Controlling Fan Using Smart Android Device Via Wireless Bluetooth Microcontroller

M.Preethi[1], R.Dharmalingam[2]

PG Scholar, Department of Applied Electronics, Maharaja Institute of Technology, Coimbatore, India[1]

Assistant Professor and Head of the department ECE, Maharaja Institute of Technology, Coimbatore, India[2]

preethi545er@gmail.com[1], dharmalingamr1986@gmail.com[2]

Abstract: *This paper presents the overall cost-effective home Appliances such as a FAN control through Android mobile with wireless micro controller. This is designed using mobile technology will be beneficial to our society. The System is made to satisfy the needs of elderly and physically challenged people. There are many ways to control the app that may depend on many variables like electrical, mechanical or electronic. The most generic ones are direct and remote control which can be manual or automatic. Automated process gives more comfort for users, reduce risks and increase performance. In case of development of remote systems, the telecommunications, electronics and control concepts provides it possible to access and control any strategy, system or interface from a computer, mobile device with highly user friendly interface. Recent days the Smartphone and tablets are becoming powerful with new and useful characteristics. This is suitable to develop control systems. In this project, we introduce an Android OS based application for Smartphone that communicates with the fan through mobile device continuously to control the FAN speed. The Android platform plays a vital role to holds a maximum number of Users when compared to all other platform.*

Keyword: *Arduino; Android Debug Bridge; CMOS; Darlington transistor; IOREF Pins;*

1. INTRODUCTION

In modern days the popularity of controlling electrical device through phone has been increasing due to high performance and reduce work by connecting through Smartphone which is useful for elderly and physically disabled people, who can access and control the Appliances by staying at some place and access them remotely without the help of others. This can increase the life quality of them. Wireless technology is emerging day by day, several different connections are introduced such as Bluetooth, WIFI, and GSM. Bluetooth with globally available frequencies of 2400Hz is able to provide connectivity up to100 meters a speedup to 3Mbps. Based on the microcontroller the data may send and receive between the mobile device and hardware is possible.

Not only this, it can control all micro components also. This communication between two devices by using Bluetooth is more reliable and securable.

2. LITERATURE SURVEY

Smart Home Automation System has become common in recent years of technology especially with fast development in Internet. There are various smart home Automation systems with different technologies that have been implemented. Most of them are based on controlling home automation in android application which gives user interface for monitoring and controlling their home Appliances

remotely. Previous works on the smart home implementation includes the use of android app which communicates to an ARM based processor through GSM (Global System for Mobile Communications) network and controls the electric appliances at home via radio frequency. Other than that, there is also an Arduino based system which uses wireless Zigbee and wired X10 technologies[1]. The system is based on the dual tone multifrequency (DTMF) signals that could be sent through a loop of wire to switch on/off various appliances via a personal computer (PC). The system hardware and software are designed based on the telephone standards.[2].

Many appliance manufacturers focus on the development of intelligent (or information) appliances to be integrated into a complete HA system for monitoring and controlling. Due to the advent of advanced computer and wideband network, the personal computer-based environment seems to be a very suitable platform for system integration [3]. Remotely check or control household devices through the use of a Touch-Tone telephone. This means that any house can be controlled from any location where there is a Touch-Tone telephone available [4].

Bluetooth technology in home automation and networking environment it proposes a network, which contains a remote, mobile host controller and several client modules (home appliances) [5]. Eliminate extensive programming using high-level languages, such as Java programming to achieve remote connectivity and focus on the primary task of implementing control

algorithms [6] An Android based home automation system that allows multiple users to control the appliances by an Android application or through a Web site is presented. The system has three hardware components: a local device to transfer signals to home appliances, a Web server to store customer records and support services to the other components, and a mobile smart device running Android application [7]. The realization of the wireless module device's driver, the difficulty in supplying the appropriate low-voltage DC for MCU and wireless module just by a single live wire. The system has the features of easy installation and low cost, and the hardware and software can be customized and extended [8] Android based user interface for control of home appliances through connection to the smart living System can be made from the designed app via Bluetooth or internet connection it integrates home security and alert system [9].

Smart home control system based on Cortex-A8 and ZigBee system consists of three parts include user intelligent control terminal, embedded home gateway and home ZigBee wireless network. It can perform functions such as safety and alarm, the indoor environment testing, household electrical appliances control and intelligent lighting and other functions [10].

