Home Automation using Android and Arduino

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Abstract---With the rapid development of technology around us, the home environment had undergone so many evolutions that make life easier. When these current technologies in home combined with an upcoming trend like automation, appliances become smarter leading to concept of home automation. Though there are so many proposals emerged into market, When people order a new car, they often invest a fair amount of money in electronic, comfort-enhancing accessories. Some extras, such as climate control, navigation or entertainment systems, there seem to be nearly no limits as the money one can spend for additional functionality on gadgets. In this paper we propose and implement a procedure through which home automation is delivered in a very simple and powerful manner using open source hardware and software.

I. INTRODUCTION

While talking about automation, which often comes to our mind is the Robot that can be programmed to do anything which we need. As same as here we use this principle for our home appliances, But we wonder how these electrical appliances can work on their own since its manually controlled by switches. On this case we here apply the concept of embedded systems, which can also acts as an interface between electric and electronic devices. One such embedded system here we use is a massively developing open source hardware, An Arduino micro controller. These have many external modules such as Bluetooth module, Wi-Fi module, GPS module, Sensors And more on going day today.

Automation plays an increasingly important role in the home environment. With advances in automation, homes can potentially become the places where people can interact with the world and receive a number of services, now distributed in many different places, from hospitals to shops, to libraries to museums. Modern automation is providing new methods, components, and architectures that, when implemented in a home, allow for highly personalized services at an affordable cost. Similarly, automation industries see the potential of developing a consumer market in parallel to the established professional market. Home automation is thus broad and includes man machine interface issues, energy usage and task planning and management, intelligent non-intrusive automation systems, highly distributed sensing and actuation, automation devices into everyday objects, privacy issues, safety and security protocols, new telecommuting and production paradigms, and ethics of a changing society. Next thing here we a use massively used and day today developing open source software, Android OS. Basically this system core runs on the powerful linux kernel which supports you to configure the devices on hardware level. While coming to the higher level, the Application running on the android OS purely build on Java language. Again this makes our protocol much easier for developing the application, since java had been an open source and no more restrictions are here.

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II. LITERATURE REVIEW

Our proposal is not the first procedure to implement the home automation technique; this technique has been implemented before using Intel 8081 though that has many disadvantages and failure rates. To overcome those failures we use an open source hardware arduino. Intel 8081 has a small range of coverage below l0m and it's a proprietary hardware.

There has been significant research into the field of home automation. The X10 industry Standard, developed in 1975 for communication between electronic devices, is the oldest standard identified from the author's review, providing limited control over household devices through the home's power lines. Because of this the ZigBee based home automation came into establishment. Flexible ZigBee based home automation system. The architecture is designed to reduce the system's complexity and lower fiscal costs. Hence, the system endeavors not to incorporate complex and expensive components, such as a high end personal computer, where possible. The system is flexible and scalable, allowing additional home appliances designed by multiple vendors, to be securely and safely added to the home network with the minimum amount of effort. The system allows home owners to monitor and control connected devices in the home, through a variety of controls, including a ZigBee based remote control, and any Wi-Fi enabled device which supports Java.

Additionally, users may remotely monitor and control their home devices using any Internet enabled device with Java support. A home gateway is implemented to facilitate interoperability between heterogeneous networks and provide a consistent interface. But the problems that arise are to insert more number of ZigBee routers resulting in high cost. Mobile service is designed to work with most of today's standard mobile phones and, hence, is available for most users (fulfilling requirement a.). However, this means that we have to pay careful attention to the usability. Especially simplicity should be one of our main concerns.
Mobile phones are by design constructed to be used "on the road" in almost any situation (b.) due to their small size, low weight, and portable power source. Unfortunately, this also

implies limited interaction capabilities as a result of the small screen and the low number of small keys.

A. Intel 8081

Intel produced a series of development systems for the 8080 and 8085, known as the MDS-80 Microprocessor System. The original development system had an 8080 processor. Later 8085 and 8086 support was added including ICE (in-circuit emulators). It was a large and heavy desktop box, about a 20" cube (in the Intel corporate blue color) which included a CPU, monitor, and a single 8 inch floppy disk drive. Later an external box was available with two more floppy drives. It ran the ISIS operating system and could also operate an emulator pod and an external EPROM programmer. This unit used the Multi bus card cage which was intended just for the development system. A surprising number of spare card cages and processors were being sold, leading to the development of the Multi bus as a separate product.

