Smart Home Wireless Automation Technology using Arduino based on IOT

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Abstract
The "IOT based Interactive Controlling and Monitoring System for home automation" is another technological headway which can control and screen gadgets nor just for home automation yet any genuine apparatuses remotely. Any automation venture utilizing inserted system like PIC Microcontroller gives an astute, low cost, energy protecting system for homes, schools, healing facilities .The primary goal of this paper is to plan and give execution points of interest of IOT for home and also for any genuine applications to consequently switch on/off lights, fans, gas, shades, doors utilizing sensors, which is equipped for controlling and mechanizing the greater part of the genuine living. In general, we know that we are using a number of appliances at homes, theatres, shopping malls, Convention Halls, Hotels that appliances we are connecting directly to the power and consumes a power. Due to this, some appliances failure due to over voltage. Here, we are using some components to control from overflow voltage. In this model we use micro controller (ATMEGA328P), is connected to the nodemcu, 4-channel relay board and liquid crystal display (LCD). Here the input is given to the micro controller through the LCD to display temperature. The output of this signal is given to the micro controller which in which a pin becomes active when any obstacle is finding the room temperature. 4-channel relay board is connected to control the large appliances, meanwhile we are connecting switches to operate and nodemcu(Wi-Fi module) to control with remote access.

Keywords
Home Automation, Internet of Things, Smart Homes, Sensor System,ARDUINO, WiFi.

I. Introduction
In recent days electricity is the each one essential need and utilization of energy is builds step by step .and assets energy proclaims step by step. Use of energy is additionally expanding that is the reason counteractive action is superior to cure consciousness of energy utilization ought to be brought into each place before assets get smothered. Furthermore, in now day's innovation is the most imperative part human's life. By utilizing these innovation social connection of people groups developing. Innovation are additionally use for transportation ,internment and in restorative field its likewise utilization for making of numerous gadgets like cell phones, PCs tablets have caused many people groups are associated with innovation to speak with their companions ,family access and store the data, for example, archive motion picture music and picture. The web has turned into a typical interface that numerous gadgets use to improve the day by day life of many people groups. Web causes us to take prompt answer for some issues and furthermore ready to associate from any of the remote spots which adds to general cost lessening and energy utilization. The composed system will help in diminishing the energy wastage by ceaselessly monitoring and controlling the electrical apparatuses. Shrewd Home or home automation present innovation for home climate which is utilization to give straightforwardness and assurance to its inhabitants. By utilizing the innovation of the Internet of Things, The web of things (IoT) is the system of physical gadgets, vehicles, structures and different things insert with electronic, programming, sensors, actuators, and system network that empower these articles to gather and trade data [1]. Smart Home automation is the private augmentation of building automation and includes the control and automation of lighting, warming, ventilation, aerating and cooling (HVAC), apparatuses, and security. Present day systems for the most part comprise of switches and sensors associated with a focal center point once in a while called an "entryway" from which the system is controlled with a UI that is collaborated either with a divider mounted terminal, cell phone programming, tablet PC or a web interface. Shrewd Home automation intends to associate every single electrical gadget in the home to a focal control system that control those gadgets as indicated by client inputs. The associated electrical gadgets are shrewd it could be said. Web causes us to get with prompt answer for some issues and furthermore ready to interface from any of the remote spots which adds to general cost diminishment and energy utilization The Internet may even be used in home automation that offers a few choices from conservative utilization of energy to extra support, assurance and security. Indeed, even finished awesome separations the client can screen and deal with their home door, different apparatuses and kill on/ the T.V with no human intercession [2]. In past home automation, sensors are utilization for information accumulation, transmission of information and after that sends to the server and passage for investigation the data. In existing system connections in the middle of actuator and sensors was plainly defined.in proposed system IoT condition is uses.in proposed system sensors and actuators are not unmistakably isolated yet rather it characterized as an individual protest or thing, in these each question and things is sensors .

