SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF INFORMATION TECHNOLOGY

19CSE303 – ARTIFICIAL INTELLIGENCE
III YEAR IV SEM

UNIT V – **LEARNING**

TOPIC : HOME AUTOMATION CASE STUDY

Abstract

- Home automation is on horizon.
- It is an emerging technology and also a need of today.
- From the last decade a number of standards have been defined for home appliances.

Objectives

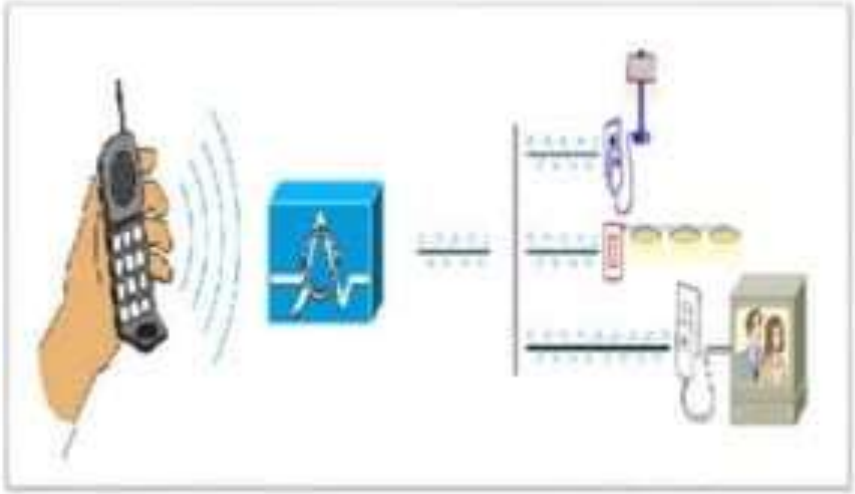
- The main objectives of home automation are controlling, management and co-ordination of home appliances in a comfortable, effective and secure way.
- On the other hand, Artificial Intelligence is evolving as a technology for developing automatic systems that can perceive the environment, learn from environment, and can make decision using case based reasoning.
- Using Vision capability, knowledge based, learn ability, decision making and reasoning the AI provides a better solution for almost all automatic systems.

INTRODUCTION

- One definition of an automated and networked home is "An automated and networked home is one in which every appliance can be remotely managed from anywhere on the Internet with a simple Web browser".
- The general goal of the automatic-home movement is to use networking technology to integrate the devices, appliances and services found in homes so that the entire domestic living space can be controlled centrally or remotely.
- Home wiring, the advance home developers are installing, typically adds several thousand dollars to the cost of a new home, and it is usually Ethernet or coaxial cable -- or some combination of both -- with other technologies in the mix.

Figure: 1

- The network is being designed to make possible remote operation of appliances connected to the network.



Already available extra wiring for device controlling in smart infrastructure.

PRELIMINARIES

- If we talk home automation, there are following three main issues,

1. How to connect home appliances and apparatus.
2. How to make two home appliances to communicate to each other.
3. How to control and manage home appliances

- As far as first issue is concerned, a number of standards have been developed for interconnecting the home devices and apparatus in a network so as to make their management much easier and comfortable. Summarized from a following are the main networking technologies used for connecting devices in home environment.

1. Direct cable connection.
2. Bluetooth Connection.
3. Phone Line.
4. Ethernet.
5. Radio (Free) Network.

- So we can connect the entire home devices by selecting any of the above mentioned network technologies.
- Apart from connecting devices, the second issue regarding the home automation is "how to make two devices communicate to each other". For handling this issue a number of standards have been developed.
- These are following leading communication technologies in home environment:

1. UPnP (Universal Plug and Play) devices
2. X-10 based devices
3. Infrared devices
4. Bluetooth Devices
5. IP based devices

- All these technologies are well matured and have well settled standards. But, in this paper we will skip it as this is not of our concern.

