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SMART HOME AUTOMATION – A SURVEY

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ABSTRACT
Home automation trade has drawn good attention of researchers for quite a decade. The main attraction of any automated system is reducing human labor, effort, time and errors due to human negligence.Smart home aims people manage the home appliance freely and build an autonomous environment in home or work area. Smart home system enriches the life of humans and takes care of old people who live alone. It is the integration of technology and services through home networking for better quality of living. The smart home system consists of Physical components, Control system and communication system. People can use smart phones or tablets to control or monitor the home appliances both locally and remotely. We come up with the concept of Smart Units and Home Proxy. The remote server can act as a service provider and provide service for different homes and offices. This paper aims to perform a survey of all the existing such systems and compare the available features. The paper will also compare and contrast all the systems and their features. A wide variety of options are available for the home automation systems.In this paper, the Technologies and tools that can be integrated or applied in Smart Home systems are also presented.

Keywords:
Smart Home, Ubiquitous, Automation, X10, Home Automation, Smartphone, Voice Control, wireless technology

INTRODUCTION

Automated central control of building-wide systems was found only in larger commercial buildings and expensive homes. It involves only lighting, heating and cooling systems, building automation rarely provides more than basic control, monitoring and scheduling functions and was accessible only from specific points within the building . With the advent of 'Internet of Things' in the last decade, we have been pushing for ubiquitous computing in all spheres of life. Voice controlled House Automation System aims for the cause of automation to achieve the goal of simplicity. The classic control unit is the home computer, for which many of the earlier home automation systems were designed. Today's home automation systems are more likely to distribute programming and monitoring control between a dedicated device in the home, like the control panel of a security system, and a user-friendly application interface that can be accessed via an Internet-enabled PC, smart phone or tablet.

SMART HOME SYSTEMS

A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. A home automation system typically connects controlled devices to a central hub or "gateway". The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet

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COMPARING HOME AUTOMATION TECHNIQUES

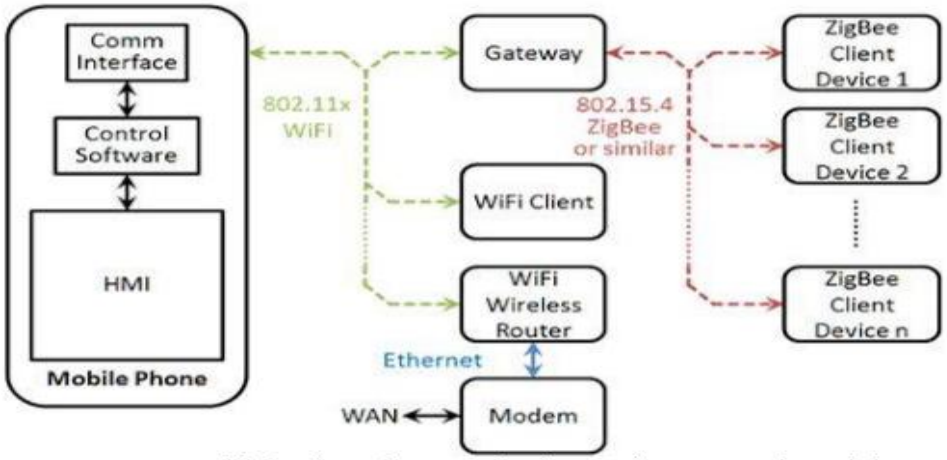

Fig 1:- shows the comparison between home automation techniques

3. Smart Home Technology

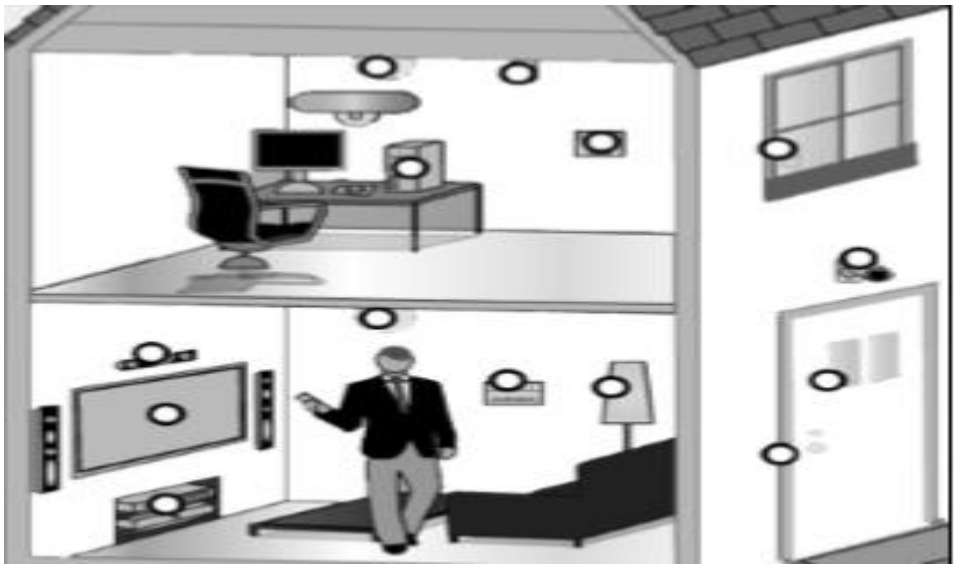

Figure 2. The dots represent devices that could be connected to your smart home network.