II. Related work

A. Home Automation Utilizing RF Module
The essential objective of Home Automation System is to assemble a home automation system utilizing a RF controlled remote. Presently innovation is quickening so homes are additionally getting more intelligent. Present day homes are purposely moving from current l changes to brought together control system, containing RF controlled switches. Today conventional divider switches arranged in different parts of the home makes it relentless t for the end client to go close them to control and work. Significantly further it transforms into more tricky for the old people or physically impeded individuals to do as such. Home Automation utilizing remote actualizes a simpler arrangement with RF innovation. With a specific end goal to fulfill this, a RF remote is joined to the microcontroller on transmitter side that sends ON/OFF signs to the recipient where gadgets are associated. By working the expressed remote switch on the transmitter, the heaps can be turned ON/OFF all inclusive utilizing remote innovation

Bluetooth based home automation system utilizing PDAs:
In Bluetooth based home automation system the home apparatuses are associated with the Arduino BT board at input yield ports utilizing transfer. The program of Arduino BT board is based on abnormal state intelligent C dialect of microcontrollers; the association is made through Bluetooth. The secret word security is given so just approved client is allowed to get to the machines. The Bluetooth association is built up between Arduino BT board and telephone for remote correspondence. In this system the python content is utilized and it can introduce on any of the Symbian OS condition, it is convenient. One circuit is planned and actualized for accepting the input from the telephone, which show the status of the gadget.

B. Zigbee Based Home Automation System Utilizing PDAs

To screen and control the home apparatuses the system is composed and executed utilizing Zigbee. The gadget execution is record and store by arrange organizers. For this the Wi-Fi organize is utilized, which utilizes the four switch port standard remote ADSL present day switch. The system SSID and security Wi-Fi parameter are preconfigured. The message for security reason initially process by the virtual home calculation and when it is pronounced safe it is re-encoded and forward to the genuine system gadget of the home. Over Zigbee arrange, Zigbee controller sent messages to the end. The wellbeing and security of all messages that are gotten by the virtual home calculation. To diminish the cost of the system and the meddling of particular establishment of the system Zigbee correspondence is useful.

C. Wi-Fi based Home Automation System Utilizing Mobile Phones

Wi-Fi based home automation system fundamentally comprise three modules, the server, the equipment interface module, and the product bundle. The figure demonstrates the system display design. Wi-Fi innovation is utilized by server, and equipment Interface module to speak with each other. A similar innovation uses to login to the server online application. The server is associated with the web, so remote clients can get to server electronic application through the web utilizing good web program. Programming of the most recent home automation system is part to server application programming, and Microcontroller (Arduino) firmware. The Arduino programming, manufactured utilizing C dialect, utilizing IDE accompanies the microcontroller itself. Arduino programming is chargeable for social occasion occasions from associated sensors, at that point applies activity to actuators and preprogramed in the server. Another activity is to report and record the history in the server DB. The server application programming bundle for the proposed home automation system, is an online application manufactured utilizing asp.net. The server application programming can be gotten to from inner system or from web if the server has genuine IP on the web utilizing any web pilot bolsters asp.net innovation. Server application programming is at fault of, keep up the entire home automation system, setup, and design. Server utilize database to keep log of home automation system parts, we utilize XML documents to spare system log.

III. Overview of Internet of Things

In the digital world, especially the computer communication starts with sharing data between machine to machine, and it moves to machine to infrastructure, then machine to environment and machine to people but now internet is everything.

The people also want to communicate with all non-living things through internet such as home appliances, furniture's, stationeries, cloths etc. The people already have a lot of technologies to interact with living things but IoT enables to communicate with nonliving things with comfort manner. IoT is a convergence of several technologies like ubiquitous, pervasive computing, Ambient Intelligence, Sensors, Actuators, Communications technologies, Internet Technologies, Embedded systems etc see fig. 1.

