

Smart Home System

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Abstract— An internet based home automation system focuses on controlling home electronic devices whether you are inside or outside your home. Home automation gives an individual the ability to remotely or automatically control things around the home. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The words appliance and devices are used interchangeably. It needs to control as well monitor such different types of devices, appliances, etc. which can be done using Arduino development boards. This paper describes application and utilization of Arduino development board for home automation system.

I. INTRODUCTION

Automation is today's fact, where things are being controlled automatically, usually the basic tasks of turning on/off certain devices and beyond, either remotely or in close proximity. Automation lowers the human judgment to the lowest degree possible but does not completely eliminate it. The concept of remote management of household devices over the internet from anywhere, any time in the world today can be a reality. Assume a system where from the office desk, the user could view the status of the devices and decides to take control by tuning his TV set to his favourite channel, turns on the cooling system, say the air conditioner, and switches on or off some of the lights. This user could walk back home and only finds a very comfortable, pleasant home. The recent developments in technology which permit the use of radio frequency technology such as Bluetooth, have enabled different devices to have capabilities of communicating with each other. Bluetooth is a new technology, which has at its centre the goal of eliminating wired connections between computers. Instead of connecting with wires, every appliance has small transmitters/receivers. The radio frequency used (2.4 GHz) is so high that the range of transmission will be small (about 30 feet). This is important because the range is so small, that it can be used in apartments without much interference to your neighbours or from them. These are a few reasons that make Bluetooth technology ideal for home automation. With this in mind, I propose to design an internet based home automation system for remote control of home appliances.

Many people are always on the move from place to place due to business demands. Some people can spend a couple of days away from their home leaving all their household appliances without any kind of monitoring and control. Some devices are left plugged into power sockets whereas others are supposed to be plugged into and out of power sockets at different intervals depending on the time of the day. All this requires an individual to manually attend to each of the devices independently from time to time. All such monitoring and control can be done without necessarily being around or inside the home. Some devices if not controlled properly consume a lot of energy which leads to extra expenditure on electricity. Therefore I propose to design an SMS based home automation system which will enable one to remotely manage his/her appliances from anywhere, anytime.

II. SMART HOME

A Smart home system focuses on controlling home electronic devices whether you are inside or outside your home. Smart Home gives an individual the ability to remotely or automatically control things around the home. A Smart home is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use. The task can be performed by on bases of sensor data, which will take itself decision and action to perform. The recent developments in technology which permit the use of radio frequency technology such as Bluetooth have enabled different devices to have capabilities of communicating with each other. Bluetooth is a new technology, which has at its centre the goal of eliminating wired connections between computers. Instead of connecting with wires, every appliance has small transmitters/receivers. The radio frequency used (2.4 GHz) is so high that the range of transmission will be small (about 1M). This is important because the range is so small, that it can be used in apartments without much interference to your neighbors or from them. These are a few reasons that make Bluetooth technology ideal for home automation.

A. Schematic

Fig.1 shows architecture of smart home system using different types of sensors and building blocks based on Atmega328.

