

Home Automation Indian Scenario: A survey of Architectures and Technologies

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Abstract— Home automation is the automatically controlling the day today activities of the home. Home automation involves the controlling of various devices of the home, taking care of the well being of the occupants, providing security to the occupants, monitoring health of the occupants. Home automation network involves wireless embedded sensors and actuators which monitor various devices used for home management. One of the most critical aspects in home automation is communication and network technology. In this article a discussion is done about the Indian needs, challenges faced as per the Indian requirements and shortage of resources in India. The already available home automation technology can be tuned to be cheaper and widely acceptable even at the remote areas.

Index Terms— Home automation, Home security, Energy management.

1 INTRODUCTION

WE are living in the era of minute by minute developments in new technologies: The demand of easy way of the life is the talk of the day. Engineering industries are focusing on the projects which facilitate their customers with comfortable and secure living. During the last five years there was an enormous growth in field of communication. Speed with which new things are happening in the mobile communication and its popularity to every household makes a man rethink about having such technological changes in other fields like energy management, home automation and security trying to merge it with a hand held device like mobile phone

The rapid and magnanimous growth of communication facilities and living standards, there is great demand for enormous quantity of energy and automation. At the same time conventional sources of energy are rapidly depleting and also at the same time the cost of energy is rising. As the energy saved is less expensive than to generate equivalent amount of energy it is seriously required to find out ways to judiciously save energy and at the same time provide sufficient energy to the consumers to fully enjoy the comforts provided by the technological development. Then only a sustainable economical growth is possible. If we don't plan properly definitely there will be serious energy crisis. To overcome this crisis the only alternative in sight is exploration of non-conventional sources of energy. As the renewable energy tapping is costly, to make it more economical and cost effective it is required to make a system with value added services like home automation and home security. We can also have distributed energy generation systems wherever possible at the place of consumption. This will reduce the transportation costs. Such a system is really cost effective if advancements of communication

and computer engineering can be effectively utilized.

2 DESIGN CONSIDERATIONS

India is mainly a country with 70% population living in rural area with more than 40% population are living below poverty line and with 70% people are agriculturists. All the technical innovations in the field of home automation already popular in the developed countries cannot be directly suitable for the Indian conditions.

On basis of the above prerequisites we can set the following guidelines for the suitable home automation system for Indian homes. Indians cannot afford a costly home automation system. This discussion is focused on advanced idea of providing an integrated solution in which the comprehensive controlling and monitoring of all home appliances along with the security and smart energy management. The reason for integrating many things along with the home automation is one of the methods of cost reduction.

In India already mobile communication has become so popular that even the poorest families are using more than one mobile phone. So we find a solution to make the home automation a cost effective and easy to hand if we interface with already popular mobile communication system. The end user will be using a hand held device like mobile phone to control the home automation, home security and also do the energy management.

Home automation part mainly involves the things like light control, remote control, smart energy management, remote care, security and safety like burglar alarm, automatic water level control, automatic water temperature controller, automatic gate opening and closing, fire alarm, automatic emergency light controller, smoke detector, control of power generation using bio waste, automated electric fence for the farmlands, automatic operation of street lamp and gate lamp and night lamps, controller for intruder sensor.

Home security can be done with automatic biometric identification and authorization for entry, face recognition system, raising the alarm whenever unauthorized intrusion occurs, dialing to emergency helpline numbers during situations like

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security breach, fire accidents, and untoward incidents.

Energy management system involves management of the emergency lighting system, management of solar lighting system, management of micro wind power generation, power generation using hybrid power generation using biogas and solar etc. If every house can be made a power generating place using renewable energy sources and biomass energy generation systems, this will solve the energy shortage needs of the remote villages. India is already suffering a lot due to the transmission and distribution losses. Indian government instead of providing subsidized power to the farmers it can help them produce power generation from the biomass waste products. With this there can be way for income generation for the rural people.

The home automation and security and energy management system can integrate many other things like the health of the people, health monitoring of the old people, providing emergency medical help to the remote areas, monitoring of the government operated community health program related problems like pulse polio, malaria eradication, child vaccination, monitoring health and malnutrition. Health of every person in home from elderly to child can be monitored. This will reduce the wastage of government's efforts towards the social health related projects.

Government of India has many schemes to help the people who come under the category of below poverty line. Whether such benefits have reached those needy people or not can be effectively observed by having home automation system to monitor such activities also.

India has already started the ambitious project ADHAAR which provides the citizen ship card to all its citizens. This system can interface to the home automation system.

An integrated home automation system suitable to India requirements has multiple users and /or multiple stake holders. From the above discussion it can be concluded that many users are occupants of the house, family members, partners living in the same space, friends and family members living elsewhere who are involved in care or interested in well being of their family members, government representatives who are involved in the government schemes like social health workers, school teachers, doctors, people from government departments. Like this there can be many users. These people can be direct or indirect users or stake holders. Some of them can be in contact with data or people of home or can also be in direct need of the access to the devices of home care system.

Even though the users and stake holders are many there should be absolute privacy to the occupants of the house and there has to be serious measures taken to maintain the security of movable and immovable belongings of the members of the house.