The voice input has been captured by the android and will be sent to the Arduino Uno. Bluetooth module in Arduino Uno received the signal and processed the input signal to control the light and fan [11]. Software application will control the electrical appliances switches wirelessly. This is seen potentially used in hospitals, home care for elderly and facilities for disabled users[12].The control messages for home appliances are directly transferred using PLC rather than WSNs[13].Android based home monitoring system detects the threshold violation in power usage and produces appropriate signal to take remedial action[14].

2.1 Existing System

Managing household appliances from a computer or a smartphone was invented in existing system there was used to control only ON and OFF process. The used technologies in existing system we may use GSM, infrared and Wi-Fi. By using this method it takes more time to configure and control the appliances. Even it may cover large areas but it produces more interference while using GSM to connect with mobile internet.

2.1.1 Drawbacks

- More time consumption
- Cost effective
- Interference problem
- Data connection required
- Less reliability

3. PROPOSED SYSTEM

The Bluetooth technology is the gift for the mod-ern home automation which operates over 2.4GHz frequency, Bluetooth technology can link digital devices within a range of 10m to 100m at the speed of up to 3 Mbps depending on the Bluetooth device. This proposed technology is used to adjust the speed variation, and control the speed of the FAN using Bluetooth signal through Android mobile phone by using android application.

3.1 Advantages

- More reliability
- Low connection
- Unwanted wiring reduced
- Faster transmission
- More useful for elders and physically challenged

The Arduino Uno powered through the USB or with an external power supply. External power can come from an AC-to-DC adapter . The adapter connected by plugging a 2.1mm plug into the board's power socket. Leads from a battery inserted in the Gnd and V_{in} pin headers of the POWER connector. The board operates on an external supply of 6 to 20 volts. If it is supplied with less than 7V, anyway, the 5V pin may supply less than five volts and the board may be unstable. If we use more than 12V, the voltage regulator may get overheated and it will cause damage on the board. The preferable range is 7 to 12 volts.

3.2 TX and RX

TX is transmitter and RX means the receiver. Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the; bc y USB-to-TTL Serial chip. External Interrupts: 2 and 3. These Pins Configured To Make An Interrupt On A Low Value, A Rising Or Falling Edge.

3.3. Power LED

There is a fixed LED attached to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. The Uno has 6 analog inputs, each of which provides 10 bits of resolution. By default they calculate from ground to 5 volts, though is it possible to change the higher end of their range using the AREF pin.

3.4 Digital Pins

The digital pins on an Arduino board used for the use of general purpose input and output via the pinMode(), digitalRead() and digitalWrite() commands. Aurdino board has 14 pins. Each pins has internal pull up resistor which can be turned on and off using digitalWrite() when the pin is configured as an input. The maximum current per pin is 40 mA.2 and 3 are the external pin which is used to trigger an interrupt on a low value, a rising or falling edge or a change in value. 3,5,6,9,10 and 11 are the PWM pins which is provide 8 bit PWM output with the

analogWrite() function. The pin 7 is used to reset the Bluetooth which is connected to the reset line of the Bluetooth module.The pin 10(SPI), 11(MOSI), 12(MISO), 13(SCK) which is supporting the SPI Communication gave by the corresponding hardware is not currently built-in in the Arduino language.The pin 13 which is used as built in LED. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

3.5 Analog Pins

The analog input pins support 10 bit analog to digital conversion using the analogRead() function. Most of the analog inputs can also be used as digital pins. Analog input o as digital pin 14 through analog input 5 as digital pin 19. Analog inputs 6 and 7 cannot be used as digital pins. If micro controller receives analog as input and its converts digital signal by using of ADC and finally send to the rider IC.

3.6 Reset

It is an automatic reset button presented in microcontroller. Rather than requiring a physical press of the reset button before e an upload, the Uno board is designed in a way that allows it to be rearranging by software presently running on a computer. One of the hardware flow control lines of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 Nano farad capacitor. When this line is asserted (taken low), the reset line droops long enough to reset the chip. The Arduino Software uses this capability to allow you to upload the code by pressing the upload button in the interface. This means that the boot loader can have a shorter timeout, as the lowering of DTR can be well coordinated with the start of the upload.

3.7 USB Interface

It is an easy USB interface. This allows interface with USB as this is like a serial device. The chip on the board plugs directly into USB port as a virtual serial port. The benefit of this setup is that serial communication is a really easy protocol which is time tested and USB makes it comfortable.