Now we move toward third issue i.e. "how to manage and control the home appliances" which is the issue we are concerned with,

- This issue can be handles in two ways. First, by using traditional digital and microprocessor based systems.
- Second method for this is by using the sophisticated processing of artificially intelligent agents.
- If we consider the first choice, then it is somewhat more common but at the cost of time efficiency as well as feature limitations.
- On the other hand AI based technique provides more efficient and featured services like easy video and audio processing, easy reasoning etc.,

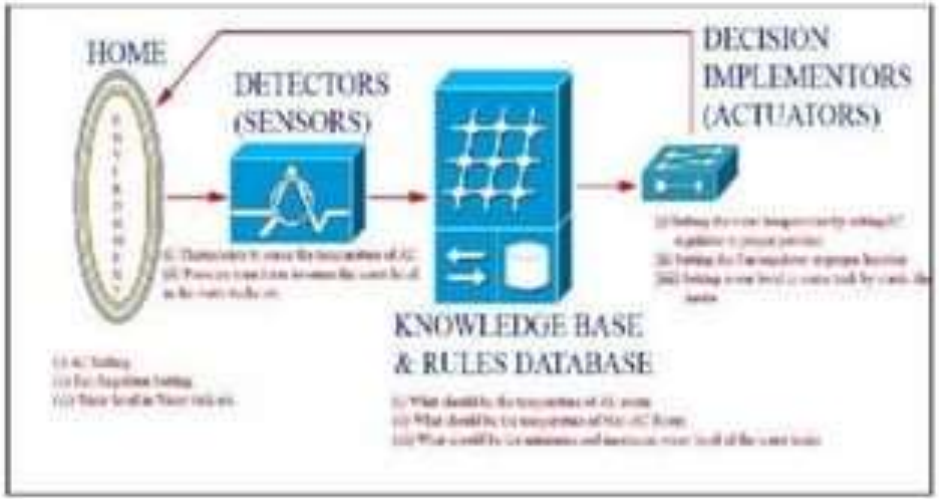
MANAGING HOME APPLIANCES FOR COMFORTABILITY

- As discussed in, the first service that a user expect from the home automation system is the comfortable management of devices.

e.g. the regulator setting of AC depends upon the temperature of the room. As the temperature increases the AC regulation rating (hence cooling rate) also need to be increased.

Figure: 2

- Such class of services is simplest of all types' services and has the structure as shown below



Typical structure of home automation system designed for user comfort ability

- Some features of such systems are:

1. These are closed loop systems.
2. Sensors are transducers and other mechanism for sensing the current proximity condition e.g. sensing the room temperature.
3. Actuators are simply the mechanism to change the environment according to the control signals received from the knowledge base.
4. Knowledge base (KB) is the centralized part of the system and is the main part to discuss here.

- This KB system can be implemented by using simple digital circuitry or using microprocessor systems. But both suffer from the problem of manual setting. In both the system user has to decide and change the threshold setting whenever there is a change in the environment.

E.g. in summer AC is used to down the temperature while in winter the same are used to up the temperature. So, user has to change the setting when season changes because the system can't learn from its experience.

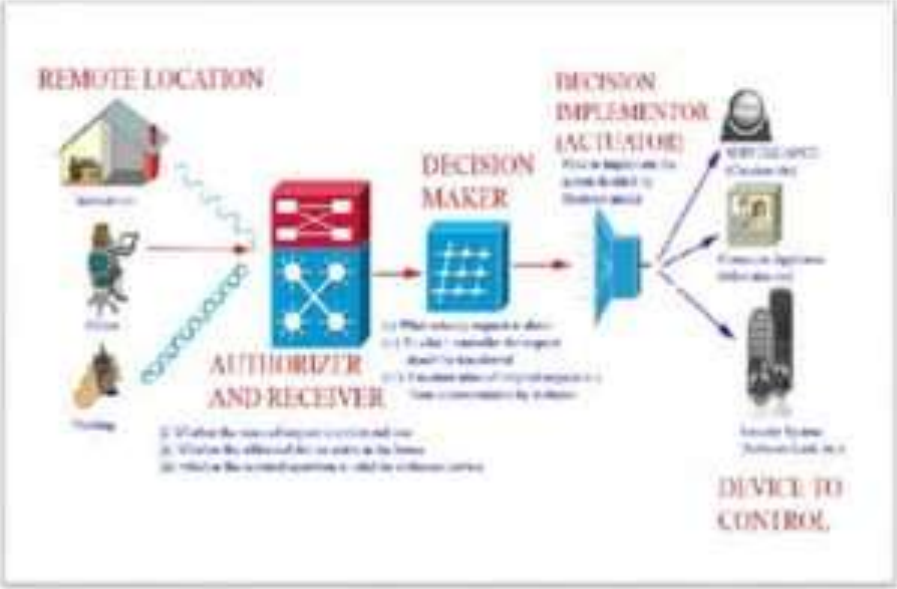
CONTROLLING HOME APPLIANCES FROM REMOTE LOCATION

- The second feature provided by the home automation system is the remote access to devices and their management.

