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Design of a Smart Remote

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Abstract: This paper describes a design and implementation of a smart infrared (IR) remote control which can be used for various home appliances. The entire system is based on microcontroller that makes the control system smarter and easy to modify. It enables the user to operate a T.V, Air Conditioner and other Home appliances from about 10 meters away. This Smart remote control can incorporate all infrared remote controls in the room or office into ones smart phone based on Android Platform. By downloading the android app one can configure their remotes into the smart remote app and control them from his/her smart phone to eliminate the need to have half a dozen controllers spread out across their home or office.

Keywords: Aurdino (microcontroller), MIT App Inventor, Bluetooth, IR transceiver

I. INTRODUCTION

1.1Background

As the technology is developing and continuously improving people's living standard, people are in pursuit of automated, intelligent and convenient home control systems. Consider a living room where you have around 3 home appliances (TV, AC, Audio player) which imply bulk of different remotes in convenient to carry, high cost, and more usage of batteries. Therefore, it is a good choice to design a smart remote. With the popularity of smart phones, particularly, the phone based on Android system is rapidly developing. The remote control based on Android phone will become a mainstream way. After logging into the GUI, users can easily control the TV, AC and Audio player, which brings great convenience to people and improves the quality of life.

1.2. Literature Survey

For the proposed paper, following IEEE papers were studied as part of literature survey.

[1]Jianjun Lv et.al(2010) has discussed that the infrared remote control device can't be used to manipulate the different kinds of home appliances therefore it isn't compatible with others and leads to the wastage of resources. This theory has given us an idea to create smart remote.

[2] Jinsoo Han et.al(2008) has done an paper on how to control IR-based legacy consumer devices regardless of the line of sight. This was done by small ZigBee-based IR remote control repeater is attached near the IR receiving part of a legacy consumer device. It receives the control message via ZigBee protocol and converts the received message into IR signal which is transmitted to the legacy consumer device

[3] Sachin Kishor Khadke (2014) proposed a paper that makes user to log into the smart phone interface, and click the buttons gently to send commands which will be transmitted to external transceiver through the Bluetooth module. Exploiting Bluetooth on android mobile devices for Ardiuno application [for all functions] has been integrated into our everyday life. The functioning of the Bluetooth is understood.

1.3 Motivation

As the environment pollution is increasing in these days, our project is aimed to reduce alkaline batteries usage by eliminating many remote controls. There are three main reasons why alkaline batteries are dangerous to live stock:

1:-They are not recyclable.

2:-They will be just thrown out in a land fill or at the most hazardous waste land fill.

3:-The Environmental Protection Agency (EPA) warns that if potassium hydroxide, which is contained within the cells of alkaline batteries, leaks out, it can cause chemical burns on skin or in your eyes.

1.4 Scope

The users can manipulate appliances anytime letting our houses become more and more automated and intelligent. At present, the home appliances have the different remotes for different appliances which is restricted to a single device. So therefore it's a good choice to design a smart remote which brings the all the remotes in a single smart remote

II. SYSTEM ARCHITECTURE

2.1 System overview

The system is composed of android mobile terminal, Bluetooth network, Transceiver module fixed on Ardiuno Uno microcontroller. And the architecture of the system is shown in Fig.2.1 at any moment; the GUI in phone allows the user to manually control any of appliances in the room. First of all, the action listener should be set for each button which will be clicked to send message command via the Bluetooth network. After

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reading and parsing the commands, Micro controller controls the wireless module to send the address and data codes to achieve remote control of appliances ultimately.