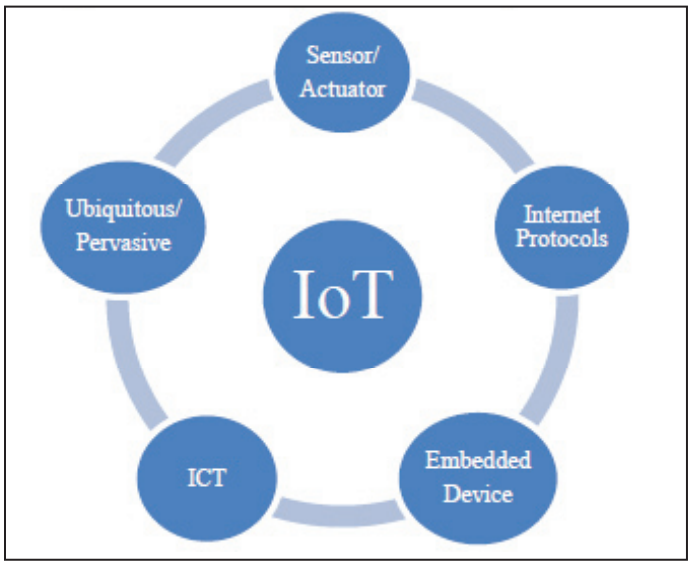

Fig. 1: Architecture of IoT

In the architecture, embedded system, sensors and actuators are the physical components which are directly interacting with the users. The users manipulate the data through these components. ICT, ubiquitous/pervasive computing, Internet protocols used to create communication among the devices and manage high end user interactions. According to the IoT architecture the components are further classified into three functional units (fig. 2).

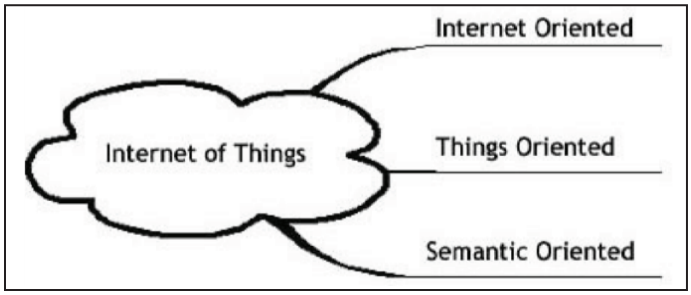

Fig. 2: Functional Classification of IoT

In the IoT architecture, "Internet Oriented" represents internet and its technologies and it act as a middleware between user and intelligent things and so it's called as intelligent middleware. Intelligent middleware will allow the creation of a dynamic map of the real/physical world within the digital/virtual space by using a high temporal and spatial resolution and combining the characteristics of ubiquitous sensor networks and other identifiable "things"
"Things Oriented" is known as "Intelligent Things" which represents sensors and actuators which is respond it to stimuli from the environment in a consistent manner. This phase sense and react based on the environment and user actions such as When white light is shone on a red object the dye absorbs nearly all the light except the red, which is reflected. At an abstract level, the colored surface is an interface for the object, and the light arriving at object

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can be a message sent to the thing, and accordingly its reflection is the response from the thing. The consistency in responses received from the interfaces for each message, enables things to interact with their surroundings. Hence to make the virtual world comprehensible, there needs to be consistency in messages and it responses. This is enabled through standard interfaces, which is in turn to facilitate interoperability. Simply this phase focuses the functionalities and communications among sensor/actuators, embedded devices and any other smart devices.

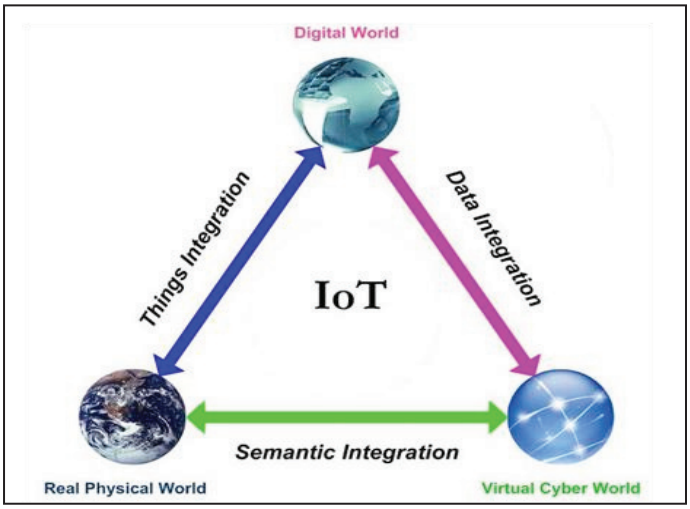


Fig. 3: Functional Integration of IoT

"Semantic Oriented" is known as "Intelligent Process" which represents knowledge based and decision making processes.

