

# Smart Home Implementation Techniques: A Survey Approach

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## Abstract—

Smart Home technology is the integration of technology and services through home networking for a better quality of living. This paper provides a comparative review of the traditional smart home system; embedded M2M and mobile IP based smart home system and Smart house control using LabVIEW. Embedded gateway is an intermediary device for traditional smart home system.M2M technology has without human intervention, and realizes the data to upload, improve information processing efficiency; real-time control of advantages, for industrial intelligent control, information life has the extremely vital significance. Whereas Mobile IPv6 is a version of Mobile IP that allows users with mobile devices whose IP addresses are associated with one network to stay connected when moving to a network with a different IP address.

**Keywords-** Smart home, M2M, MIP based smart home, mobile IPV6.

## I. INTRODUCTION

Smart homes offer a number of benefits that a conventional home could not offer. For example, in a conventional home, you need to have chains and padlocks to keep intruders from entering your home premises. In a smart home security system, the residents may even know and talk to persons that wish to visit without moving an inch. All the devices and appliances in home are connected to each other so they can communicate with each other and with the residents. The home devices and equipments can be controlled using the latest state-of-the-art Smartphone's[1].

Smart home system is the use of advanced computer technology, network communication technology and automatic control technology, which combines the given sub system into a whole control system concluding the family communication, family equipment automatic control, family safety precautions. Recently, people want to know family condition at any place, what's more, when their home come problem, they will soon receive relevant information, so that remote monitoring becomes a very important function for smart home system.

Use of wire transmission way can't satisfy people's need for remote monitoring, however, wireless communication is able

to overcome the disadvantages of wire transmission, can get rid of geographical constraints, thus realize data transmitted over a long distance . This paper gives the comparative survey of traditional smart home system and embedded M2M smart home system.

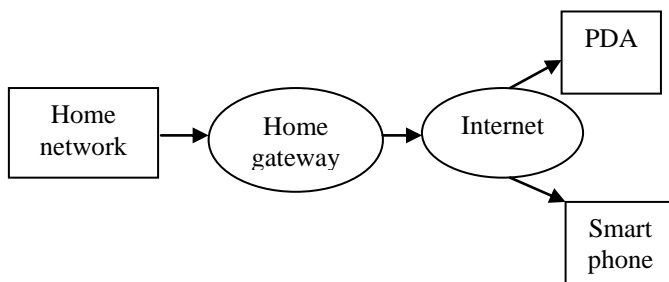
## II. LITERATURE REVIEW

We can easily control home's mechanical systems and appliances over your cellular phone or Internet, and the lighting in your home can be set to save your money when you leave the room. The Internet provides even more incredible access to information and services. We believe that the Internet will become the next essential utility in the home. Lots of advanced techniques have been proposed for smart home system. The different technologies that could provide for smart home communication are X10, Insteon, Zigbee and Z-Wave. X10, developed in 1975 by Pico Electronics of Glenrothes, Scotland, allows compatible products to talk to each other remotely over the already existing electrical wires of a home. The first "home computer" was an experimental system in 1966. The Smart House Project was initiated in the early 1980's as a project of the National Research Centre of the National Association of Home Builders (NAHB) with the cooperation of a collection of major industrial partners. There have been several smart home projects undertaken by individuals over the last few years. The most popular of these has been Microsoft founder Bill Gates' residence on Mercer Island east of Seattle.This section of the paper discusses various techniques and proposed earlier in literature for smart home system.

### A. Traditional Smart Home System

Home gateway is used to control all components in a home network in traditional home architecture, which provides the service for users. Embedded gateway is an intermediary device, so data transfer between the remote terminal and users is totally depends on embedded gateway [2]. It shows that this data communication mode is a kind of indirect type of communication, because each time the user have communicate with the terminals of embedded gateway first. This design easily appears is that the embedded gateway

becomes the network bottlenecks and only people access to WEB server can know that remote control information.



**Figure 1. Architecture of a Traditional Smart Home System**

Figure 1 shows a traditional architecture for a smart home architecture where in the home gateway controls other home appliances and also connects with other user devices through the Internet. Home gateway, also called as residential gateway is defined as an intelligent network interface device located at the residential user premises. Wire transmission technology has some disadvantages to provide people's need for remote monitoring; therefore wireless Communication is use for long distance. So embedded M2M technology is used to overcome the above problems[3]. Compared with the traditional smart home system, adopts embedded gateway method, using M2M technology are quite different.