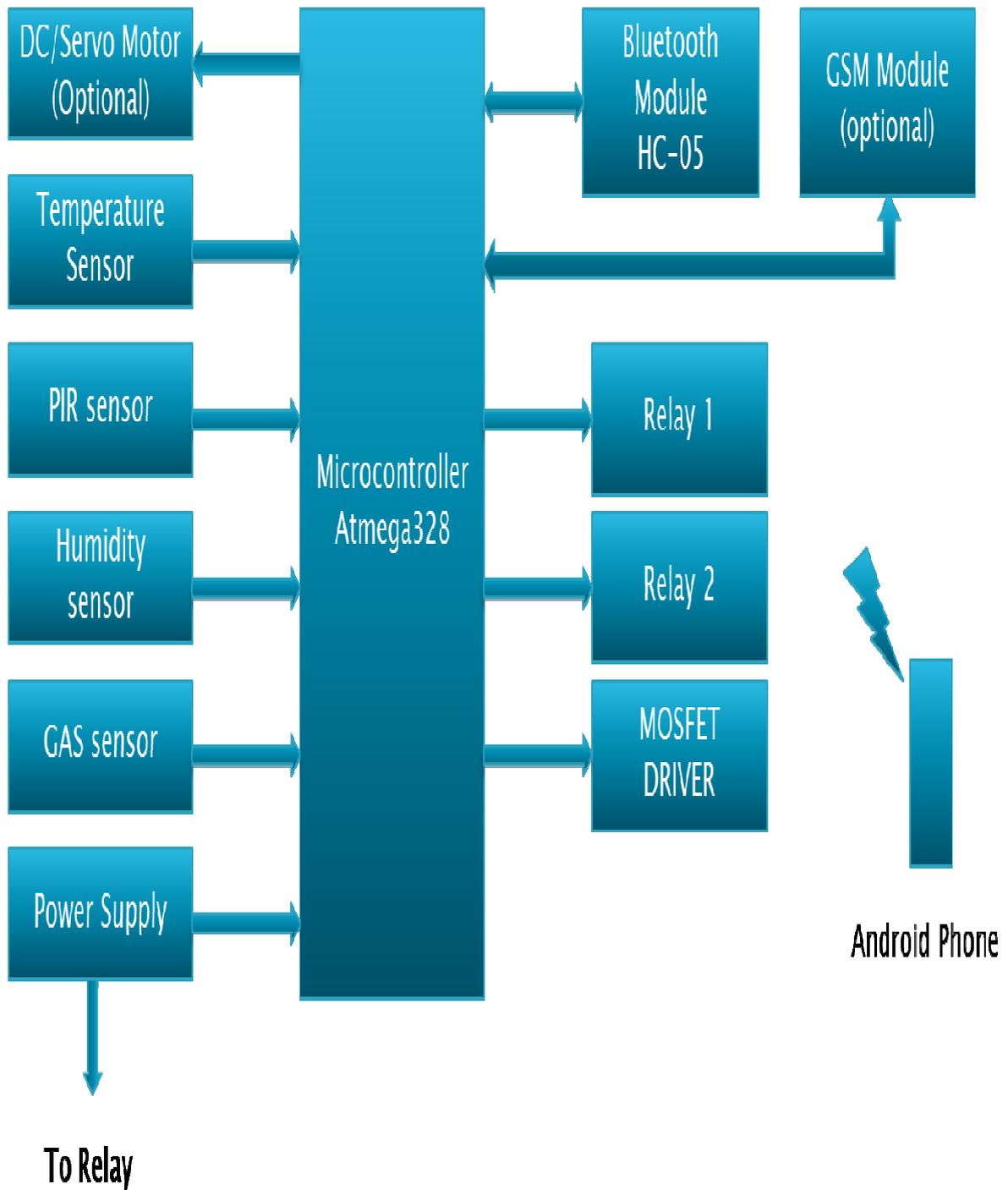


Fig. 1: Schematic of smart home automation system

B. Arduino as communication Interface

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB

connection to the computer (but not for serial communication on pins 0 and 1). A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

B. GSM module



Fig. 2: SIM300 GSM module

GSM stands for Global System for Mobile Communications. It is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. A Modem is a device which modulates and demodulates signals as required to meet the communication requirements. It modulates an analog carrier signal to encode digital information, and also demodulates such a carrier signal to decode the transmitted information. A GSM Modem is a device that modulates and demodulates the GSM signals and in this particular case 2G signals. The modem we are using is SIMCOM SIM300. It is a Tri-band GSM/GPRS Modem as it can detect and operate at three frequencies (EGSM 900 MHz, DCS 1800 MHz and PCS1900 Mhz). Default operating frequencies are EGSM 900MHz and DCS 1800MHz. Sim300 is a widely used in many projects and hence many variants of development boards for this have been developed. These development boards are equipped with various features to make it easy to communicate with the SIM300 module. Some boards provide only TTL interface while some boards include an RS232 interface and some others include an USB interface. If your PC has a serial port(DB9) you can buy a GSM Modem that has both TTL and RS232 interfacing in economy. Sim300 GSM module used here, consists of a TTL interface and an RS232 interface. The TTL interface allows us to directly interface with a microcontroller while the RS232 interface includes a MAX232 IC to enable communication with the PC. It also consists of a buzzer, antenna and SIM slot. Sim300 in this application is used as a DCE (Data Circuit-terminating Equipment) and PC as a DTE (Data Terminal Equipment).