The later iPDS was a portable unit, about 8" x 16" x 20", with a handle. It had a small green screen; a keyboard built into the top, a 5¼ inch floppy disk drive, and ran the ISIS-II operating system. It could also accept a second 8085 processor, allowing a limited form of multi-processor operation where both processors ran simultaneously and independently. The screen and keyboard could be switched between them, allowing programs to be assembled on one processor (large programs took a while) while files were edited in the other. It had a bubble memory option and various programming modules, including EPROM and Intel 8048 and 8051 programming modules which were plugged into the side, replacing stand-alone device programmers. In addition to an 8080/8085 assembler, Intel produced a number of compilers including PL/M-80 and Pascal languages, and a set of tools for linking and statically locating programs to enable them to be burnt into EPROMs and used in embedded systems.

B. X10 Industry Standards

Since we came up with X10 technology more than 30 years ago, it has become the standard technology used in Home Automation systems worldwide. It is a type of power line control protocol that allows communication between transmitters and receivers by sending signals over your existing house wiring. It allows you to set up a home control system easily without adding any additional wiring. In simpler terms, you have a controller, which can be any number of things including a simple plug-in device, a wireless remote or motion sensor and transceiver or even you're PC. The controller sends commands through your home's power lines to turn on, off and adjust your lights, appliances, thermostat and more.

In even simpler terms, X10 Technology allows you to control your lights, appliances and more using wireless remotes, plug-in controllers, motion-activation or your computer. A Simple Project Proposal from ECAD describes deeply about the endless possibilities of Home Automation with Bluetooth coupled with the X10 Automation standards. Every so often a new technology comes along that results in a fundamental change in the way products are designed and the way they behave. Bluetooth has the exciting potential to add all sorts of new functions and forms to all manner of devices, freeing electronics in all forms from the proprietary tether of cables. In the short term this will make mobile computing easier. In the longer term it will change the appearance of the products we use and usher in a new era of personal connectivity. At its simplest, Bluetooth is a chip technology enabling seamless voice and data connections between a wide range of devices through short-range digital two-way radio. It is an open specification for short-range communications of data and voice between both mobile and stationary devices. For instance, it specifies how mobile phones, computers, PDAs and other wireless capable devices interconnect with each other, with computers, and with office or home phones. Allowing for all sorts of interaction: Dial your phone with your palm pilot or computer, have your caller ID appear on your computer screen, go online with your computer wirelessly where ever you get cell phone service, the list is nearly endless.

C. ZigBee Method

Various progressive wireless communication standards were developed and implemented into praxis during last decade. GSM, WiFi and are well known by most people in the modern society. These standards have penetrated into their daily routine with outstanding popularity. "An Internet of people" has become ordinary for everyone who wants to have everybody and everything within reach. Even though it seems that all peoples' wireless requirements have fulfilled, it turns on, that they lack of something like "an internet of things" especially in mainstream Home Automation (HA). The HA systems provide mutual interoperability between various electronic, electrical, and power devices as well as interactive interface for people to control their operation. These features are very helpful to optimize and to economize energy consumption whereby saved energy during some few years could make more money than HA systems implementation cost. These technologies make peoples' life also easier, especially for elderly persons and persons with disabilities. These systems exist of course, but there are many non-interoperable, expensive, and often wired systems. Wiring complicates implementation of the HA in buildings which are already built, especially in historical ones. Therefore, an invention of an open and standardized wireless network of battery powered cheap sensors, actuators, and control devices which could effectively communicate with each other for some years, eventuate in new wireless standard. This standard was named "ZigBee". Naming this standard, the ZigBee alliance engineers were probably inspired by philosophical similarity of packet routing strategies in networks with large nodes amount and zig – zag dance which bees use for food path showing.

D. GNU/GPL

I consider that the golden rule requires that if I like a program I must share it with other people who like it. Software sellers want to divide the users and conquer them, making each user agree not to shar with others. I refuse to break solidarity with other users in this way. I cannot in good conscience sign a nondisclosure agreement or a software license agreement. For years I worked within the Artificial Intelligence Lab to resist such tendencies and other inhospitalities, but eventually they had gone too far: I could not remain in an institution where such things are done for me against my will. So that I can continue to use computers without dishonor, I have decided to put together a sufficient body of free software so that I will be able to get

along without any software that is not free. I have resigned from the AI Lab to deny MIT any legal excuse to prevent me from giving GNU away.