Home automation system has to be flexible, easily modified to add additional facilities. This is required as the need of the people keep changing, the government policies keep changing, there can be additional facilities provided to improve the living conditions.

Next discussion will be related to the technical aspects. Tech-

nical aspects can be classified as things related to controller, remote devices, communication aspects, logic devices, sensors. Controller design aspects mainly can be open loop system or closed loop system. For all requirements one cannot make closed loop or open loop controller. This depends on the specific needs. We cannot involve more intelligence in the controller as this will increase the cost. It is better to have some set of preset parameters. The external inputs can be compared with the preset parameters and produce the signal to the actuators.

Sensors used in home automation can be wired or wireless sensors. If wireless sensors are used then lot of wiring will cause lot of cabling and long term maintenance will be problematic. As cost reduction measure all the sensors need not be wireless but some sensors can be made wired ones. But with wireless sensors we have to make the optimum analyses of the strength of the electromagnetic wave. Too much of electromagnetic interference will have to be avoided in the home environment. But an analysis can be made to make use of power line communication. So the existing electric wiring itself will be sufficient to connect the sensor devices present inside the home. So the method will be to connect all the sensors in the home through the wireline communication network.

There should be a centralized controller in the home which will communicate with the external network. This controller can be made to be enabled to communicate with the mobile type of hand held devices of the individual occupants and also it has the capability to interface with the local mobile tower or to the telephone line.

3 DESIGN AND IMPLEMENTATION

A basic in the rural atmosphere is an independent house with compound wall, this has been shown with the schematic as given in fig1. At specific places along the compound wall sensors are needed to be placed which can produce alarm during unauthorized intrusion. The gate has to be automated to provide access to authorized people only.

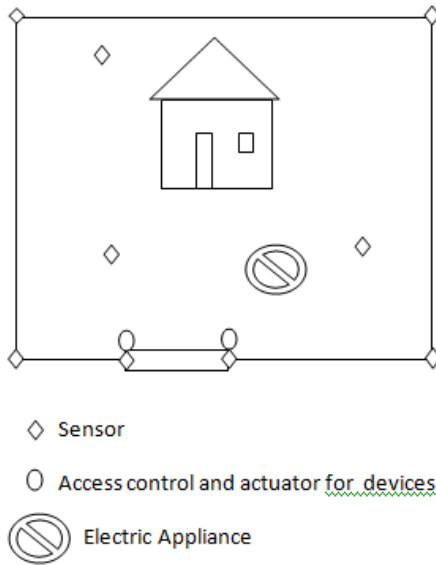


Fig 1. Layout plan of home automation setup.

As shown in the fig1 many sensors can also be placed at various places in the surrounding of the house. For example it may be for the purpose of knowing the humidity of the soil so that electric devices like the water pump can be switched on to start the sprinkler to water the plants or the lawn. At the gate of the compound sensors will give input to the controller and the actuator operating the gate can be driven by the output of the controller or by occupants of the house remotely by bypassing the controller also.

In fig.2 the typical house is shown. It is floor plan of a typical house. Every room will have a window opening to the outside. As shown sensors are placed at each window which is shown with sensor symbol. At all the doors sensors are placed along with the actuators to operate the doors. There are various electric devices in each of the rooms as shown with the symbol.

All the sensors and actuators can be connected to the central controller through a wired connection or wireless connection. The choice between these two implementations can be done depending on the cost and flexibility of implementation. More advanced implantation will be by making use of power line communication technique inside the house and surrounding to the house.



Fig2. Floor plan of home for home automation

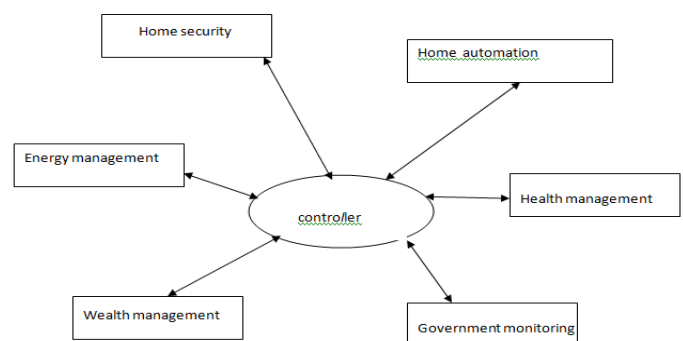


Fig3. Block diagram for integrated home automation

Fig 3 shows the implementation of the home automation suitable for the Indian home. Here the integration of the home automation home security, home energy management, health and wealth management and interfacing with the government agencies.

4 DISCUSSION

The above implementation gives the overall picture of integrated home automation system suitable for the Indian environment and the setup. There can be various types of implementations can be possible but the implementation should satisfy the needs of poor people, farmers, implementation of government policies, well being of elderly and also children.

5 CONCLUSION

This paper presents a new dimension to the concept of home automation. It will be not affordable for the Indian setup if only the home automation is done. But an integrated system as discussed in the paper will real beneficial if government comes forward and makes the coordinated effort by using the resources from energy department, telecommunication companies ,banking sector and also agencies involved in the social welfare and social justice. This is not a small task but a huge effort is required from lot many people.

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