

IoT Based Home Automation and Safety: Building Computerization for a Smart Home

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Internet of Things (IoT) based Home automation or a domestic is building automation for a home, called a smart home or smart house. A home automation system will monitor and / or control home attributes such as lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an essential constituent of the Internet of Things. For example, we can put our lights on schedules so that they turn off when we usually go to sleep, or we can have our thermostat turn the A/C ON about an hour before we return from work. Home automation makes life more convenient and can even save our money on heating, cooling, and electricity bills. Home automation can lead to greater safety with IoT devices like security cameras and sensing systems etc. But hold up; what are IoT devices in Home Automation?

IoT IN HOME AUTOMATION: The Internet of Things, commonly known as IoT, refers to any device that's connected to the Internet that isn't normally; for example, a smart light bulb that we can turn on and off via an app. The devices / appliances involved in home automation are IoT devices, which can be automated to trigger one another. So while IoT refers to the devices themselves, home automation is what we can do with the IoT devices to make our life just a tad bit easier.

HOW DOES HOME AUTOMATION WORK: Home automation works via a network of devices that are connected to the Internet through different communication protocols, i.e Wi-Fi, Bluetooth, LPWAN and others. The devices can be managed remotely through Mobile apps or web panels, IoT dashboard or a voice assistant like Alexa or Google home. Many of these IoT devices have sensors that monitor changes in motion, temperature, and light so the user can gain information about the device's surroundings. To make physical changes to the device, the user or sensors can trigger actuators or the physical mechanisms like light switches, motorized valves, or motors that allow devices to be controlled remotely. There can be many features in a Home Automation App.



Home Automation

FIGURE 1: HOME AUTOMATION & SURVEILLANCE SYSTEM (HASS) IS AN INTELLIGENT SYSTEM TO MONITOR AND CONTROL THE BUILDING.

There are three distinct levels of home automation.

1. MONITORING
2. CONTROL
3. AUTOMATION

MONITORING OF OUR HOUSE: The ability to view the status of systems i.e.:

1. WHAT IS THE TEMPERATURE?
2. IS THE DOOR LOCKED?
3. IS THE LIGHT ON OR OFF?



FIGURE 2: HASS IS AN INTELLIGENT SYSTEM TO MONITOR AND CONTROL THE BUILDING AND WOULD HELP IN MANAGING / CONTROLLING THE APPLIANCES (i.e. LIGHT, FAN, A.C., T.V., REFRIGERATOR etc.) BEING USED INSIDE THE BUILDING AND ALSO FACILITATES THE VIDEO SURVEILLANCE.

CONTROL OF VARIOUS HOME APPLIANCES: The ability to change the state of systems i.e.:

1. TURN ON THE HEATER OR AIR CONDITIONER.
2. LOCK THE DOOR.
3. TURNING THE LIGHT ON OR OFF.

AUTOMATION AND SCHEDULING OF APPLIANCES: The ability to change the state of a system automatically in response to an event i.e.:

1. TURN ON THE HEATING IF THE OUTSIDE TEMPERATURE FALLS BELOW A CERTAIN TEMPERATURE.
2. TURN THE LIGHTS OFF WHEN NO ONE IS AT HOME.

SMART HOME - AUTOMATION SYSTEM COMPONENTS: A home automation system will consist of:

1. END DEVICES LIKE SWITCHES, SENSORS, LIGHTS, LOCKS, etc.
2. CONNECTION DEVICES LIKE HUBS AND GATEWAYS.
3. A NETWORK OR NETWORKS e.g. WI-FI, ZIGBEE, LPWAN etc.
4. INTERNET CONNECTION - MAY BE OPTIONAL

ROLE OF IoT IN HOME AUTOMATION: The IoT based Home Automation will enable the user to use a Home Automation System based on the Internet of Things (IoT). Modern homes are automated through the internet and the home appliances are controlled. The user commands over the internet will be obtained by the Wi-Fi modems. The Microcontroller has an interface with this modem. The system status is displayed through the LCD, along with the system data. This is a typical IoT based Home Automation system, for controlling all our home appliances. The smart home market is taking off as IoT device prices come down and the general public comes to understand the benefits of these products. And from smart homes, the next logical step is smart cities, which would take the IoT to the next level. And yet, smart homes are just one small part of our daily lives that the Internet of Things will transform in the coming years.

IoT HOME AUTOMATION: GETTING STARTED - Home automation has three major parts:

1. HARDWARE
2. BACKEND AND USER APPLICATION
3. COMMUNICATION PROTOCOL

Each of these parts is equally important in building a truly smart home experience for our customers. Having the right hardware enables the ability to develop our IoT prototype iteratively and respond to technology pivots with ease. A protocol selected with the right testing and careful consideration helps us to avoid performance bottlenecks that otherwise would restrict the technology and device integration capabilities with sensors and IoT gateways. Another important consideration is the firmware that resides in our hardware managing our data, managing data transfer, firmware OTA updates, and performing other critical operations to make things talk.

HOME AUTOMATION COMPONENTS: We have talked about them before, but let's separate our components that will finally help us build a realistic model of what significant components are involved in building a smart home. The major components can be broken into:

1. IoT SENSORS
2. IoT GATEWAYS
3. IoT PROTOCOLS
4. IoT FIRMWARE
5. IoT CLOUD AND DATABASES
6. IoT APPLICATION

IoT sensors involved in home automation are in thousands. The biggest players in IoT cloud can be divided into a platform-as-a-service (PaaS) and infrastructure-as-a-service (IaaS).

CHARACTERISTICS OF IoT PLATFORMS: Again, these platforms are extremely divided over the IoT application and security-related features that they provide. A few of these platforms are open source. Let's have a look at what we should expect from a typical IoT platform:

1. DEVICE SECURITY AND AUTHENTICATION
2. MESSAGE BROKERS AND MESSAGE QUEUING
3. DEVICE ADMINISTRATION
4. SUPPORT TOWARDS PROTOCOLS LIKE COAP, MQTT, AND HTTP
5. DATA COLLECTION, VISUALIZATION, AND SIMPLE ANALYSIS CAPABILITIES
6. INTEGRABILITY WITH OTHER WEB SERVICES
7. HORIZONTAL AND VERTICAL SCALABILITY
8. WEBSOCKET APIS FOR REAL-TIME FOR REAL-TIME INFORMATION FLOW

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