E. Arduino

Arduino, like Processing before it, adopted the idea of a code sketchbook. We will carry on this metaphor as we talk about the process of sketching in code as an intuitive method for quickly testing out new ideas in code. Most of this book is written around this idea of developing programming skills through sketching. We will also provide some suggestions for new projects and hardware, new languages to try out, and ways to contribute back to the community. This book intentionally does not dwell toolong on electronics theory, circuit design, hacking, or other specifically hardware-based practices, although we'll revisit the hardware side of things in our last chapter to provide a small foundation for physical computing. This book in many ways picks up where the *Arduino Programming Notebook* left off, with even more in-depth discussions about the Arduino environment; simple, no-frills code samples; and clear, easy-toread schematics and illustrations. The *Notebook*, a little PDF booklet, was my first experience writing about the Arduino and was never meant to be more than a brief guide for my students when I first introduced a class of 15 college art and design majors to the Arduino in 2007. Best laid plans and all, this little booklet has now been translated into Spanish, Russian, and Dutch (that I know of), is hosted in so many different places that it is impossible to keep track of, and it's been used in workshops and classes around the world. I haven't updated the *Notebook* over the last few years, and in all honesty I am not entirely sure what to do with it now, so hopefully this new book will fill a void and find a similar, widespread adoption that the little booklet has enjoyed all these years.

F. Android

The Android platform is packing some serious heat these days in the mobile marketplace and gaining traction worldwide. The platform has seen numerous advancements in terms of SDK functionality, handset availability, and feature set. A wide diversity of Android handsets and devices are now shipping and (finally) in consumers' hands—and we're not just talking about phones: Android has begun to ship on netbooks, Internet tablets (such as the ARCHOS 5), ebook readers (like the Barnes & Noble nook), digital photo frames, and a variety of other consumer electronics. There are even proof-of-concept appliances such as an Android microwave and washer/dryer combo. (Hey, why not? See http://bit.ly/bGqmZp.) Mobile operators and carriers are taking the platform seriously and spending gazillions on ad campaigns for Android phones—like Verizon's Droid campaign. In the past year or so, the Android platform h s transitioned from a "gearheads-only" platform to providing some serious competition to more established platforms. (Yes, we're talking about platforms such as the iPhone.) But let's not digress into an argument over whose platform is better so early, okay? Because, honestly, you're wasting your time if you think there's one platform to rule them all. The reality is, people the world over use different phones in different places (CDMA, GSM) and for different reasons (price, availability, coverage quality, feature set, design, familiarity, compatibility). There is no one-size-fits-all answer to this debate. Having developed for just about every major mobile platform out there, we are keenly aware of the benefits and drawbacks of each platform. We do not presume to claim that one platform is better than another in general; each platform has distinct advantages over the rest, and these advantages can be maximized. The trick is to know which platform to use for a given project. Sometimes, the answer is to use as many platforms as possible. Lately, we've been finding that the answer is the Android platform: It's inexpensive and easy to develop for, it's available to millions of potential users worldwide, and it has fewer limitations than other platforms. Still, the Android platform is relatively young and has not yet reached its full-fledged potential. This means frequent SDK updates, an explosion of new devices on the market, and a nearly full-time job keeping track of everything going on in the Android world. Android is the first *complete*, *open*, and *free* mobile platform. Developers enjoy a comprehensive software development kit, with ample tools for developing powerful, feature-rich applications. The platform is open source, relying on tried-and-true open standards developers will be familiar with. And best of all, there are no costly barriers to entry for developers: no required fees. (A modest fee is required to publish on third-party distribution mechanisms such as the Android Market.) Android developers have numerous options for 0distributing and commercializing their applications.

III. PROPOSED METHODOLOGY

A. Microcontroller(ATMEGA8)

The low-power Atmel 8-bit AVR RISC-based microcontroller combines 8KB of programmable flash memory, 1KB of SRAM, 512K EEPROM, and a 6 or 8 channel 10-bit A/D converter. The device supports through put of 16 MIPS at 16 MHz and operates between 2.7-5.5 volts. By using this controller we can run the all the component of the Board according to our requirement .It is the heart of the whole board.