A. Applications of IoT

The potentialities offered by the IoT make it possible to develop numerous applications based on it. All the applications are comprised in many more smart "things" such as sensors, actuators, microcontrollers etc. Antoine de Saint-Exupery [2] classifies IoT applications are three major categories they are

- Society,
- Environment
- Industry.

Based on the classification the term "Things" can be perceived in a different way and depending on the application domain in which it is used. In Industry, all IoT Activities are involving in financial or in commercial transactions among companies, organizations and other entities such that Manufacturing, logistics, Service Sector, Banking, Financial Governmental Authorities, Intermediaries, etc. On the whole the "Thing" may typically be the product itself, the equipment, transportation means, etc; everything that participates in the product lifecycle.

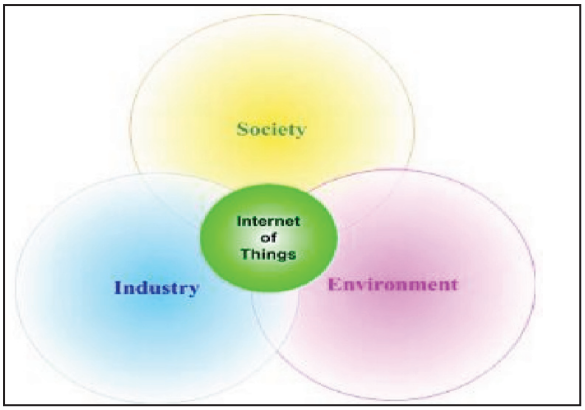


Fig. 4: Classification of IoT Applications

In Environment applications based on the activities regarding the protection, monitoring and development of all natural resources such as Agriculture & breeding, recycling, environmental management services, energy management, etc.

Lastly, in the whole society the "Thing" may be related to devices within public spaces or devices for Ambient Assisted Living, etc. For example Agriculture & breeding, recycling, environmental management services, energy management, smart home, smart city, smart office etc.

IV. Nodemcu ESP-8266

A. What is node MCU?

Node MCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espresso Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language.

B. ESP8266 Arduino Core

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate tool chains to allow Arduino C/C++ to be compiled down to these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file down to the target MCU's machine language. Some creative ESP8266 enthusiasts have developed an Arduino core for the ESP8266 WiFiSoC that is available at the GitHub ESP8266 Core webpage. This is what is popularly called the "ESP8266 Core for the Arduino IDE" and it has become one of the leading software development platforms for the various ESP8266 based modules and development boards, including NodeMCUs.

ESP8266 with NodeMCU Firmware can be configured as an Access Point, Wifi Client (Host / Station) or both as Client and AP at the same time. It has capability work with 802.11b, 802.11b and 802.11n networks. In this article we will check some of the WiFi configuration methods with sample code.

