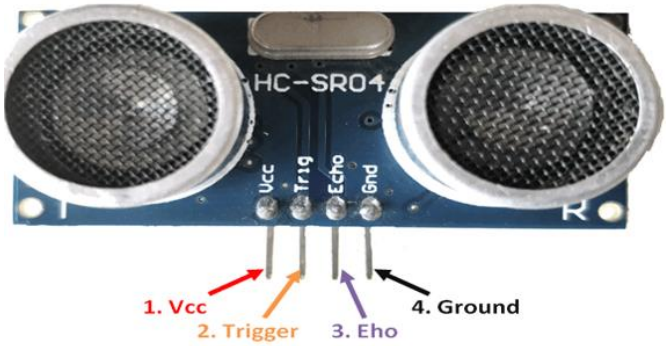
### BUZZER FEATURES AND SPECIFICATIONS

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: <30mA
- Sound Type: Continuous Beep
- Resonant Frequency: ~2300 Hz




The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

ULTRASONIC SENSOR




As shown above the HC-SR04 Ultrasonic (US) sensor is a 4-pin module, whose pin names are Vcc, Trigger, Echo, and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes-like projects in the front which form the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in the air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module

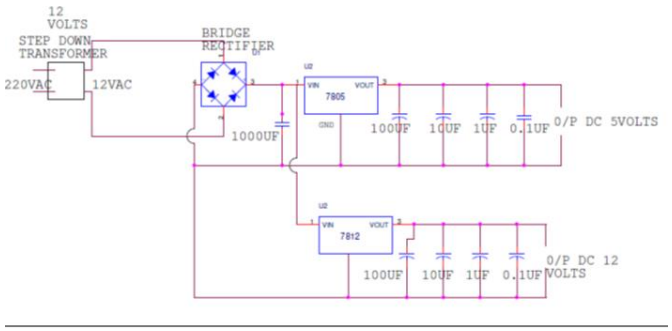



Fig.3.7 Transformer Bridge Rectifier

CIRCUIT EXPLANATION

TRANSFORMER

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled electrical conductors. A changing current in the first circuit (the primary) creates a changing magnetic field; in turn, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other.

The secondary induced voltage VS, of an ideal transformer, is scaled from the primary VP by a factor equal to the ratio of the number of turns of wire in their respective windings:

BASIC PRINCIPLE

The transformer is based on two principles: firstly, that an electric current can produce a magnetic field (electromagnetism) and secondly that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). By changing the current in the primary coil, it changes the strength of its magnetic field; since the changing magnetic field extends into the secondary coil, a voltage is induced across the secondary.

A simplified transformer design is shown below. A current passing through the primary coil creates a magnetic field. The primary and secondary coils are wrapped around a core of very high magnetic permeability, such as iron; this ensures that most of the magnetic field lines produced by the primary current are within the iron and pass through the secondary coil as well as the primary coil.

INDUCTION LAW

The voltage induced across the secondary coil may be calculated from Faraday's law of induction, which states that:

Where VS is the instantaneous voltage, NS is the number of turns in the secondary coil and Φ equals the magnetic flux through one turn of the coil.

If the turns of the coil are oriented perpendicular to the magnetic field lines, the flux is the product of the magnetic field strength B and the area A through which it cuts. The area is constant, being equal to the cross-sectional area of the transformer core, whereas the magnetic field varies with time according to the excitation of the primary. Since the same magnetic flux passes through both the primary and secondary coils in an ideal transformer, the instantaneous voltage across the primary winding equals

Taking the ratio of the two equations for VS and VP gives the basic equation for stepping up or stepping down the voltage

IDEAL POWER EQUATION

If the secondary coil is attached to a load that allows current to flow, electrical power is transmitted from the primary circuit to the secondary circuit. Ideally, the transformer is perfectly efficient; all the incoming energy is transformed from the primary circuit to the magnetic field and into the secondary circuit. If this condition is met, the incoming electric power must equal the outgoing power.

Pincoming = IPVP = Poutgoing = ISVS

giving the ideal transformer equation

DETAIL OPERATION

The simplified description above neglects several practical factors, in particular the primary current required to establish a magnetic field in the core, and the contribution to the field due to current in the secondary circuit.

