

## Wireless ARM based Automated System for Geriatrics

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**Abstract:-** This paper is an attempt to present Wireless ARM based automated system with extended range of Bluetooth, keeping in mind the low cost factor while conceiving the design having a user friendly interface and easy installation process enabling user to control the various home appliances in the connected cluster/s in a comfortable manner. The target customers are geriatrics who needs special attention.

**Keywords:-** Android, Bluetooth, Range Extender, Geriatric, Automated system, ARM, Smart home.

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### Introduction

This project is developed focusing on geriatrics whose requirements are catered to a possible extent in a cost effective, reliable and simple manner. Thus Focusing on the needs of Geriatric and differentially enabled personsto help them lead a better life .

Also an application of the smart home concept improves the level of material comfort in general. The main control system implements ARM based wireless Bluetooth technology along with indigenously developed range extension protocols to provide remote access from the Android smart phone. This device brings all bits and pieces of hardware into one single switch. Hardware and software seamlessly works in tandem with our unified android application interface and provides response within a fraction of a second. The main advantage is that the existing sockets can be converted into an intelligent socket by installing our hardware internally or a module externally. This stands as a testimony of our intension.

In addition this design uses the existing electrical wiring which is an added advantage. Every user interface indicates the real time status of existing switches.

### Background and Motivation

Whenever any automation is introduced for geriatrics, there are a percentage of risks, and our motto is to eliminate them and make the product more reliable.

I believe in the present day scenario IoT is entirely in its native stage just as seen in the development of operating system like DOS where there is a poor extensibility and portability similarly there is a requirement of a common language (operating systems for IoT) for IoT devices to

communicate and that's what Apple's home kit and Google's Brillo is doing. Maybe after the release of these operating systems for IoT there might be a paradigm shift in

IoT and considering all the infrastructure and cost required, we tried to do things thinking in a different perspective.

Google's nest thermostat and other systems like Philips hue light bulbs inspired us and were the driving force initially. This led us to contemplate about Home automation system. The technologies in the market like cloud computing related internet of things and other internet dependent automation systems were found to be less reliable owing to a low internet infrastructure in the country like India at present. Thus, we developed this self-sufficient automation system which eliminated this risk and introduced more reliability

### Why Bluetooth?

The reason for choosing Bluetooth is that, it can work effectively without the requirement of an internet connection and its integration into the already available hardware resources. In addition investment is one time on installation. The operating costs are low as it works wirelessly without internet.

The HAS works with conventional android based device running our own android application.

### Methodology

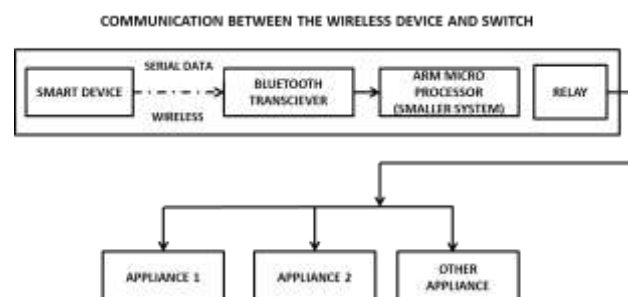


Fig. -1-

Figure 1 describes the wireless control part.

The overall agenda of this particular experiment is to control the appliances present anywhere in a particular floor of a building by communication through Bluetooth modules. The communication is established by sending serial data commands through a network of Bluetooth modules from an android device. These signals received, drive a microprocessor placed near the wall switch and controls the relevant appliance.

A module with relay is fixed to every wall switch connected in such a way that the relay switches and the native wall switch work serially. Relays are controlled by the microprocessor and they in turn are controlled by the data received from the android device. The logic connection block diagram is shown in figure 2

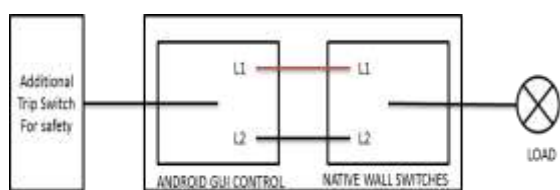


Fig -2-

Figure 2 describes the series connection of switches. When both the switches are connected to their L1 position respectively, the appliance is put to use and controlled wirelessly and the connection is as shown in figure 3.

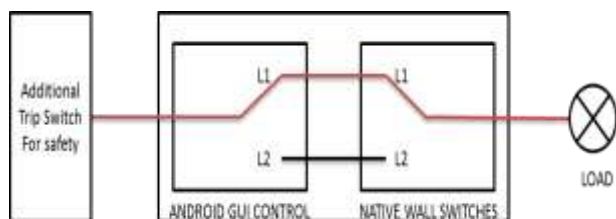


Fig -3-

Figure 3 describes ON state of switches

The logic truth table describes the functionality of the switches as shown below:

| ANDROID GUI CONTROL | NATIVE WALL SWITCH | APPLIANCE STATUS |
|---------------------|--------------------|------------------|
| OFF                 | OFF                | OFF              |
| OFF                 | ON                 | OFF              |
| ON                  | OFF                | OFF              |
| ON                  | ON                 | ON               |

The wireless control works only when the wall switch is switched ON and when the wall switch is switched OFF the wireless control system is redundant as shown in figure -4-.