3.1. Z-Wave. Z-Wave uses a Source Routing Algorithm to determine the fastest route for messages. Each Z-Wave device is embedded with a code, and when the device is plugged into the system, the network controller recognizes the code, determines its location and adds it to the network. When a command comes through, the controller, it uses the algorithm to determine how the message should be sent. Because this routing can take up a lot of memory on a network, Z-Wave has developed a hierarchy between devices: Some controllers initiate messages, and some are "slaves," which means they can only carry and respond to messages

3.2 ZigBee. ZigBee's name illustrates the mesh networking concept because messages from the transmitter zigzag like bees, looking for the best path to the receiver. While Z-Wave uses a proprietary technology for operating its system, ZigBee's platform is based on the standard set by the Institute for Electrical and Electronics Engineers (IEEE) for wireless personal networks. Like Z-Wave, ZigBee has fully functional devices (or those that route the message) and reduced function devices

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3.3 Insteon. Using a wireless network provides more flexibility for placing devices, but like electrical lines, they might have interference. Insteon offers a way for your home network to communicate over both electrical wires and radio waves, making it a dual mesh network. If the message isn't getting through on one platform, it will try the other. Instead of routing the message, an Insteon device will broadcast the message, and all devices pick up the message and broadcast it until the command is performed. The devices act like peers, as opposed to one serving as an instigator and another as a receptor

Fig.3. Room control unit

Fig.4. control panel

Fig.5. Internet Enabled Cat Feeder

Fig.6.Well pump automation

Fig.7.Navigation Tool

Fig.8.Thermostat with energy usage

Fig.9. Smart home system – An indication

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X10 is a common protocol for PCS, it is a signaling technique for remotely controlling any device plugged into an electrical power line. X10 signals, which involve short radio frequency (RF) bursts that represent digital information, enable communication between transmitters and receivers. In Europe, technology to equip homes with smart devices centers on development of the European Installation Bus, or Instabus. This embedded control protocol for digital communication between smart devices consists of a two-wire bus line that is installed along with normal electrical wiring. The Instabus line links all appliances to a decentralized communication system and functions like a telephone line over which appliances can be controlled. X10 does have some limitations. Communicating over electrical lines is not always reliable because the lines get "noisy" from powering other devices. An X10 device could interpret electronic interference as a command and react ,or it might not receive the command.

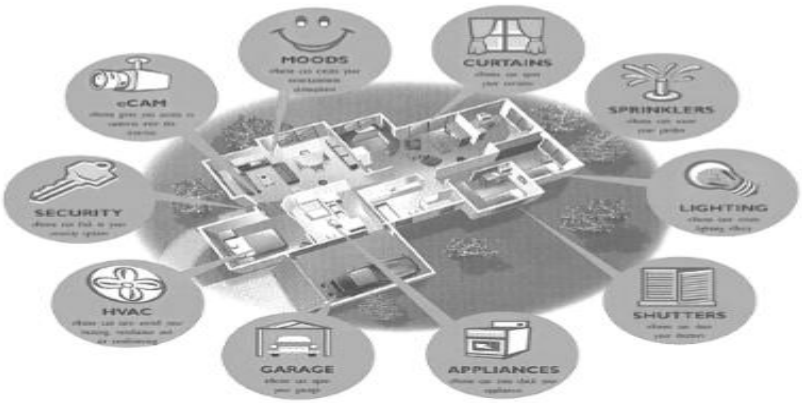

Fig.10. Smart Home Technology Automation

APPLICATIONS AND TECHNOLOGIES

- Heating, ventilation and air conditioning (HVAC): it is possible to have remote control of all home energy monitors over the internet incorporating a simple and friendly user interface.
- Lighting control system: a "smart" network that incorporates communication between various lighting system inputs and outputs, using one or more central computing devices.
- Occupancy-aware control system: it is possible to sense the occupancy of the home using smart meters and environmental sensors like CO_2 sensors, which can be integrated into the building automation system to trigger automatic responses for energy efficiency and building comfort applications.
- Appliance control and integration with the smart grid and a smart meter, taking advantage, for instance, of high solar panel output in the middle of the day to run washing machines
- Home robots and security: a household security system integrated with a home automation system can provide additional services such as remote surveillance of security cameras over the Internet, or access control and central locking of all perimeter doors and windows. Leak detection, smoke and CO detectors Indoor positioning systems (IPS).
- Home automation for the elderly and disabled
- Pet And Baby Care, for example tracking the pets and babies movements and controlling pet access rights.
- Air quality control. For example Air Quality Egg is used by people at home to monitor the air quality and pollution level in the city and create a pollution map Smart Kitchen and Connected Cooking . Using Voice control devices like Amazon Alexa or Google Home to manage coffee machines, ovens and fridge.