Models of an ideal transformer typically assume a core of negligible reluctance with two windings of zero resistance. When a voltage is applied to the primary winding, a small current flows, driving flux around the magnetic circuit of the core. The current required to create the flux is termed the magnetizing current; since the ideal core has been assumed to have near-zero reluctance, the magnetizing current is negligible, although still required to create the magnetic field.

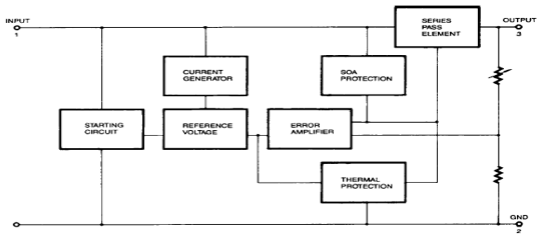
The changing magnetic field induces an electromotive force (EMF) across each winding. Since the ideal windings have no impedance, they have no associated voltage drop, and so the voltages VP and VS measured at the terminals of the transformer, are equal to the corresponding EMFs. The primary EMF, acting as it does in opposition to the primary voltage, is sometimes termed the "back EMF". This is due to Lenz's law which states that the induction of EMF would always be such that it will oppose development of any such change in magnetic field

BRIDGE RECTIFIER

A diode bridge or bridge rectifier is an arrangement of four diodes in a bridge configuration that

provides the same polarity of output voltage for any polarity of input voltage. When used in its most common application, for conversion of alternating current (AC) input into direct current (DC) output, it is known as a bridge rectifier. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a center-tapped transformer design, but has two diode drops rather than one, thus exhibiting reduced efficiency over a center-tapped design for the same output voltage.

**Internal Block Digram**




GAS SENSOR

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated.

The type of gas the sensor could detect depends on the sensing material present inside the sensor. Normally these sensors are available as modules with comparators as shown above. These comparators can be set for a particular threshold value of gas concentration. When the concentration of the gas exceeds this threshold the digital pin goes high. The Analog pin can be used to measure the concentration of the gas.

WI-FI MODULE

ESP8266 was designed by the Chinese company Espressif Systems for uses in Internet of Things (IoT) systems. ESP8266 is a complete WIFI system on chip that incorporates a 32-bit processor, some RAM and depending on the vendor between 512KB and 4MB of flash memory. This allows the chip to either function as a wireless adapter that can extend other systems with WIFI functionality, or as a standalone unit that can by itself execute simple applications. Depending on the specific module variant (ESP-1 to ESP-12 at the time of this thesis) between 0 and 7 General Purpose Input/Output (GPIO) pins are available, in addition to Rx and Tx pins of the UART, making the module very suitable for IoT applications. The Software Development Kit (SDK) provided by Espressif contains a

lightweight implementation of a TCP/IP control stack (IWIP) for WIFI communication. The modules house libraries for optional services such as Dynamic Host Configuration Protocol (DHCP),

Domain Name System (DNS), JavaScript Object Notation (JSON) and Secure Socket Layer (SSL) libraries for Application Level programming. It incorporates 802.11 MAC extensions such as 802.11b/g/n/d/e/h/i/k/r that manage signal transmission, encapsulation, encryption, collision management and roaming functionality. The chip generally comes as part of a module, soldered to a Printed Circuit Board (PCB), however it is possible to purchase only the chip itself in order to create a truly custom module. The module variants currently available on the market may include an antenna (PCB or ceramic) or a U-FL connector, a hardware component for serial communication and a myriad of other auxiliary components such as resistors, capacitors and LEDs.

| Mode | Typ | Unit |
|---|---|---|
| Transmit 802.11b, CCK 11Mbps, $P_{OUT}$=+17dBm | 170 | mA |
| Transmit 802.11g, OFDM 54Mbps, $P_{OUT}$=+15dBm | 140 | mA |
| Transmit 802.11n, MCS7, $P_{OUT}$=+13dBm | 120 | mA |
| Receive 802.11b, packet length=1024byte, -80dBm | 50 | mA |
| Receive 802.11g, packet length=1024byte, -70dBm | 56 | mA |
| Receive 802.11n, packet length=1024byte, -65dBm | 56 | mA |
| Deep sleep | 10 | uA |
| Power save mode DTIM 1 | 1.2 | mA |
| Power save mode DTIM 3 | 0.9 | mA |
| Total shutdown | 0.5 | uA |

Table 3.2 ESP8266EX current draw at 3.3V as listed in the official documentation from Espressif