### B. Embedded M2m Smart Home System

M2M represents the Machine to Machine, Man to Machine, Machine to Man, Mobile network to Man. It includes all technology and method of communication among men, machines, and system. The concept of M2M is make net of all things, and data transmission of all equipments [].The M2M communications is to enable M2M components interconnected, networked, and controllable remotely, with low-cost, scalable, and reliable technologies. M2M is a new type of data transmission technology and the direct communication mode of equipment and equipment. System chose Samsung's S3CZ44BOX as MPU, with LINUX operating system, and adopted 3G wireless communication mode based on the standard of TD-SCDMA.

- *2G Vs 3G Technology*

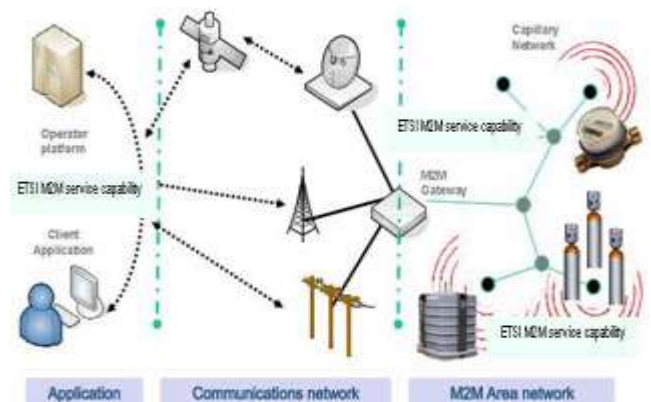
There are lot of advantage for 3G compared to old one 2G which are high speed, data over voice and many more features. Third generation is a new revolution in the area of telecom. Although we cannot say it new because of in the USA or in the European countries it is already being used but it's new for some developing countries like in India. The customers will get a high speed network for their communication which is far better than the 2G technology, particularly in data communication. Its transfer data rate for

144kbps, outdoor static or walk rate for 384kbps, and indoor for 2Mbps. 3G network have advantages of broad covering, high bandwidth, forever online, good security .It is very fit for wireless smart home system as compared to 2G.

3G wireless communications have three main interface standards, they are W-CDMA (Wideband Code Division Multiple Access), CDMA2000 (CDMA Multi-Carrier) and TDSCDMA Time Division-Synchronous Code Division Multiple Access standard is used for the communication. It support ascending and descending asymmetric data transmission, uses a variety of frequency bands between 1785 MHz and 2220 MHz, ascending and descending transmission speed can be achieved 128kbps and 384kbps and offers sufficient data throughput to handle the traffic for Multi Media and Internet applications.

- *M2M technology*

The European Telecommunications Standards Institute (ETSI) has divided M2M systems into three parts including area networks, communication networks and applications. Fig 2. Shows an area network is composed of data end points, which are usually sensors, compact microprocessors, subscriber identification module (SIM) cards and smart meters. Sensor data (usually an alert) is sent to microprocessors via communication circuit. Microprocessors then deliver these alerts to a radio module, which converts the instructions into packets and sends them over the communication network [4].



**Figure 2 . ETSI M2M Network Architecture**

The Telecommunications Industries Association (TIA), has established the working group TR 50 for Smart Device Communication (SDC). The European Alliance (ESNA) and National Institute of Standards and Technology (NIST) are other organizations which are specifying standards for M2M.

• System Structure

The structure of wireless smart home system is shown in Fig 3. Control terminals connect with home appliance equipment for collecting user's concerned data and controlling equipments. Control terminal connect with camera for collecting home video image, and connect with smoke and gas sensor for collecting gas concentration, and connect with air condition for switching the air condition and adjust the temperature of the air condition, and so on.

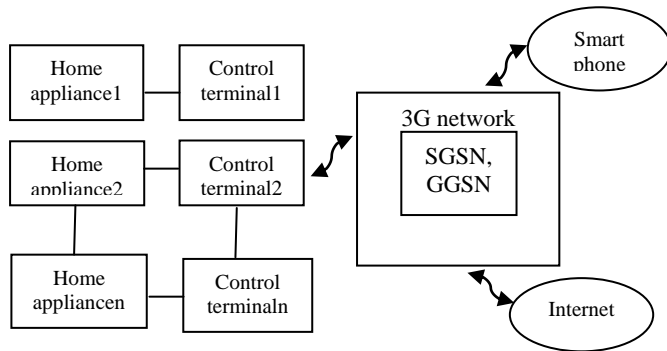


Figure 3 . Wireless Smart Home System

Controlling terminal access 3G network through 3G module and have communication with remote mobile phone or remote computer. Video Monitoring adopted the motional detection technique and send alarm information to users mobile phones when detected the moving pictures. The users can also see the home video information at real-time way [5].

