Home Automation System

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Abstract

Automation was initially used in Industries to reduce the human exposure to hazardous situations and to have work done more effectively and efficiently. Its use reduced the man power required, and also helped in handling complex systems more effectively. In this project we have tried to bring a model of Home Automation which is simple, reliable and cost-effective. By making use of the fact that mobile phones have became an inseparable part of our lives, in this model we have kept the mobile phone at the centre of our system i.e. we have tried to automate entire home with the help of a mobile phone. This Home Automation model is hugely expandable and is capable to handle several complex tasks in parallel. The idea behind making of this project is to get a feeling of how a home can be automated completely with the help of a mobile phone.

1. Introduction

Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. In the scope of industrialization, automation is a step beyond mechanization. Automation plays an increasingly important role in the world economy and in daily experience. Slowly automation has started penetrating our homes. Its presence can be felt in the TV remote controls, fire alarm systems, water tank management systems, and also in security systems. We have started relying on Automation to make our lives easy and secure. Automating Home helps in saving electricity, reduces manual labor, increases reliability and efficiency, and also helps in tackling security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care. The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity though Smartphone and tablet connectivity. The concept of the "Internet of Things" has tied in closely with the popularization of home automation.

2. Problem Statement and Synopsis

The field of Automation has well advanced in Industries, as majority of automobile industry plants as well as bottling plants have Automated assembly lines. But automation has not yet penetrated in the homes especially in India. If automation was to be used in homes than everyday life would be get eased. Simple example of use of automation in home can be seen in the transfer of water from the under-ground water tank to the over-head water tank, by sensing the level of water in both the tanks. This process eases the every time effort the user has to put in for filling the tank and also helps in saving water. Also people are getting more acquainted daily with the use of Smartphone and tablets which are capable of doing much of PC's work handy. So we have decided to make a low cost Embedded System in which the smart phones can be used to help automate entire home. In this system the user will have remote access and control over all the subsystems present in the house.

3. Home Automation using Android Application

We can automate home using various wireless technologies such as Bluetooth, WI-Fi, Zig-Bee, GPS and GSM etc. For controlling as well as monitoring the entire home system we are going to use Bluetooth module and an Android phone. As android is open source software we can easily make an application on it as per our necessities and requirements. This application will provide an interface between users and the actual appliances which he wishes to control. By designing entire embedded system with the help of the controlling, receiver modems and the devices we would prepare an actual model of the home automation system which will be cheap and easy enough to implement in our homes and other places.

4. Working

There will be wireless communication between the mobile and central controlling device whereas there will be wired communication between the controlling device and also the systems in the Home. Some directions to the appliances will be given by central microcontroller and others will be given by the central controller itself without any conscience of the mobile. At user side there will be an Android enabled Mobile phone which will communicate with the central controlling device. In order to send signals to the central controlling device wireless communication in form of Bluetooth will be used. For successfully establishing the communication the mobile phone has to pair up with a Bluetooth module and transmit signal to the module serially. This wireless communication will take place serially via Bluetooth in form of transmission of characters in form of Bytes, which will be received and stored in the Bluetooth modules memory. At receiver side, the Module will serially communicate with the microcontroller Board. The Bluetooth module will deliver the output serially in form of Bytes of characters it receives at the input. These characters will be verified by the controller's code and based on the logic written in the code successive operations will be performed by the controller. The controller will be connected to different systems, to which it will give directions.

5. Components Used

- An Android Smartphone
- Bluetooth module RN-42
- Arduino board

6. Module Level Description

- **Bluetooth module RN-42:** This module from Roving Networks is powerful, small, and very easy to use. The end user just sees serial characters being transmitted back and forth. RN-42 is a Class 2 device meaning its range is about 50 to 60 feet and correspondingly the power consumption is also low. The RN-42 is perfect for short range, battery powered applications. The RN-42 uses only 26uA in sleep mode while still being discoverable and connectable. Supporting multiple Bluetooth profiles such as SPP and HID and simple UART hardware interface, it is simple to integrate into an embedded system or simply connect to an existing device.

- **Arduino:** Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. It is loaded with the huge collection of in-built libraries. It is very much suitable for multi-tasking application as well as for the function programming and works very well with Master-slave environment.

- **Android:** It is a Linux-based operating system designed primarily for touch screen mobile devices such as smart phones and tablet computers. Google releases the Android code as open source, under the Apache License. The Android Open Source Project (AOSP), led by Google, is tasked with the maintenance and further development of Android. Additionally, Android has a large community of developers

writing applications ("apps") that extend the functionality of devices, written primarily in a customized version of Java.

7. Software development tools

Android: Java using Eclipse
Arduino programming board: C language

8. Uses

Home Automation can be used in:

- Saving resources like water, electricity and fuel by making optimum use of them using various feedback systems
- Reducing effort and time
- In improving the security of home by 24*7 surveillance
- Can be of immense help to physically handicapped person

9. Applications

- Adjust the thermostat while you lie in bed, or from a cell phone on your way home from work.

- Heat the hot tub or turn on the oven on the way home from work through the cell phone.

- Eliminate the need to walk around the house turning off lights before exiting the home or going to sleep, turn off all house lights with the touch of a single button.

- Set a series of events for your morning routine, designate the thermostat to warm the room, have lights gradually increase intensity, ensure the coffee begins brewing and the television turns on.

- Program your security system to alert you through e-mail or phone when the system detects activity in the home while you are away.

- Organize and control every component of the home entertainment system-- television, DVD, VCR and whole-house audio -- with a single touch-screen remote from anywhere in the home.

- See who is at the front door without leaving the comfort and safety of your couch through a display on your TV screen showing the visitor at the front door.

- Control all scheduled tasks, such as watering the lawn and outdoor lighting, with a simple computer program.

- Ensure pets are automatically fed, provided new water and clean litter while you are away from home.

10. References

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