SERIAL COMMUNICATION

ESP8266 has multiple peripherals through which it can interface with other modules in a classic embedded fashion. In this section only the setup of the communication link will be presented, since the exact flow of bits to achieve such communication was handled automatically by the module and is therefore deemed of no immediate interest for this thesis. In this case classical UART was used to decode output and encoding data to be sent to the sensor. Similarly, EM50 data logger has an UART of its own and can do the same thing on its end. Serial asynchronous communication does not require a common clock, however in order for the data to be processed correctly and at right intervals a common baud rate (can be viewed as symbols per second) needs to be set for both devices. The baud-rates supported by ESPs UART component range from 9600 to 921600bps, while the EM50 is configured for 9600bps as default.

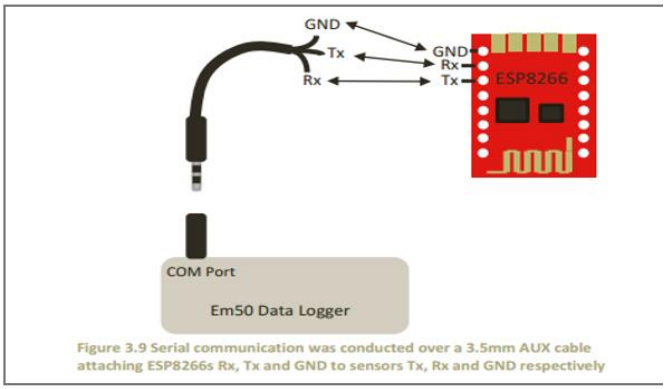



Figure 3.9 Serial communication was conducted over a 3.5mm AUX cable attaching ESP8266s Rx, Tx and GND to sensors Tx, Rx and GND respectively

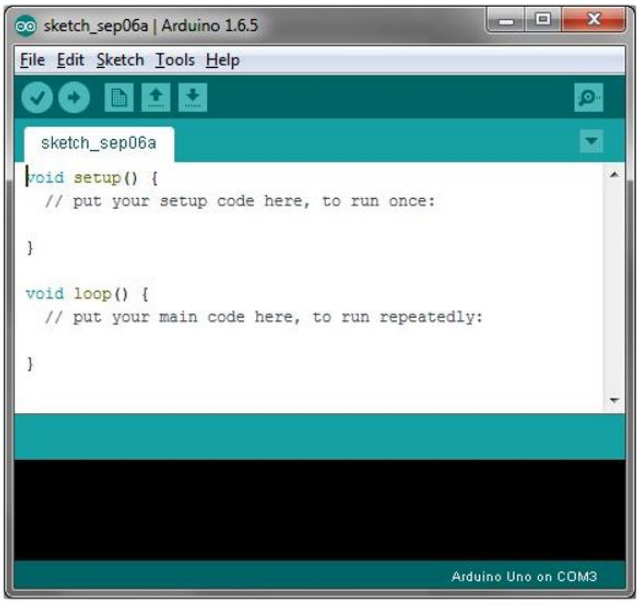
**SOFTWARE DESCRIPTION**

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 and Genuino hardware to upload programs and communicate with them.

ARDUINO IDE INTIAL SETUP

This is the Arduino IDE once it's been opened. It opens into a blank sketch where you can start programming immediately. First, we should configure the board and port settings to allow us to upload code. Connect your Arduino board to the PC via the USB cable.



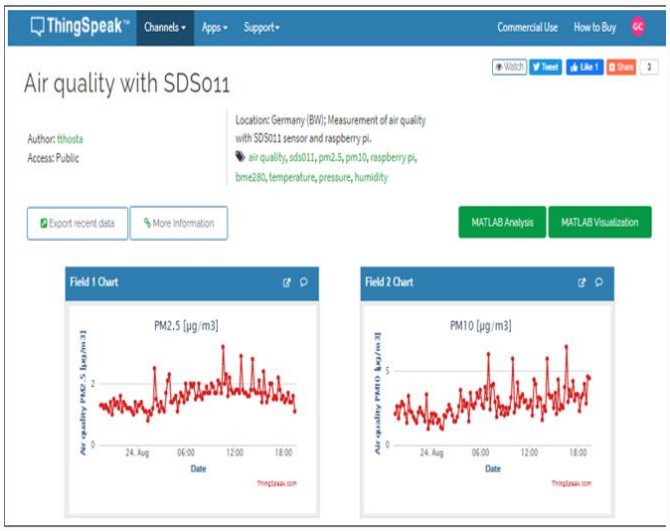

Arduino IDE Default Window

## ThingSpeak IoT Platform

ThingSpeak is IoT platform for user to gather real-time data; for

instance, climate information, location data and other device data. In different channels in ThingSpeak, you can summarize information and visualize data online in charts and analyze useful information.