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BUILDING AUTOMATION

Self-powered wireless switches, sensors and controls with EnOcean technology are good for energy-efficient, comfortable and secure buildings. EnOcean-based devices can flexibly be placed wherever they deliver most accurate data. This results in significant energy savings at low installation cost of up to 40 percent. Energy harvesting wireless sensor networks from EnOcean are the key to "intelligent green buildings". EnOcean's energy harvesting wireless technology enables flexible smart home solutions for new built and retrofit from a simple switch "all on/all off" to a gateway-connected system (TCP/IP) controlled via smart phone. EnOcean´s energy harvesting long-range wireless sensor solution is being used in the agricultural field, where there are heavy rain showers, freezing conditions, strong winds and sunlight. Apart from using it in the agricultural field, it can also be used for monitoring buildings and bridges that are exposed to rain and sea water directly, water level monitoring in rivers and shores, measuring temperature and flow rate in chemical plants and tanks, managing entrance and exit to parking lots, as well as various ocean applications for measuring distance and water temperature. EnOcean includes eight different sensors with generic interfaces, including a temperature and humidity sensor (ESO-A), a soil moisture sensor (ESO-H), a soil temperature sensor (ESO-T) and an illumination sensor (ESO-I). Now, further sensors such as an occupancy sensor (ESO-O), a distance sensor (ESO-P), a food sack temperature sensor (ESO-R) as well as a barrel temperature sensor (ESO-S) complete the system. All sensors are connected to EMOS 200LH via short cables with robust outdoor plugs. A generic interface was developed for this purpose, which enables new sensors to be added to the system flexibly later on without requiring software updates in EMOS 200LH. The system will be completed with further sensors like a CO2 sensor for use in greenhouses as well as a tilt sensor for infrastructure applications, which are currently both in field trial.

- **Building automation** reduces energy consumption and operating costs. Furthermore, it increases security and comfort.
- **Wireless technology** is essential to a flexible, efficient building automation at minimized installation time and system cost.
- **Battery-less devices** eliminate the need to monitor, replace and dispose of batteries. This saves maintenance cost and resources, particularly in large systems.

- Comprehensive Easyfit LED controls portfolio with EnOcean radio standard
- Self-powered sensors and switches, combined with LED fixture controllers and a commissioning tool, permit easy configuration, intelligent local control, and seamless integration into building automation systems.
- The wireless LED controls portfolio is ideal for both, new buildings and retrofits. They can be easily introduced into intelligent building technology: in residential buildings, by connecting it with a transmitter and a receiver.
- Self-powered, wireless Easyfit LED controls from EnOcean, world leader in energy harvesting wireless technology, are now included in the DLC Qualified Product List (QPL). EnOcean customers across the US are now free to pursue new and retrofit projects that may qualify for higher utility rebates with a QPL solution, all without adding batteries to their wireless installations. EnOcean offers a comprehensive wireless LED controls portfolio for intelligent commercial lighting control, enabling maintenance-free, ready-to-use LED lighting applications based on energy harvesting technology.
- The EMOS 200LH sensor transceiver is encased in a robust and weather proof housing with three M16 interfaces. Two interfaces are used for connecting external sensors, while the third permits the individual configuration and software updates. An integrated solar cell allows for fully maintenance-free operation and facilitates the collection and transmission of data within a defined period of time over several kilometers. The EMOT 200LH gateway transceiver uses the same housing but without a solar cell window, since the latter is supplied via its own interface. This interface also makes it possible to transfer the data to the cloud.
- EMOS 200LH and EMOT 200LH can be used for over 10 years without having to worry thanks to their water resistance and sturdy materials. The aluminum housing is heat- and water-proof, resistant to humidity and sunlight and also provides dust resistance.

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CONCLUSION

People who are elderly or disabled benefit the most from a home automation system that employs artificial intelligence. These systems offer those who are less mobile, or in delicate health, the opportunity to be independent, rather than staying in an assisted living facility. Designing a Smart Home is also very crucial. It was discussed a general system's architecture and the barriers, challenges, benefits and future trends that future smart homes and grids will face. Efficient usage of electricity results in lowering peak load, reducing energy bills, and minimizing greenhouse gas emissions. In order to realize an effective integration of smart homes into a smart grid, the migration towards bi-directional communication networks has to be fostered, and well-tuned home automation system has to be designed

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