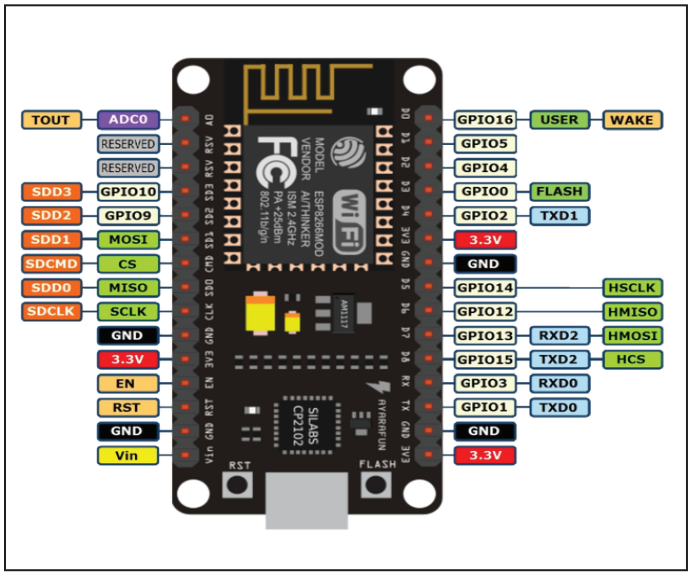


Fig.

This Instructable will show you the steps needed to get started with the ESP8266 using a fantastic little development board for the ESP-12E module. The board includes everything needed including a USB to Serial adapter, surface-mount LED and voltage regulator. In addition, it is easily mountable on a breadboard for developing your own IoT project(s).

The main goal of the instruct able is to cover all the different options you can use in terms of firmware for developing applications that use the ESP8266 to connect to the web. The content, although available, is scattered throughout various sites around the web thus we decided to condense it in one place.

Since the summer of 2014, the ESP8266 has seen a wide adoption as a cost-effective solution for IoT and WiFi-capable devices. The ESP8266 was developed by Shanghai-based Espress if Systems, as a Serial (UART) to Wi-Fi SoC (System On a Chip) based around a Ten silica Xtensa LX3 DPU. This tiny IC includes an RF front end, RAM, and (usually) an onboard TCP/IP stack that allows it ready to connect to a nearby Access Point, to act as an Access Point itself, or both.

C. Family of Breakout Boards (ESP-NN)

Quickly after launch, a variety of breakout boards for the ESP8266 started becoming available. The most popular ones have been the ESP-NN series, which typically integrate the SoC along with Flash RAM, a crystal and even an onboard antenna. The most salient distinction between different ESP-NN models are the pins that are broken out from the ESP8266

As the ESP8266 was developed as a Serial to Wi-Fi adapter, its firmware implemented an interrupter for AT commands. Thus initial usage of the IC was limited to using a either a USB to Serial adapter, or a separate microcontroller (e.g., ATmega328) to issue AT commands over the ESP8266's Serial UART interface. For this reason, the ESP-01 board quickly became popular amongst the ESP8266 community because of its 2×4, 0.1in-pitch connector that can be easily wired to a USB to Serial adapter. The connector gave access to the pins used for serial communication, namely RX and TX, as well as 4 control pins, GPIO0, GPIO2, CH_ PD and RST (reset), along with VCC and GND.

However, other ESP-NN boards offer access to a wider variety of pins, although their packaging is of a custom Surface-Mount Device, with castellated pins as seen in the documentation page linked above. From the different ESP-NNboards, we began to experiment with the ESP-12E. The main reason is that this module was the one chosen by the developers of the NodeMCU project for their hardware DevKit 1.0 (see Firmware Options for details about NodeMCU).

Because the ESP8266 provides a cost-effective solution to the rapidly growing market of internet-connected projects and devices (i.e., the so-called Internet Of Things), it has become one of the most popular development platforms over the past year and a half. In consequence, a dedicated community has formed around the platform (http://esp8266.com), which has been focused on improving its functionality. For starters, different firmware options have been ported to run on the ESP8266, effectively taking it from a simple Serial to Wi-Fi adapter into a fully functional microcontroller with access to its GPIO and hardware-based functions like PWM, I2C, 1-Wire communication, and ADC; all this, of course, in addition to maintaining its Wi-Fi capabilities.

A few different firmware options are available for the ESP8266. These allow us to access the module in different ways, as you can see below.

D. AT Command Processor (Default)

The quickest way to get started with the ESP8266 is to use its original firmware, which allows it to process any AT commands that it receives over its Serial UART interface. The biggest advantage of this option is that we need not be familiar with any specific language or framework to use the module. We can simply send it a series of commands to achieve our goal. The downside to this is that we need either an additional microcontroller involved or a USB to Serial adapter to send the necessary commands.