C. Mobile Ip-Based Setup for Smart Homes

After embedded M2M smart home system there is new technology which is mobile IP based. The proposed architecture for Smart Homes is based on the integration of the emerging technologies of Wireless Sensor Networks and Mobile IP. The traditional setup for Smart Homes is enhanced by providing mobility utilizing the current state of the art principles of MIPv6. The users can control the devices on the home network even if he moves in to a foreign network as shown in fig 4.

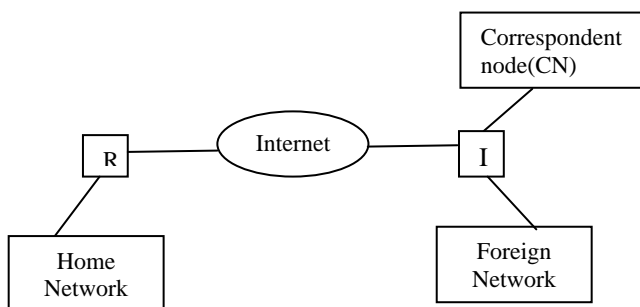


Figure 4. Mobile IPv6 Architecture

R-IPv6 router with home agent functionality  
I-Regular IPv6 router

The utilization of Mobile IPv6 with the Smart Home Systems is optimized to provide mobility and enhanced communications and interconnection for home networking that could lead to efficient, reliable, and emergent services a home networking could offer. The proposed architecture could provide a seamless convergence for communicating between the users and the home devices and equipments as he leaves his residence as compare to the available smart home system.

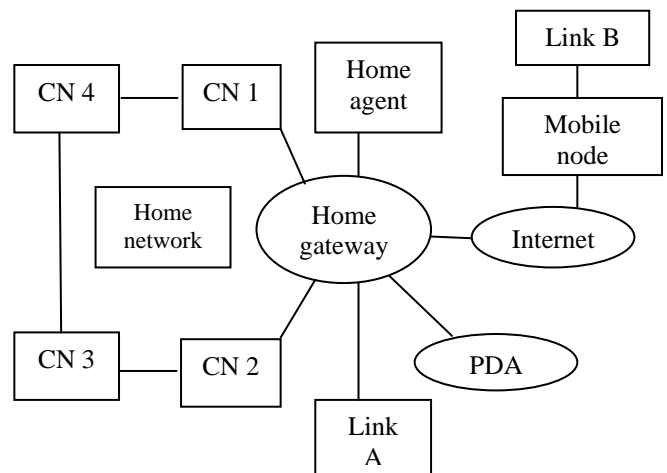


Figure 5 . Overview MIPv6-Based Smart Home System

Fig 5. Mobile IPv6 is a version of Mobile IP that allows users with mobile devices whose IP addresses are associated with one network to stay connected when moving to a network with a different IP address. When a user leaves the network with which his device is associated (home network) and enters the domain of a foreign network, the foreign network uses the Mobile IP protocol to inform the home network of a care-of address to which all packets for the user's device should be sent [8]. Each mobile node is identified by its home address disregarding its current location in home network. While away from its home network, a mobile node is associated with a care-of address which identifies its current location and its home address is associated with the local endpoint of a tunnel to its home agent. Mobile IP is most often found in wireless WAN environments where users need to carry their mobile devices across multiple LANs with different IP addresses.

The most significant difference between MIPv4 and MIPv6 is that MIPv6 is integrated into the base IPv6 protocol and not an add-on feature, as is the case with IPv4 and MIPv4. Because most Internet devices will soon be mobile, it is important that all devices are inherently designed to be mobile and IPv6/MIPv6 allows for this. This integrated aspect of IPv6 and MIPv6 also makes MIPv6 more efficient and much easier to implement. Mobile IPv6 provides a number of security

features that provide protection against many of the threats posed to Mobile IPv6 as a result of its new features [6].

#### D. Smart House Control Using Lab View

The system is based on the Lab VIEW software and can act as a security guard of the home. The system can monitor the temperature, humidity, lighting, fire & burglar alarm, gas density of the house and have infrared sensor to guarantees the family security. The system also has internet connection to monitor and control the house equipment's from anywhere in the world. The smart house has two interfaces, computer interfacing, and remote control unit interfacing. Computer device that provided with Lab VIEW software is the main controller unit for all systems in the house as shown in fig 6.