3.8 External Power Supply

The board operates on an external supply from 6 to 20 volts. If supplied with fewer than 7V, however, the 5V pin may supply fewer than five volts and the board may become unstable. If using more than 12V, the voltage regulator may be overheated and which cause damage on the board. The recommended range is 7 to 12 volts.

3.8.1 Vin

The input voltage to the Uno board is given from the external power source (as opposed to 5 volts from the USB connection or regulated power source). This can supply voltage via this pin or if supplying voltage

through the power jack, access it through this pin.

3.8.2 5V

This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack(7 to 12V), the USB connector(5V), or the pin of the board(7 to 12V) supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.A 3.3V supply generated by the on board regulator. Maximum current draw is 50 mA.

3.9 IOREF

This pin on the Uno board provides the voltage the voltage reference with the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

3.10 ICSP Header

ICSP is basically in circuit serial programming which allows user to upload software to MCU without having to pull it out every time. 2X3 is a connector which is used to connect the pins into the ICSP port. Finally user can upload software to the MCU
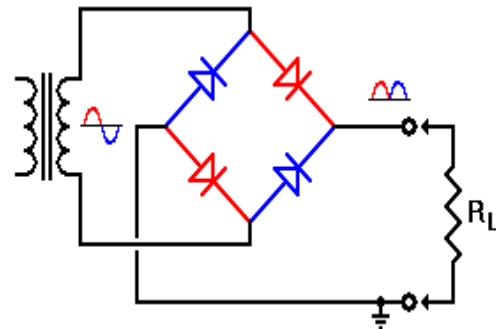

Figure 1 AC to DC Converter

3.11 AC to DC Converter

AC TO DC converter is a mechanism for converting analog signal into digital signal with help of full wave rectifier. In half wave rectifier it may allow only positive current at a time. It receives 230V from main power supply and its converts into digital signal with help of ADC (Analog into Digital) converter and finally sends to the Microcontroller. AC TO DC converter is shown in Figure 1.

3.11.1 IC- ULN2003APG

Figure 2 ULN2003APG

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It has seven NPN Darlington pairs and high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current ranking of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current ability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers, line drivers, and logic buffers. The ULN2003 has a 2.7kΩ series base resistor for every Darlington pair for operation directly with TTL or 5V CMOS devices. ULN2003APG is shown in Figure 2.

3.12 Bluetooth Module

Bluetooth is a wireless technology standard for exchanging data over short distances. If the distances may exceeds it cannot work. Range of Bluetooth is 30 feet. HC-05 module is an easy to use Bluetooth Serial Port Protocol module, designed for translucent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with entire 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm

3.13. Relay

Figure 3 Relay

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit When the current or voltage exceed a threshold value and the coil activates the armature and it operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that force to do the switch mechanism. Relay is shown in Figure 3.

3.14. Fan

There are usually two capacitors in a ceiling fan motor. One is the start capacitor and the other is the run capacitor. An AC motor needs a magnetic field in order turn the fan blades and it is done by applying voltage with different phase's t different windings. In a single phase system, there Fan is only one voltage phase and the capacitor is used to give a phase shift in the windings of the motor, making it appear that the motor is operating in a multiphase system.

Figure 4 Fan

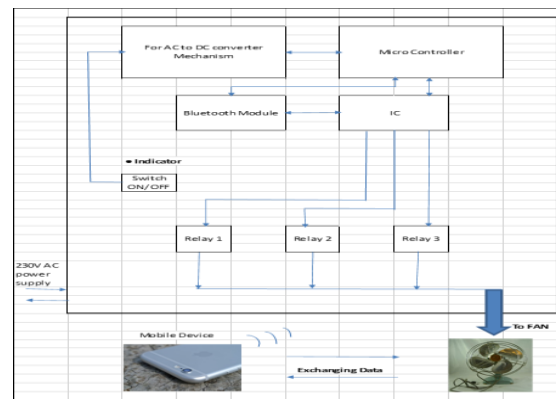### 3.15 Block Diagram of Controlling Fan through Bluetooth Microcontroller

Figure 5 Controlling Fan Through Bluetooth Microcontroller

4. SOFTWARE DESCRIPTION
4.1 Android

Android is a mobile, operating system based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for mobile devices such as Smartphone's and tablet computers, with effective user interfaces for televisions such as Android TV, car, Android Auto, and Android wrist watches. Android's has encouraged a large community of developers as a foundation for community for community driven projects, which add new features for advanced users or bring Android to devices which were officially released running other operating systems.