E.g. suppose you are going back to your home and it will take 20 minutes to reach your home. when you reach your home you find your home with comfortable temperature. In such a scenario you need to access your home appliances and also to control them from remote location.

- The typical structure of home automation system for this type of services is given in Fig. 3.

Figure: 3



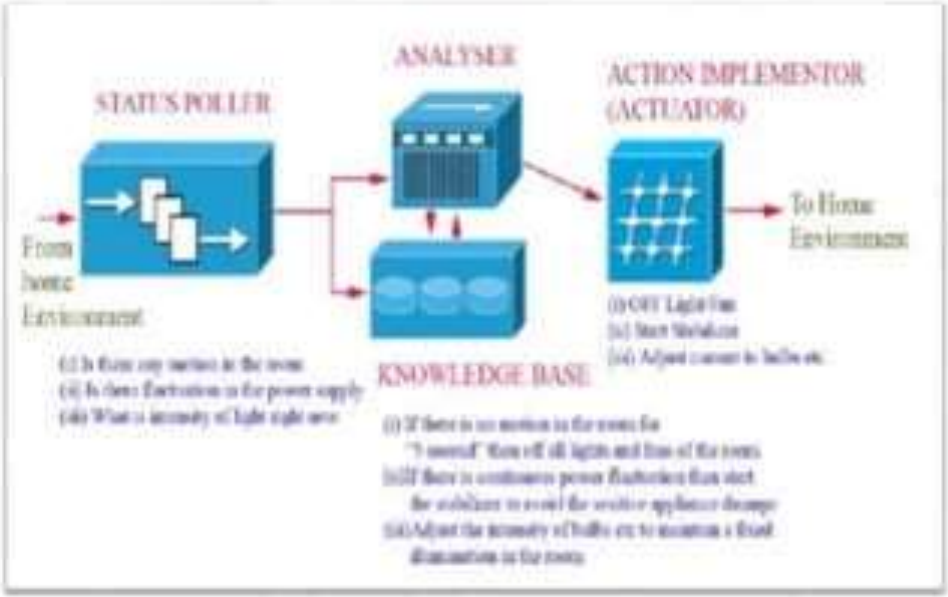
Typical structure of home automation system designed for remote management of home devices

EFFICIENT UTILIZATION OF HOME APPLIANCES

- This application of home automation system is not as common as discussed two applications. But, on the other hand if the automation system is applied in the industrial environment then it becomes the more prominent and beneficial feature of the automation system.

E.g. Suppose the AC of your office (or room) is ON but you are not in your room from last three hours. Then why the AC is still ON? This is just wastage of power. As said already, this power wastage is not much in case of home appliances but in industries power saving is one of the major cost cutting factor. So, for implementing this we need a system that can OFF the AC if it found that there is no person from the last significant time. We said here the word significant as the exact time can't be determined and depends upon the scenario (like for bed room the AC should down OFF if there is no person for one hour while in waiting room the AC should go down when there is no person from last two hours).