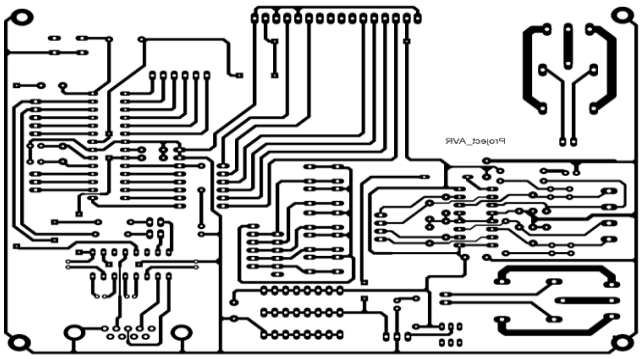

Fig. 1: PCB Layout

B. Bluetooth Module

Bluetooth is a type of radio communication. Bluetooth device scan find and communicate with each other without using any wires. Bluetooth devices(such as Bluetooth Phone Modules and speakerphones) communicate through a common link that the two devices share. A Bluetooth device can seek other Bluetooth devices and determine which ones are open. An open device is one that is awaiting a link. A Bluetooth device can then link—establish an active connection—to the device and begin exchanging voice signals or other data with it.The procedure for stablishment of connection between Bluetooth module and android

mobile phone is given in a how to connect Bluetooth module with android phone please refer that document.

C. Power Supply

The Power Supply Section Consists of 230 V AC supply to the 12V AC Transformer. The secondary of the transformer connect with the Bridge rectifier which is made of the combination four IN4007diode. Using Bridge rectifier we can get 12V pulsating DC which is filtered by a Smoothing Capacitor. After these supply is given to the 7805 IC which converts 12Vdc supply into the 5 V DC supply. This IC consists of three pin that is 12 V dc for input Middle pin for GND and remaining one for 5V DC. Led are used to indicate Power on.

D. Serial Communication

Serial communication is used for to perform communication between two devices like board and pc to burn program from pc to board or may be communication board to other device. For communication we have use Flash magic, serial cable DB9 connector logic level converter (MAX232 IC) with 4 capacitor that is called charge pump capacitor. Here serial cable use to transmit data between board and pc with
The help of DB9 connector placed on both side. For logic level converter Max232 IC is used to covert high voltage level into the low voltage level with the help of 10 µF capacitor by charging and discharging. When we burn the program to board by help of flash magic software the high level voltage signal send to the board by the serial cable and it converted into low level signal by MAX232 IC with the help of charge pump capacitor and this low level signal goes to the pin no 3 and 2 (TX,RX) pin respectively.

IV. Proposed Method

Here in our proposed methodology we propose a procedure through which home automation is made possible again using Android and Arduino. With the advent of latest handheld devices running on android, we here use the same which will act as an interaction between the user and the house hold devices.

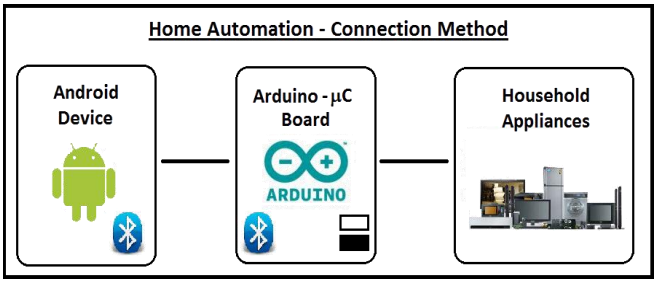

Fig. 3: Proposed Architecture

As a first step we try to switch on and switch off the house hold electrical devices. Hence, here we are going to introduce a new electronic home automation device which helps in controlling the flow of ele ctricity between the electrical

socket and the peripherals. This is a very special hardware which has three important components listed below..,

1. Bluetooth Controller
2. Arduino Microcontroller
3. Relay Module or Relay Trigger

Here, in the build circuit the Bluetooth controller plays its role by connecting the Bluetooth installed android device and the arduino microcontroller. The Bluetooth controller is programmed with a name and enabled to configure and get paired with other devices. For security purposes the pass code can also be build. The android device that is connecting to the home automation device is installed with the application that can connect with any open hardware and send signal to it. This application can send only two signals either on or off to the arduino devices and this will triggers the relay module which in alternates the state of the electrical device.