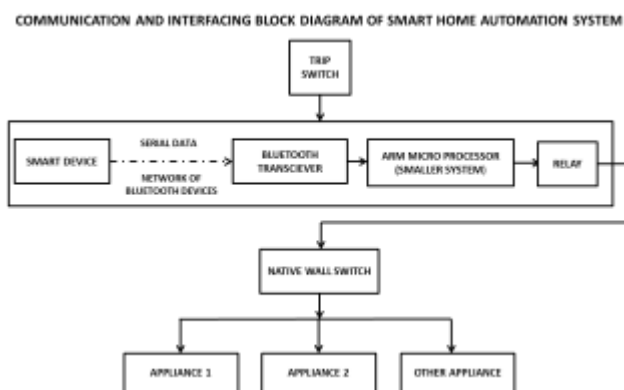


Fig -4-

Figure 4 describes the communication and interfacing of the system

In addition to Relays, PWM circuits can be used to control the speed of the fan and brightness of the light

#### Hardware Used

An Arm cortex A15 is used as a central processing gateway and also is the main processor. This is implemented on OMAP 5 platform from Texas Instruments using Embedded++ OMAP 5430 development board. For the control of the switch a smaller version of embedded device is used which has small amount of Flash and RAM.



#### Range extension algorithm

When a request is made from Android GUI, the nearby Bluetooth transceivers which are working in user mode picks up the request and it sends command to the central gateway which in turn sends command to the particular switch to be turned on. The devices are identified using their MAC addresses.

The gateway locates the switch to be turned on using predefined paths which are created during the configuration process and is stored in a separate stack. This list is updated when a new device is added or if the path is not working due to device malfunction then it tries to take an alternate path if present. Also the MAC addresses of the devices cannot be accessed by any other smaller embedded devices because they work in USER mode and take permissions from the processor working in supervisor mode. Hence protection is

taken care of. It is further increased by using MAC filtering technique.

The entire processing is done with the help of android and hence Cortex A15 is used as a suitable processor.

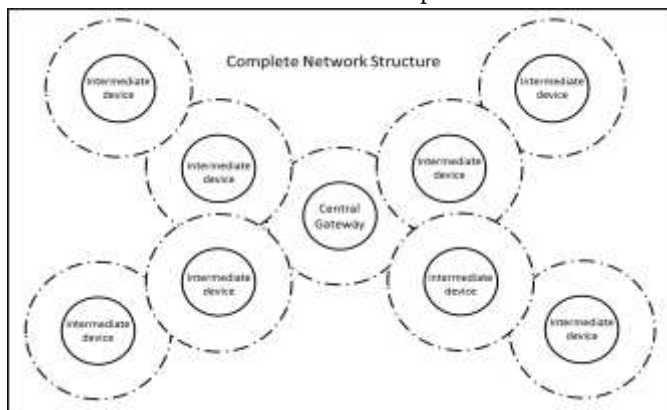


Fig -5-

The figure shows logic block diagram of complete network structure. The dotted line represents the range of each of the Bluetooth device respectively.

The signals from these intermediate devices reaches to the MAC address of the destination Bluetooth module which is received by the smaller microprocessor and it decodes the received data and appropriate switch is turned on and hence the appliance is operated.

Another advantage of the main gateway working in supervisor mode is that it allows the system to protect itself from user tasks and also protect user tasks from each other.

### Tools

The Main IDEs Usedare:

- Eclipse IDE with Android development (ADT) Bundle plugin.  
ADT (Android Developer Tools) is a plugin for Eclipse that provides a suite of tools which integrates with the Eclipse IDE. It offers access to many features that help develop Android applications. ADT provides GUI access to many of the command line SDK tools as well as the UI design tool for, designing and building of application's user interface.
- Android BSP is used for on board processing which is again written in Eclipse IDE.

### Overcoming technical limitations

The major limitation of any Bluetooth device is its range constraint. Taking this into consideration, we focus on building a network of Bluetooth enabled devices, thereby providing a medium to control a wide range of appliances remotely.

All the Bluetooth enabled devices operate within 2.4GHz band, which is the same unlicensed frequency used by many other wireless devices such as cordless phones and majority of Wi-Fi devices. This frequency sharing could deteriorate the overall network performance, the reason being the collision of signals and thereby failing to reach the desired destination, forcing them to be re-transmitted. This will decrease the communication throughput. Thus limitations, being a part of all the devices, continue to annihilate our progress

### Acknowledgment

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