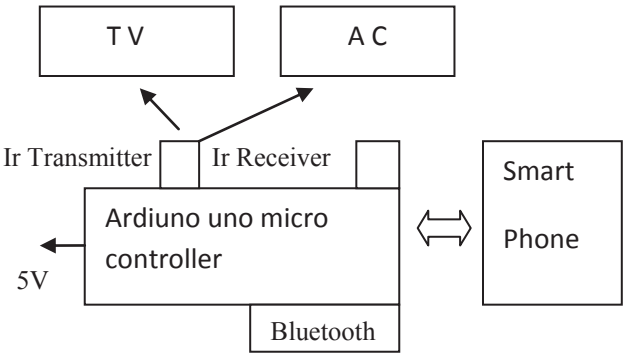


Fig 1 Functional Block Diagram of the System

The terminal based on android phone is designed, which contains GUI design, user management and message command sending event. After entering the lighting control interface, users send predefined commands just by touching the appropriate button or the button icon. The android app contains "tiny db" which is a database for storing the received hexadecimal values. The Bluetooth module is an HC-05 module which will allow the serial data transfer between microcontroller and smart phone. The microcontroller needs 5v power supply to work .The TSOP1738 is an IR receiver that will decode signals from the original remote of appliances (T V, A C, etc). The IR transmitter led works and successfully transmits pulse width modulated signals. The ardiuno uno which is an AT mega 328p microcontroller and it is a very powerful and easy to program.

III. HARDWARE DESIGN

This section mainly discuss about the hardware construction of main control board. Fig 2.2 demonstrates the hardware block diagram in the main control board. Ardiuno uno Microcontroller, AT Mega328p is chosen due to its capability to perform the both serial and USB features to establish the Bluetooth and USB connection to the GUIs. For the sensor, TSOP1738 Sensor Module is chosen because it is low cost. For the Bluetooth module, low cost HC-05 Bluetooth module is chosen to establish the Bluetooth connection between main control board and the GUIs. The electrical current is directly connect to the main control board whereby it separates the regulator and relay circuit.

In the following block diagram the red line indicates the 5v supply; orange is the ground .The Bluetooth, IR receiver both takes the 5v supply. . Pin number 3 is the pulse width modulated pin and it is connected to IR led Anode pin. Pin 8 is a digital pin which receives the IR signals from the remotes and decodes them. The pins 10, 11 are assigned as RX, TX pins for serial communication.

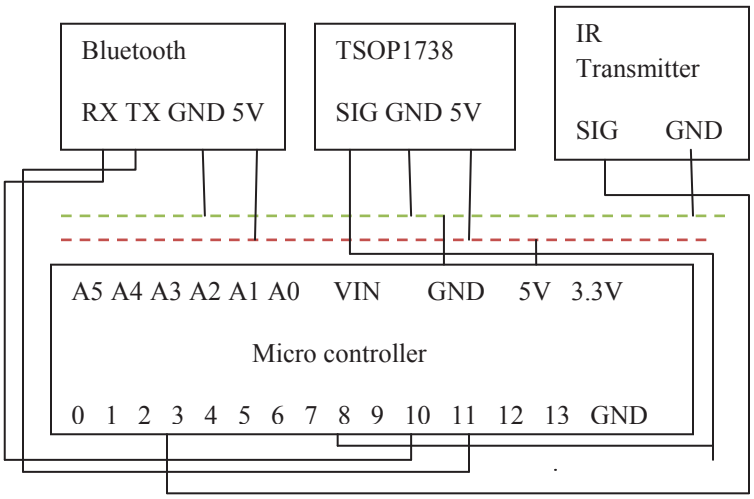
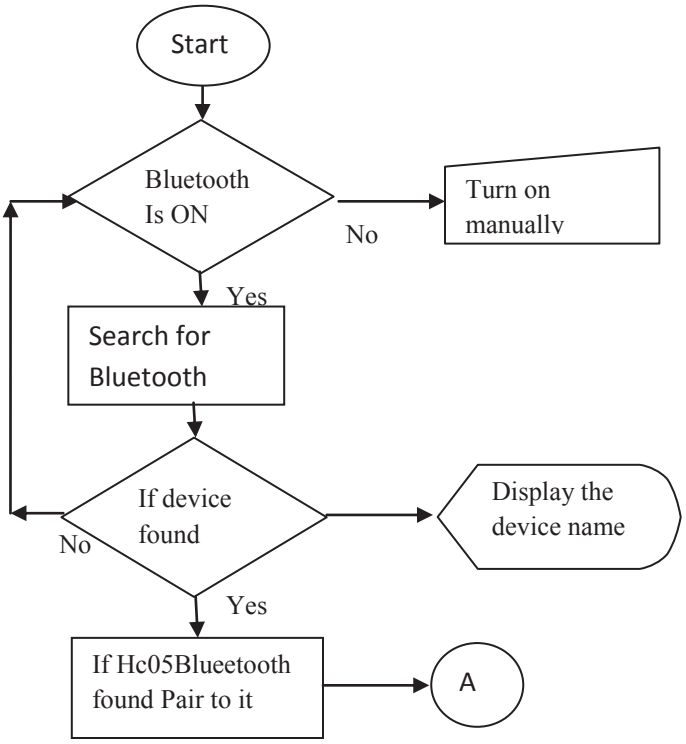