Sr. No	Component Name	Component Description	No. of Quantity
1	IR module	Led+ TSOP	1
2	Transformer	12 V & 1 A	1
3	Voltage regulator	7805 IC	1
4	Diode	IN4007 (d1,d2,d3,d4,d5)	5X
5	LED	3mm(1.5V & 20mA)	7
6	Electrolytic Capacitors	1000µF( ),10 µF(c20,c21,c22,c23),1 µF(c1,c19,crs) 100nf (c3)	1,4,3,1
7	Ceramic Capacitors	22pf(c4,c8)	2
8	Multilayer Capacitors	.1 µF (c5, c9, c10, c11, c12, c13, c14, c15, c16,c17)	10
9	Resister	220Ω (r4 ,r10,)10K(r3,r2,r1) 1k(r7,r11,r12)	2,3,3
10	Bluetooth Module	AUBTM20	1
11	push to on off Switch	6 Pin	1
12	Reset Switch	4 Pin	1
13	Crystal	16 MHZ (q1)	1
14	LCD	16*2	1
15	Max232 IC	16 Pin(IC3)	1
16	L293D IC	16 Pin(IC2)	1
17	(Arudino-Atmega8) IC	28 Pin (IC)	1
18	Female Connector	Db9	1
19	Male & Female Bug Stick	Long Strips of Both	-

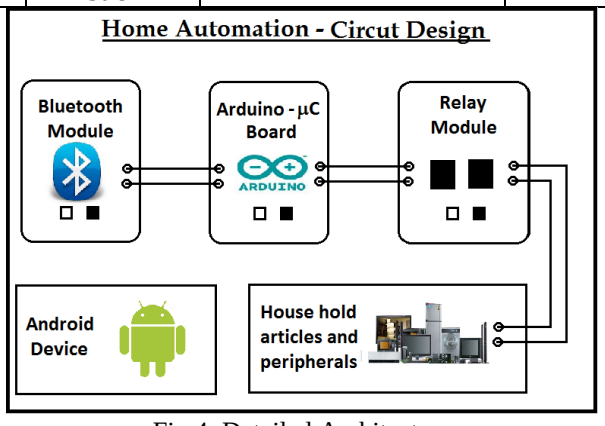

Fig 4: Detailed Architecture

Next is the Arduino Micro controller, as usual this act as the brain of the home automation module the Bluetooth controller receives the signal and forwards it to the arduino

micro controller. This arduino controller is programmed to trigger the relay module. A single arduino micro controller has a capable of handling maximum 32 devices, In our implementation we use an arduino micro controller having an capacity of handling 8 devices and which can handles the devices having an electric supply of 240 volts and if we conduct more than this the board will be short circuited.
Finally coming to the Relay module, normally this act as an electric switch which will triggers the home appliances.

A. Proposed Circuit Diagram

The process of sending password is also given in (How to connect Bluetooth module with android mobile) document and here instead of typing keyword(a,b,c,d) we should have type

When he/she enters the password it is received by Bluetooth module and given to the controller. If the given password by the user is same as the stored password than the gate will be automatically open and the amount will be detected from the total amount the user have if we want to pay automatically.

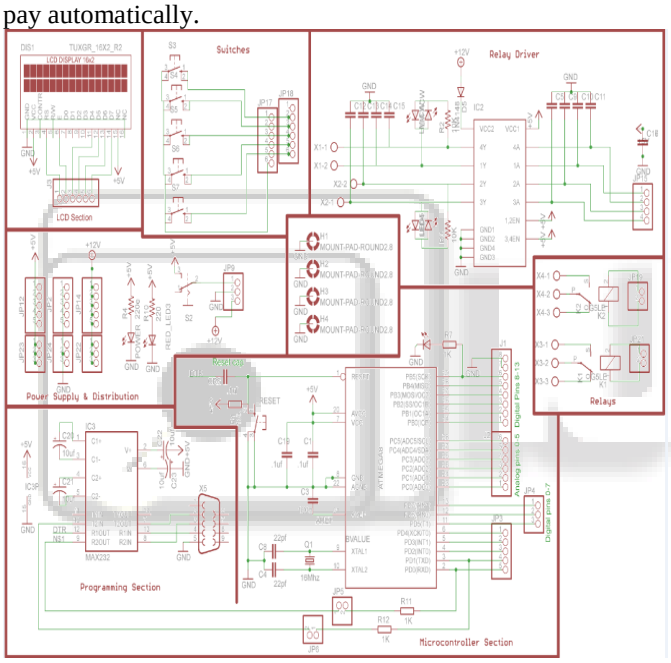

Fig. 5: Circuit Diagram

V. CONCLUSION

In our proposed system we implement a new design for home automation with the help of open source hardware and software which reduces the implementation cost comparing with the other proprietary system available in the market and also provides a complete authority, freedom over the system to end-user. Our system provides ease of use, further it provides security with the help of paring key which is coded in the arduino board and known only to the user. This method can be further enhanced with the system that provides high bandwidth like Wi-Fi, GSM and others. In other words the work can be viewed in the other perspective that leads us to the process industrial automation.

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