4.2. Android Open Source Project

The Android open source project is led by Google, and is tasked with the maintenance and Enhancement of Android. Android implementation. The compatibility program is also elective and free of charge, with in the Compatibility Test suite also free and open source.

4.3. Security

Android applications run in a sandbox, an lonely area of the operating system that does not have access to the rest of the systems resources, if not access permissions are approved by the user when the applica-

tion is installed. Previous to installing an application, play store displays all necessary permissions. A game may need to enable vibration, for instance, it should not need to read useful messages or access the contacts. After reviewing these permissions, the user can decide whether to further install the application.

4.4. Privacy

Android smart phone's have the ability to report the location Wi-Fi access points to build databases containing the physical locations of hundreds of millions of such access points. Third party software such as Taint Droid, an academic research funded project, it is some cases, detect when personal data is being sent from applications to remote servers. We are taking another look at this and considering adding permission for apps to access images.

4.5. Android Studio

Android Studio offers, Flexible Grade-based build system. Build variants and multiple apk file generation. Code templates to help you build common app features Rich layout editor with support for drag and drop theme editing. Built in support for Google Cloud Platform, making it easy to integrate Google Cloud Messaging and Aop Engine.

4.6. Android SDK

Applications are developed in Java using the Android software development kit. The android software development kit includes a complete set of development tools. In March 2015, the SDK is not obtainable on Android itself, but the software development is possible by using specialized Android applications. Developers use any platform to perform Java and XML files, then use command line tools to create, build and debug Android applications and also control attached Android devices.

4.7. Android Debug Bridge

The Android Debug Bridge is a tool built-in in the Android SDK package which consists of both client and server side programs that communicate each other. The ADB is used via the command-line interface, although numerous graphical user interfaces subsist to control ADB.

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4.8. Model Output
STEP1:

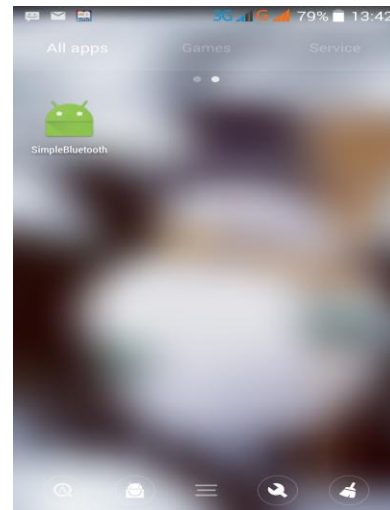
Figure 6 Simple Bluetooth application
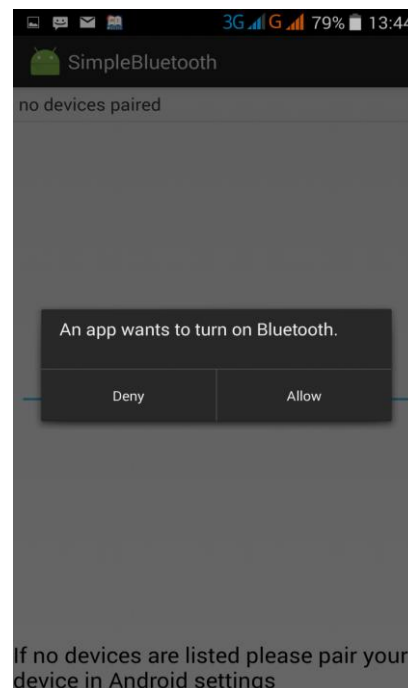
STEP 2:

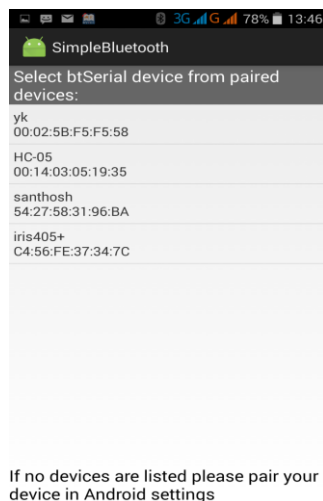*Figure 7 Response by the user*

STEP 3:

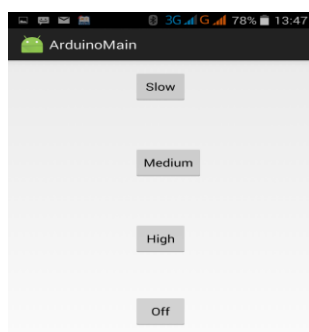*Figure 8 Selects the Bluetooth device*

STEP 4:

Figure 9 Select the operation

5. CONCLUSION

This system is designed at low cost and it is used to improve the standard of living at home. The wireless connectivity through the android device provides help to the people especially to elderly and physically challenged people.