GSM Technology has grown so much, that literally there isn't a place on earth where there is no GSM signal. In such a scenario GSM provides us a wide scope in controlling things remotely from any place just with our finger tips. GSM also provides ease to easily communicate in a more robust way.

III. DEVELOPMENT OF SOFTWARE AND ITS IMPLEMENTATION

The Arduino application installation is not a typical "Run the installer and follow the prompts..." process. You simply download the ZIP package, unzip it to any drive/directory you choose, and run the "arduino.exe" application in the folder! A shortcut to the application on your desktop or taskbar is handy since there is no install process to make one. The other potential installation requirement is drivers for the microcontroller programming hardware, which is usually some kind of USB to serial translation IC or emulation, commonly known as a VCP, or "Virtual COM Port". Typically, official Arduino boards, and a lot of

compatible designs, have used the common FTDI USB-serial driver IC (as do some Cal-Eng boards). There are other custom devices used on the Arduino UNO, Leonardo, Mega256 and others. The drivers for all the official Arduino boards are located in the “\arduino-1.0\drivers\” install directory. If and when you are prompted for a driver install after plugging in an Arduino-compatible board, point the driver installer to this directory. Typically, Mac and Linux do not need a driver install, but if they do, the process is similar. A couple of Cal-Eng boards use unique VCP driver IC’s, and may need separate drivers, but that process will be explained in the individual product page. If you’ve unzipped Arduino and loaded the VCP drivers, lets do a quick test! Launch Arduino and look for your board (or compatible equivalent). This example shows the common Arduino “Arduino Uno” being selected. Next, we need to pick which COM port your USB VCP is listed as. The actual COM port number (COM1, etc) will vary with each system, and with most modern PC’s and laptops there will probably only be one! The easiest way to tell the COM port number is to remove the USB device, check the list, plug it back in and re-check to see what was added.

A. *Android SDK*

Android software development is the process by which new applications are created for the Android operating system. Applications are usually developed in Java programming language using the Android Software Development Kit (SDK), but other development environments are also available. The Android software development kit (SDK) includes a comprehensive set of development tools. These include a debugger, libraries, a handset emulator based on QEMU, documentation, sample code, and tutorials. Currently supported development platforms include computers running Linux (any modern desktop Linux distribution), Mac OS X 10.5.8 or later, and Windows XP or later. As of March 2015, the SDK is not available on Android itself, but the software development is possible by using specialized Android applications. Until around the end of 2014, the officially supported integrated development environment (IDE) was Eclipse using the Android Development Tools (ADT) Plugin, though IntelliJ IDEA IDE (all editions) fully supports Android development out of the box, and NetBeans IDE also supports Android development via a plugin. As of 2015, Android Studio, made by Google and powered by IntelliJ, is the official IDE; however, developers are free to use others. Additionally, developers may use any text editor to edit Java and XML files, then use command line tools (Java Development Kit and Apache Ant are required) to create, build and debug Android applications as well as control attached Android devices (e.g., triggering a reboot, installing software package(s) remotely).

B. *Eclipse IDE*

In computer programming, Eclipse is an integrated development environment (IDE). It contains a base workspace and an extensible plug-in system for customizing the environment. Written mostly in Java, Eclipse can be used to develop applications. By means of various plug-ins, Eclipse may also be used to develop applications in other programming languages: Ada, ABAP, C, C++, COBOL, Fortran, Haskell, JavaScript, Lasso, Lua, Natural, Perl, PHP, Prolog, Python, R, Ruby (including Ruby on Rails framework), Scala, Clojure, Groovy, Scheme, and Erlang. It can also be used to develop packages for the software Mathematica. Development environments include the Eclipse Java development tools (JDT) for Java and Scala, Eclipse CDT for C/C++ and Eclipse PDT for PHP, among others.

C. *Eclipse ADT (Android Development Tools)*

Android Development Tools (ADT) is a Google-provided plugin for the Eclipse IDE that is designed to provide an integrated environment in which to build Android applications. ADT extends the capabilities of Eclipse to let developers set up new Android projects, create an application UI, add packages based on the Android Framework API, debug their applications using the Android SDK tools, and export signed (or unsigned) .apk files in order to distribute their applications. It is free download. It was the official IDE for Android but was replaced by Android Studio (based on IntelliJ IDEA Community Edition).