ThingSpeak can integrate IOT: bit (micro: bit) and other software/ hardware platforms. Through IOT:bit, you can upload sensors data to ThingSpeak (e.g. temperature, humidity, light intensity, noise, motion, raindrop, distance and other device information).




RELATED WORKS

Vinay Sagar K N (2016) et al present a low-cost cost flexible and reliable home automation system with additional security using an Arduino microcontroller, with IP connectivity through local Wi-Fi for accessing and controlling devices by authorized users remotely using a Smart smartphone application. The proposed system is server-independent and uses the Internet of Things to control human-desired appliances starting from industrial machines to consumer goods. The user can also use different devices for controlling with the help of a web browser, smartphone, or IR remote module. To demonstrate the effectiveness and feasibility of this system, in this paper, we present a home automation system using Arduino UNO microcontroller and esp8266-01 as a connectivity module. It helps the user to control various appliances such as lights, fans, and TVs and can make decisions based on the feedback of sensors remotely.

Pooja N. Pawar (2018) et al designed a people prefer more automatic systems rather than manual systems. With the influence of the Internet in people's life lots of new technologies are coming up. One of the latest, emerging, and trending technologies is the 'Internet of Things'. This technology is expected to rule the world within a few years. Home Automation System uses the technology of the Internet of Things for monitoring and controlling the electrical and electronic appliances at home from any remote location by simply using a Smartphone. The implementation of a low-cost, flexible home automation system is presented. It enhances the use of wireless communication which provides the user with remote control of various electronic and electrical appliances.

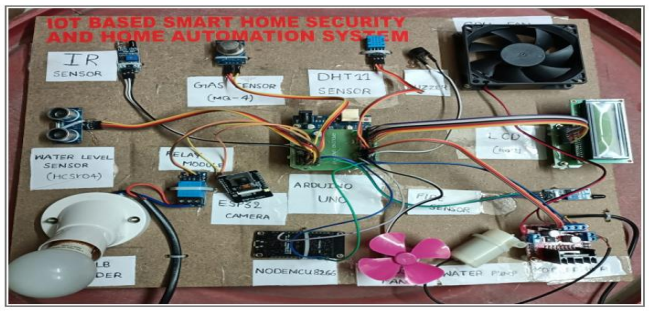
Shweta Singh (2017) et al proposed home automation with the proliferation of IoT is becoming a reality now, and a variety of players like, Apple, Amazon, Google, and Samsung, are all converging into this space to provide the platform and solutions for smart homes. In Light of this, the present study addresses IoT concepts through a systematic review of scholarly research papers, corporate white papers, professional discussions with experts, and online databases. The main objective of this paper is to provide an overview of the Internet of Things, architectures, and vital technologies and their usages in our daily life

K. Saiteja (2017) et al develop a system that will provide remote control of home appliances and also provide security against mishaps when the host is not at home. This paper is mainly concerned with the automatic control of light or any other home appliances using the internet. It is meant to save the electric power and human energy. This application is made with the help of the Internet of Things and Raspberry Pi. The various appliances connected to the Raspberry Pi is using the wireless network.

Priyanka Zambare (2018) et al designed an IoT that has nowadays become an emerging and trending technology.

It is a system of physical things embedded with sensors, software, electronics, and connectivity to allow it to perform better by exchanging information with other connected devices, the operator, or the manufacturer. Home automation based on IoT allows users to access and control various home applications remotely using smartphones. It is mainly useful for physically disabled people and also to provide security to our house. It improves the standard and quality of people's lives. And also make our home and life safer.

RESULT




FUTURE SCOPE OF THE POWER THEFT DETECTION SYSTEM INCLUDES THE FOLLOWING:

The future scope of wireless device monitoring and control using IoT and Arduino includes the potential for expanded automation, improved energy efficiency, and enhanced connectivity for a wide range of applications, from smart homes to industrial processes

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