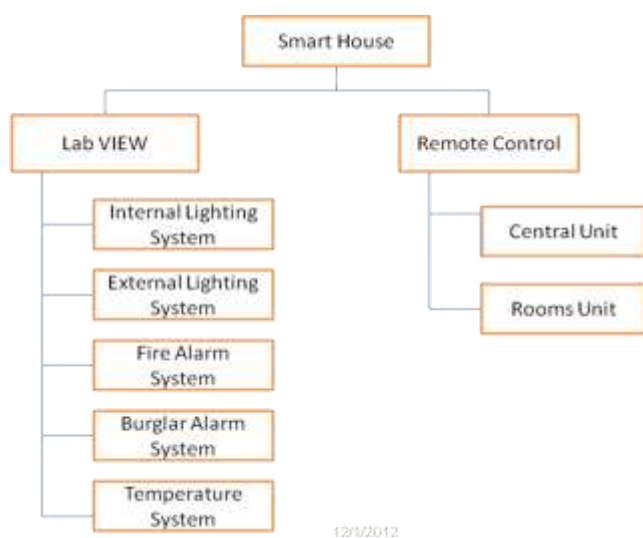


Figure 6 . Smart House Control

It receives data from house sensors, process information and updates data for the difference systems, and transmit controlling signal to house systems and switching output devices.

Lab VIEW software is used for a wide variety of applications and industries. Lab VIEW is a highly productive development environment for creating custom applications that interact with real-world data or signals in fields such as science and engineering. The net result of using a tool such as Lab VIEW is that higher quality projects can be completed in less time with fewer people involved. So productivity is the key benefit, but that is a broad and general statement. Lab VIEW is unique because it makes this wide variety of tools available in a single environment, ensuring that compatibility is as simple as drawing wires between functions.

Smart house controlled by LabVIEW that controls main system. The main system consists of five parts; these five parts are connected to LabVIEW software as the main controller for

these systems. The first subsystem in smart house project is security systems that include fire alarm system used in announcing the outbreak of a fire and work to extinguish the fire, and burglar alarm system that signals the occurrence of a burglary. The second subsystem is lighting system that include the internal lighting of the house, and the ceil lighting outside the house. The third subsystem is remote control system for house controlling. The fourth subsystem is temperature system for air conditioner controlling. The fifth subsystem is Main house power switching system to switch the power supply for all rooms in the house as shown in fig 7.

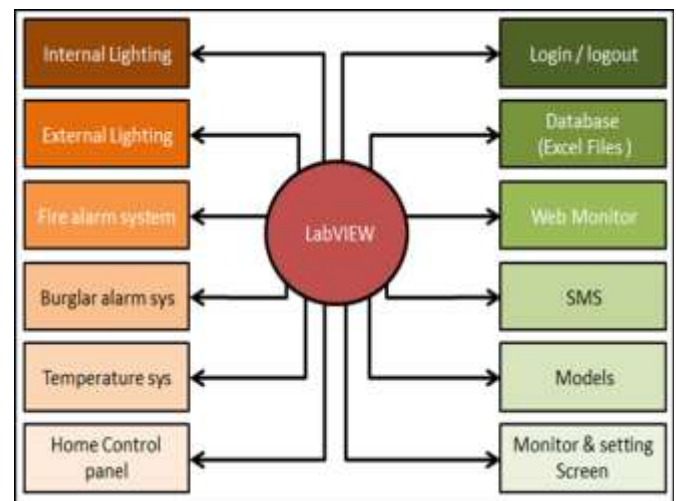


Figure 7 . Lab VIEW Control of Smart House

Lab VIEW Support for thousands of hardware devices, including: Scientific instruments, Data acquisition devices, Sensors, Cameras, Motors and actuators, Familiar programming model for all hardware devices, Portable code that supports several deployment targets Lab VIEW makes the process of integrating hardware much easier by using a consistent programming approach no matter what hardware you are using[7]. The system also is connected to the internet to monitor and control the house equipment's from anywhere in the world using Lab VIEW.

### III. CONCLUSION

The main objective of this Paper is to design and implement a control and monitor system for smart house and also provides a comparative review of the various types of smart home system .This proposed paper provides an over view of various Smart home techniques ,challenges and opportunities. This shows that the system also connected to the internet to monitor and control the house equipment's from anywhere in the world.

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