Fig 2.Main Control Board Hardware Block Diagram

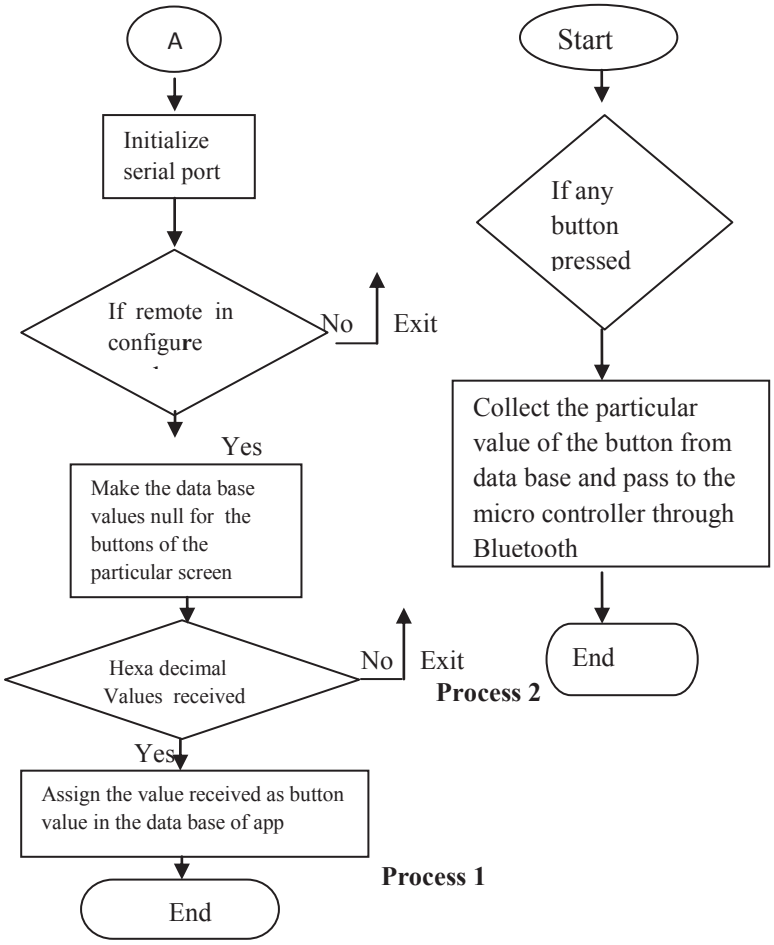
IV. SOFTWARE DESIGN

Figure 3 shows the Bluetooth module and Android Smartphone connection flowchart, which show that transfer of data from Android application to Bluetooth Module after which is compare to programming code of AVR Microcontroller.

First check Bluetooth position of Android Smartphone (Bluetooth is ON or OFF). If Bluetooth of android Smartphone is ON then it check the surrounding Bluetooth Module and if Bluetooth Connection is off then user have to start the Bluetooth condition from OFF to ON of Android Smartphone. Then Smartphone search for the surrounding Bluetooth Module. After searching the Bluetooth Module it start pairing between Bluetooth Module and Android Smartphone. And if paring is occurs then hardware initialize the serial port. Then PCB Hardware gets ready to receive the data which is send by the Android Application software.