Figure: 4

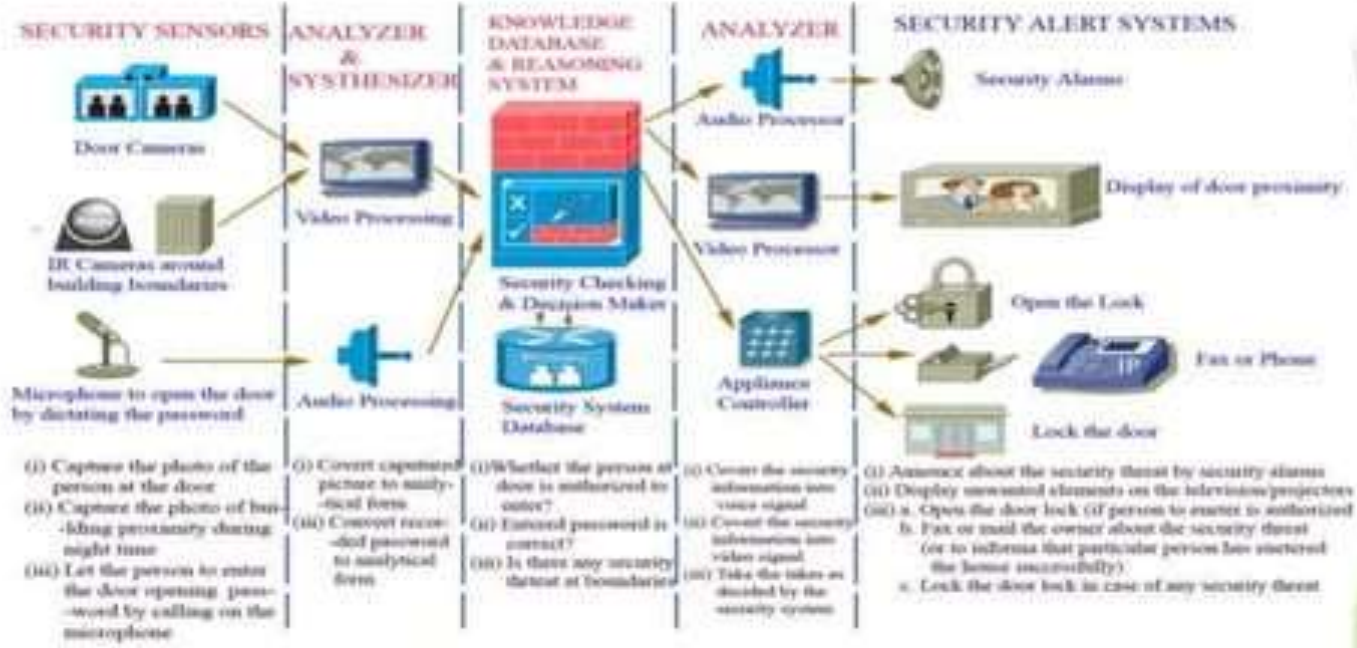


Typical structure of home automation system designed for optimizing resource utilization.

SECURE HOMES

- Security sensors sense the environment for security threat.
- The analyser and synthesizer analyses the data received from the sensors and filter out any security threat. If it found any security threat, then it sends the sufficient information to reasoning system
- The Reasoning system apply the reasoning for detecting whether the security threat is really a threat, if yes then it fires the security alert system for alerting the user about this security threat by analyser.
- This analyser is same as used at the second stage but opposite in nature. The previous converts the physical information into digital form while later one converts the digital information back to physical form to alert the user.

Figure: 5


SECURITY SENSORS
ANALYZER & SYSTHESIZER
KNOWLEDGE DATABASE & REASONING SYSTEM
ANALYZER
SECURITY ALERT SYSTEMS
Door Cameras
IR Cameras around building boundaries
Microphone to open the door by dictating the password
Video Processing
Audio Processing
Security Checking & Decision Maker
Security System Database
Audio Processor
Video Processor
Appliances Controller
Security Alarms
Display of door proximity
Open the Lock
Fax or Phone
Lock the door
(i) Capture the photo of the person at the door
(ii) Capture the photo of building proximity during night time
(iii) Let the person to enter the door opening password by calling on the microphone
(i) Convert captured picture to analytical form
(ii) Convert received password to analytical form
(i) Whether the person at door is authorized to enter?
(ii) Entered password is correct?
(iii) Is there any security threat at boundaries
(i) Convert the security information into voice signal
(ii) Convert the security information into video signal
(iii) Take the taken as decided by the security system
(i) Announce about the security threat by security alarms
(ii) Display unwanted elements on the televisions/projectors
(iii) a. Open the door lock (if person to enter is authorized
b. Fax or mail the owner about the security threat (or to inference that particular person has entered the house successfully)
c. Lock the door lock in case of any security threat

CONCLUSION

- From this discussion it is clear that AI is emerging as a very useful and applicable technology for Home automation. On the other hand, home automation systems provide AI a vast range of Application

Thank You