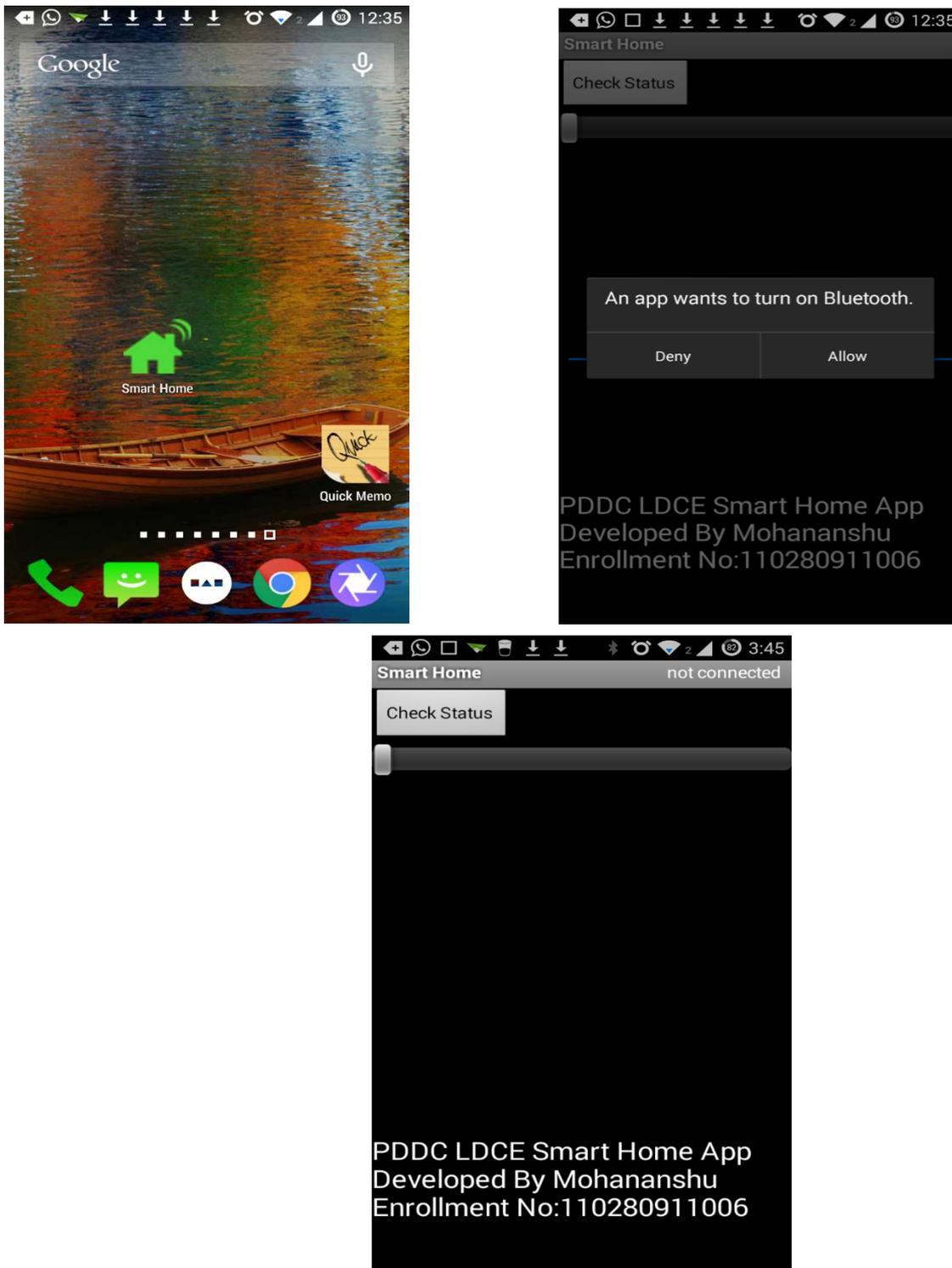


Fig. 3: Snapshot of developed anroid app for smart home automation

IV. RESULTS AND DISCUSSION

The developed smart home automation system is working properly. Arduino and Atmega328 microcontroller have been used for control as well monitor each thing. It provides efficient and instant controlling capability. It's also shows an application of open source electronic development board like Arduino, etc. It also has capability to interface it with IoT which provides real time environment control.

References

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