When the application software send the Hexadecimal value to the microcontroller then this value is pushed to pin number 3 (P w m pin). This value received is forced



in to the IR transmitter, which will send codes to the respective home appliance .Depending on the Button press respective value will be send by Android Smartphone. Actually here no need to fear about the frequencies, as pulse width modulated pin is present on micro controller and it can be programmed.

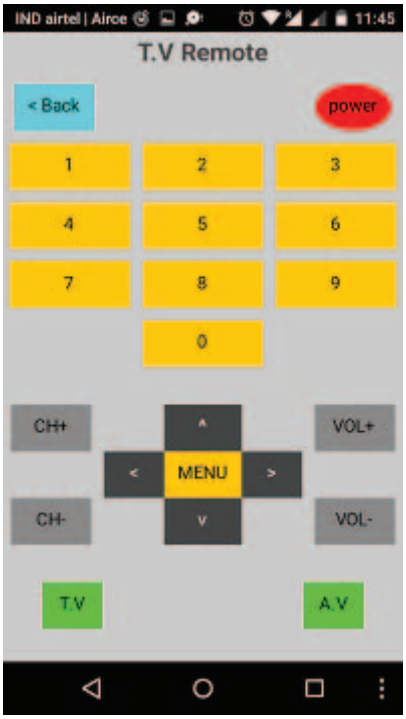
V. ANDROID APPLICATION

As the technology is rapidly increasing and the smart phones are the best example for it .Now considering the operating system that runs on them are majorly the android and the IOS, as compared to both Android has a very big market all over the world. We designed the app targeting lollipop 5.0 version mainly, but hopefully it also supports version Ice Cream Sandwich (4.0), Jelly Bean (4.1) and Kit Kat (4.4). Android applications are written in the Java language. Thanks to the MIT APP INVENTOR (beta 2), this website makes android development easy. We developed the application on this website with all proper permissions. This app inventor also provides a wonderful opportunity to turn our smart phone into emulator screen and can monitor the end result of the work. Android devices used the „.apk" file to install the application. Android's application framework allows for the creation of extremely feature rich and novel applications by using a set of reusable components. The amalgamation of the Android development environment with the Bluetooth wireless technology is known by Android's support for the Bluetooth network stack, which permits a device to wirelessly exchange data with another Bluetooth device (Smartphone Bluetooth with Bluetooth Module). The application framework enables access to the Bluetooth functionality using the Android Bluetooth APIs. These APIs allow wireless applications to connect to other Bluetooth devices for point-to-point and multipoint wireless features. Using the Bluetooth APIs, an Android application can carry out the following functions

· Scrutinize for other Bluetooth devices
· Enquire about the local Bluetooth adapter for paired. Bluetooth devices
· Establish the RFCOMM channels
· Connect to other devices through service discovery.
· Exchange data to and from other devices

Main screen

T V Remote screen



VI. APPLICATIONS AND FUTURE CHALLENGES

6.1 Applications

Followings are the applications of home appliances control system based on the android Smartphone.

6.1.1 Considering T V remote-Controls volume, Change of channel, Number buttons, T.V., A.V. buttons, Power button, Menu button, Selection of button.

6.1.2 Considering A C remote-Temperature control, Fan speed control, Swing button, Sleep button, Mode button, Power button

6.1.3 Considering Audio Player remote-Play button,, Pause button, Volume control, Fm button, Power button.

6.2 Future Challenges

In future the app needs to be developed on IOS platform too, as it should reach more people .Implementation of an amplifier circuit on the side of the IR transmitter part may increase the distance of operation , as for now it is restricted to 10 meters. App updates should be released so that it can more customizable.

VII. RESULTS

By designing the smart remote the usage of alkaline batteries is reduced. The configuring of remote button values into the application database and transmission of Infrared signals with good signal strength are the two major tasks for the smart remote. The GUI is made easy to understandable by any age group of people and it works good and responsive. For the demo purpose an Phillips TV and a O General AC are operated using smart remote.

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