**Home Automation Using the Internet of Things (IoT)**

## IoT home automation: Getting started

Home automation has three major parts:

* Hardware
* Software/Apps
* Communication protocols

Each of these parts is equally important in building a truly smart home experience for your customers. Having the right hardware enables the ability to develop your IoT prototype iteratively and respond to technology pivots with ease.

A protocol selected with the right testing and careful consideration helps your avoiding 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 your hardware managing your data, managing data transfer, firmware OTA updates and performing other critical operations to make things talk.

## Applications of home automation

Rebuilding consumer expectations, home automation has been projected to target wide array applications for the new digital consumer. Some of the areas where consumers can expect to see home automation led IoT-enabled connectivity are:

* Lighting control
* HVAC
* Lawn/Gardening management
* Smart Home Appliances
* Improved Home safety and security
* Home air quality and water quality monitoring
* Natural Language-based voice assistants
* Better Infotainment delivery
* AI-driven digital experiences
* Smart Switches
* Smart Locks
* Smart Energy Meters

The list is still not exhaustive and will evolve over the time to accommodate new IoT use cases.

Now that you are familiar with home automation applications, let’s have a detailed look at what components are involved in building a typical home automation prototype.

## Home automation components

We have talked about them before, but, let’s clearly separate them into components that would finally help you build a realistic model of what major components are involved in building a smart home. The major components can be broken into:

* IoT Sensors
* IoT Gateways
* IoT Protocols
* IoT Firmware
* IoT Cloud and Databases
* IoT Middleware (if required)

IoT sensors involved in home automation are in thousands, and there are hundreds of home automation gateways as well. Most of the firmware is either written in C, Python, Node.Js, or any other programming language.

The biggest players in IoT cloud can be divided into a platform as a service(PaaS) and infrastructure as a service(LaaS).

## Major IoT platform as a service provider:

* AWS IoT
* Azure IoT
* Thingworx
* Ubidots
* Thingspeak
* Carriots
* Konekt
* TempoIQ
* Xively
* IBM Bluemix

## 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 you should expect from a typical IoT platform:

* Device security and authentication
* Message brokers and message queuing
* Device administration
* Support towards protocols like CoAP, MQTT, HTTP
* Data collection, visualization, and simple analysis capabilities
* Integrability with other web services
* Horizontal and vertical scalability
* WebSocket APIs for real time for real-time information flow

Let’s now deeply evaluate each of these components, starting with IoT sensors

## Home Automation Sensors

There are probably thousands of such sensors out there that can be a part of this list. Since this is an introduction towards smart home technology, we will keep it brief. We will break down IoT sensors for home automation by their sensing capabilities:

* Temperature sensors
* Lux sensors
* Water level sensors
* Air composition sensors
* Video cameras for surveillance
* Voice/Sound sensors
* Pressure sensors
* Humidity sensors
* Accelerometers
* Infrared sensors
* Vibrations sensors
* Ultrasonic sensors

Depending upon what you need you may use one or many of these to build a truly smart home IoT product. Let’s have a look at some of the most commonly used home automation sensors.

## Temperature sensors

The market is full of them, but the famous temperature sensors are DHT11/22, DS18B20, LM35 and MSP430 series from TI. MSP430 series is more accurate than the rest but at the same time is one of the most expensive for prototyping or initial product testing purposes. MSP430 tops all temperature sensors as the precision and battery consumption is minimum with them.

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DHT11 has a very restricted temperature range and suffers from accuracy issues. DHT22, on the other hand, is a little bit more accurate but still, doesn’t make it as the preference.

DS18B20’s, on the other hand, are more accurate, as opposed to digital temperature sensors like DHT22 and 11, Dallas temperature sensors are analog and can be extremely accurate down to 0.5 degrees.

Take note that often the temperatures that you directly sense from these sensors may not be very accurate and you would occasionally see 1000 F or greater values no matter what you are doing.

There’s an entire logic that goes around building temperature sensors, that we will address in another blog post.

It is difficult to say, often, it is even more difficult to visualize the technology that is required to build a home automation platform.

Due to the complexity introduced by software, hardware and networking ecosystems, it becomes extremely important to learn, understand and utilize the right home automation technology for your smart home product.

We hope to address some of the concerns with this article.

What will you learn here?

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## Lux Sensors

Lux sensors measure the luminosity and can be used to trigger various functions range from cross-validating movements to turn the lights on if it becomes too dark. Some of the most popular light sensors are TSL2591 and BH1750.

Recent tests to include TSL2591 and BH1750 into low-powered IoT devices have found them to be working fairly good for most of the use cases.

To get a good idea of whether these two sensors would suffice your needs we would suggest illuminance tests followed by normalization of the data to observe deviations under various situations.

## Water level sensors for Home Automation

While building your prototype you may consider a solid state eTape liquid level sensor, or like others who just use an HC-SR04 ultrasonic sensor to measure the water level sensor.

On the other hand, in other cases where those two don’t suffice, one has to utilize something that can deliver a much higher performance.

Float level sensors and other ICs like LM1830 offers a more precise measurement capability to IoT developers. Although, they are substantially much more expensive than others.

## Air composition sensors

There are a couple of specific sensors that are used by developers to measure specific components in the air:

* CO monitoring by MiCS-5525
* MQ-8 to measure Hydrogen gas levels
* MiCS-2714 to measure nitrogen oxide
* MQ135 to sense hazardous gas levels (NH3, NOx, Alcohol, Benzene, smoke, CO2

Most of these are sensors have a heating time, which also means that they require a certain time before they actually start delivering accurate values.

These sensors mainly rely on their surface to detect gas components. When they initially start sensing, there’s always something that’s there on their surface, some sort of deposition that requires some heating to go away.

Hence, after the surface gets heated enough true values start to show up.

## Video cameras for surveillance and analytics

A range of webcams and cameras specific to Hardware development kits are usually used in such scenarios. Hardware with USB ports offers to integrate and camera module to build functionalities.

But, utilizing USB ports in not very efficient, especially in the case of real-time video transfer or any kind of video processing.

Take RaspberryPi for example, it comes with a camera module (Pi cam) that connects using a flex connector directly to the board without using the USB port. This makes the Pi cam extremely efficient.

## Sound detection for Home Automation

Sound detection plays a vital role from monitoring babies to turning on and off lights automatically to automatically detecting your dog’s sound at the door and opening it up for them.

Some commonly used sensors for sound detection includes SEN-12462 and EasyVR Shield for rapid prototyping.

These sensors aren’t as good as industrial grade sensors like those from [**3DSignals**](https://www.3dsig.com/) which can detect even ultra-low levels of noise and fine tune between various noise levels to build even machine break up patterns.

## Humidity sensors for Home Automation

These sensors bring the capability of sensing humidity/RH levels in air for smart homes. The accuracy and sensing precision depends a lot on multiple factors including the overall sensor design and placement.

But certain sensors like DHT22 and 11 built for rapid prototyping would always perform poorly when compared to high-quality sensors like HIH6100 and Dig RH.

While building a product to sense humidity levels, ensure that there’s no localized layer of humidity that is obscuring the actual results. Also, keep into consideration that in certain small spaces, the humidity might be too high at one end as compared to the others.