Whereas the AT commands are the standard way of communicating with wireless-capable ICs (e.g., Bluetooth, Wi-Fi, GSM), they pose the limitation of needing another module to run the application that specifies these commands accordingly. However, if we could run the application within the ESP8266 itself then we'd have everything self-contained by a single IC. Fortunately, Espressif made a Software Development Kit (SDK) available that allowed users to flash different firmware options.

E. NodeMCU

NodeMCU is, at the moment, the most popular alternative for firmware running on the ESP8266. Based on the eLua project, it runs a Lua interpreter onboard the ESP8266, which is able to execute commands written in the Lua scripting language. The commands are sent to the ESP8266 via the Serial UART interface.

NodeMCU is a great starting point for Makers as it provides an interactive environment that allows running commands not only for controlling theESP8266's wireless interface, but also its GPIO and hardware functionality such as i2c and PWM. In addition, we have access to the full scope of the Lua programming language for writing our applications. In the case of the default firmware (AT Commands Interpreter), the application code would have to be developed using a programming language suited to the microcontroller or SoC we use to develop the interface for sending the commands over Serial (e.g., C/C++ for microcontrollers in the Arduino boards).

Finally, not only does the NodeMCU firmware allows us to execute commands interactively, but we can save our applications as a script in the ESP8266's flash memory, and instruct it to run the application code every time it restarts! Even though this is a convenient option, our preferred method of working.

V. Proposed Method

In this project the components used are Arduino, power supply, LCD display, 4-channel relay board, nodemcu, LM35 sensor, Reed switch module, switches, bulb holders and bulbs. By using adopter which converts power supply from 230V to 5V and alternate current is connected. This DC supply is given to voltage regulator and the output will be regulated to 5V. This supply is parallel is given to micro controller, LCD display, 4-channel replay board, switches, lm35 sensor, nodemcu.The ATMEGA328P microcontroller is 28 pin digital IC. As this is the memory element IC, a crystal oscillator (11 to 12MHZ) which generates continuous clock pulse of constant frequencies and acts as a reference timer for the micro controller. As in general 1st pin is used as reset

button to refresh the memory allocation of the present stage and initialize the program from the first. The power supply for micro controller is given at 3rd and 28th pins. Key pad is used to give the input to micro controller, it helps to set time required to run the motor (set time for the motor run duration). Here we give a speed in RPM to control the speed of the motor. LCD is used to display the output of the microcontroller; it displays the time speed and password given to the micro controller to run the motor. The motor driver is connected between the micro controller and DC motors for transmitting the power supply to the dc motors and it will control the speed of the motor.

