DESIGN CONSIDERATIONS FOR A SMART HOME SYSTEMS.

There are several design challenges and considerations involved while developing a home automation system, many of which are determined by user needs. Once those have been determined, the designer can choose the appropriate processor, sensors, and communication protocol for the system, keeping the following parameters in mind:

TYPE OF INTERFACE:

The most basic and crucial requirement in a home automation system, the interface is the basic communication protocol and hardware combination used for sending and receiving messages between devices and the user. Designers have many options for executing communication between devices, the user, and the overall system, depending upon the system, range, size of house, ease of use, etc. If a user wants to control the home appliances through the Internet, the designer needs to add an Ethernet/Wi-Fi interface to connect the system to the home network. If the user wants to control the system using Bluetooth from a cell phone, the designer needs to add a Bluetooth interface to communicate with the device.

The choice of communications interface also depends upon the topology used between the central control unit (CCU) and room control units (RCU).

SENSING REQUIREMENTS:

The designer needs to determine the sensing requirements of the user and decide upon the required sensor to perform the task. He or she also needs to assess the sensor specifications required for different needs and usability in different environments. The range of sensors that should be considered include:

- Thermistors can be used to control air conditioners, refrigerators, geysers, heating system, or in case of fire.
- Humidity sensors sense the moisture level in the environment.
- Gas sensors can be used to detect gas leaks.
- Light sensors can be used to detect the luminous intensity in the house.

The information provided by these sensors (after signal conditioning) is used by the processor to make several important decisions regarding the appliances and when to switch them ON or OFF.

SECURITY LEVEL:

Another major requirement while designing the home automation system is to make the entire system secure so that it can't be easily altered to give control of the house to unauthorized users. It should be able to prevent most types of intrusion. Even if the system is broken into, it should be able to send signals to the user and the nearest police station. It also necessary to hide as many components as possible from direct access via the main control panel, preventing it from being turned into a black box. It should also be able to send and comprehend encoded data while communicating with other devices. This will prevent intruders from tapping into the system and using the same interface to hack devices.

TOPOLOGY:

Topology defines the way home automation control units interact with each other. A star type topology is the most commonly used as it makes use of a central control unit (CCU) interacting with all the available remote-control units (RCUs) and taking over decision making responsibilities. The role of the RCUs is to send data fetched from the sensors back to the CCU. After it has assessed the input from the sensors and made any necessary decisions, the CCU sends the command back to the RCU to take a specific action.

Another topology to be considered is a mesh topology, which has no CCU and makes use of a constellation of control units of roughly equal intelligence and capability connected with each other. Each unit sends information on the network which is shared by all the units. Each Unit is independent and makes its own decisions based on the shared information.

The choice of system topology governs the selection of communication interfaces such as ZigBee, RF, Bluetooth, etc.

DEPTH OF AUTOMATION:

System design is affected by the requirements ranging from simple control of lights in the house to controlling all appliances and the security system. Each requirement affects the overall design, and developers need to determine the most optimized way to perform all the

tasks with the lowest cost and complexity. Despite the internal system complexity, the system should be easy to use and not pose barriers to its operation by a household user.

COST:

This is the most important aspect of system design as system complexity and depth of automation determine the cost. A highly complex – and thus costly – system can deter customers from purchasing and installing it in their house. The cost of the system is directly linked with the number of components, interface used, and complexity of design of firmware and hardware. While there should be no compromise on the quality of hardware and software, the number of components in the system can be decreased to reduce the overall cost and system size as well. Rather than the traditional component-based approach, lower cost can be achieved using System-on-Chips (SoC) that integrate multiple peripherals and a processor into the same IC.