The implementation of the Bluetooth connection in control board allows the system to install in simple way, the control board can be directly installed besides the electrical switches. The wiring of the electronic equipment's can be greatly reduced. By using the help of Bluetooth, the devices can be controlled in faster and easier comparing with other technologies.

REFERENCES

[1] Bedong, Kedah (2016) "Android based Smart House Control via Wireless Communication" ISSN:2277-1581 Volume No.5 Issue No.5, pp: 323-325.

[2] Koyuncu, B. (1995) 'PC remote control of appliances by using telephone lines'. IEEE Transaction on Consumer Electronics, Vol. 41, Issue 1, pp.201-209.

[3] Chao-Lin Wu, Li-Chen Fu, Neng -Shiang Liang (2002) 'An integrated, flexible, and Internet-based control architecture for home automation system in the internet era'. Proceedings ICRA `02. IEEE International Conference on Robotics and Automation, Vol. 2, pp.1101-1106.

[4] Swanson, J, Schneider, S. (1997) 'Remote telephone control system'. IEEE Transaction on Consumer Electronics, Vol.43, Issue 2, pp.103-111. Bedong, Kedah (2016) "Android based Smart House Control via Wireless Communication" ISSN:2277-1581 Volume No.5 Issue No.5, pp: 323-325.

[5] Sriskanthan, N. and Tan Karand. (2002) 'Bluetooth Based Home Automation System'. Journal of Microprocessors and Microsystems, Vol. 26, pp.281-289.

[6] Kuljaca, O, Lewis, and Swamy, N. (May 2002) 'Internet-Based Educational Control Systems Lab Using Net-meeting'. IEEE Transaction on Education, Vol. 45, No. 2, pp.145- 151.

[7] Alper Gurek, Caner Gur, Cagri Gurakin, Mustafa Akdeniz, Senem Kumova Metin, Ilker Korkmaz, "An Android Based Home Automation System", 978-1-4799-2569-8/13 ©2013 IEEE.

[8] Annan Zhu, Peijie Lin, Shuying Cheng, "Design and Realization of Home Appliances Control System Based on The Android Smartphone", 978-0-7695-4881-4/12 © 2012 IEEE DOI 10.1109/ICCECT.2012.36.

[9] Shiu Kumar, Seong Ro Lee, "Android Based Smart Home System with Control via Bluetooth and Internet Connectivity", IEEE ISCE 2014 1569945213.

[10] Shuyan Zhang, Pingping Xiao, Juan Zhu, Chao Wang, Xiaoguang Li, "Design of Smart Home Control System Based on Cortex-A8 and ZigBee", 978-1-4799-3279-5 /14 ©2014 IEEE.

[11] Norhafizah bt Aripin, M. B. Othman, "Voice Control of Home Appliances using Android", 978-1-4799-6947-0/14 ©2014 IEEE.R.A.Ramlee,

[12] D.H.Z.Tang, M.M.Ismail, "Smart Home System for Disabled People Via Wireless Bluetooth", 978-1-4673-2374-1/12 ©2012 IEEE.

[13] Liu Ningqing, Yan Haiyang, Guan Chunmeng, "Design and Implementation of a Smart Home Control System", 978-0-7695-5122-7/13 2013 IEEE DOI 10.1109/IMCCC.2013.342.

[14] Suresh Sankaranarayanan, Au Thien Wan, "ABASH - Android Based Smart Home Monitoring using Wireless Sensors", 978-1-4799-3238-2/13 ©2013 IEEE.

Authors Biography

Ms. M.Preethi, is a PG Student of Applied Electronics Department of ECE in Maharaja Institute of Technology. She completed her BE in ECE department at Mahendra Engineering College. Her research interests are artificial intelligence, electronic devices, communication systems, electrical machines, and transmission and switch gears.

Mr. R. Dharmalingam, is a Assistant Professor& Head of the department of ECE in Maharaja Institute of Technology. He completed his BE in ECE department at Maharaja Engineering College. He completed his ME in department of VLSI at Maharaja Engineering College. His research interests are artificial intelligence, electronic devices, communication systems, electrical machines, and transmission and switch gears.