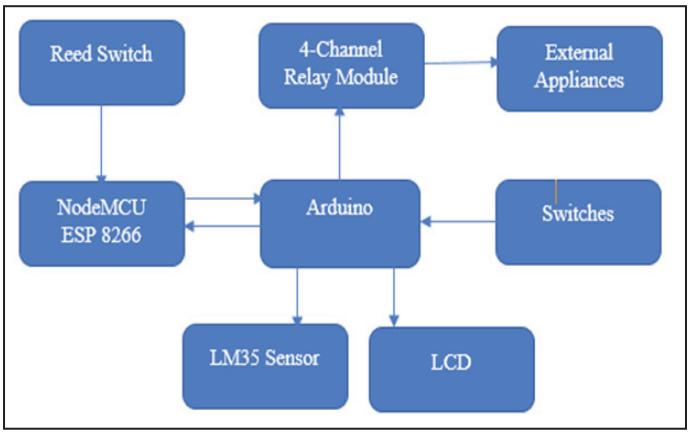


Fig. 5: Proposed Architecture Diagram

VI. Implementation and Simulation Results

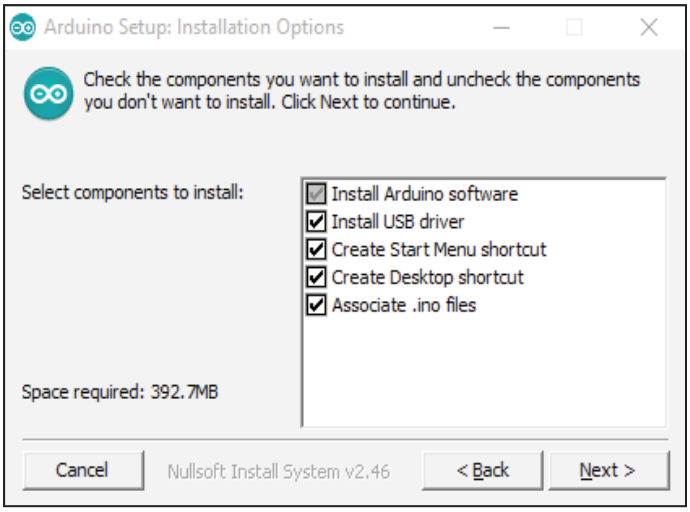
A. Arduino Software

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.This software can be used with any Arduino board.

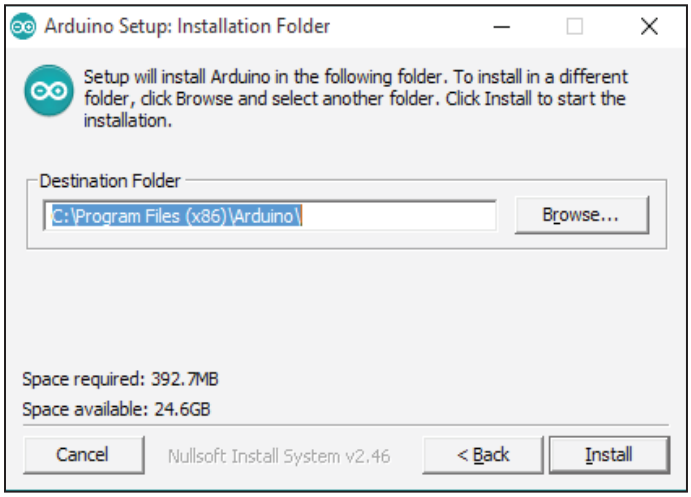
Installing Arduino Software in Windows PC:

- Download and install the Arduino Software (IDE)

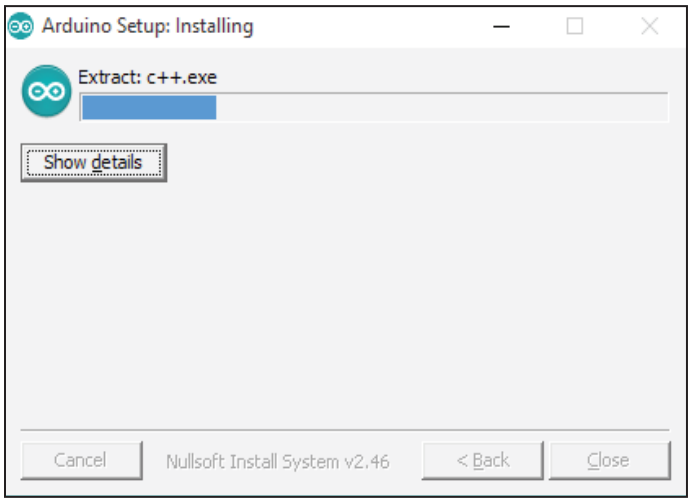
When the download finishes, proceed with the installation and please allow the driver installation process.
Choose the components to install



Choose the installation directory



The process will extract and install all the required files to execute properly the Arduino Software (IDE)



B. Configuring Arduino Board With PC

1. Connect the board

The USB connection with the PC is necessary to program the board and not just to power it up. The Uno and Mega automatically draw power from either the USB or an external power supply. Connect the board to your computer using the USB cable. The green power LED (labelled PWR) should go on. The connection between PC and Arduino is done using a USB cable.

(i). USB Cable

Fig. 6: USB Cable

2. Arduino Board Powered ON

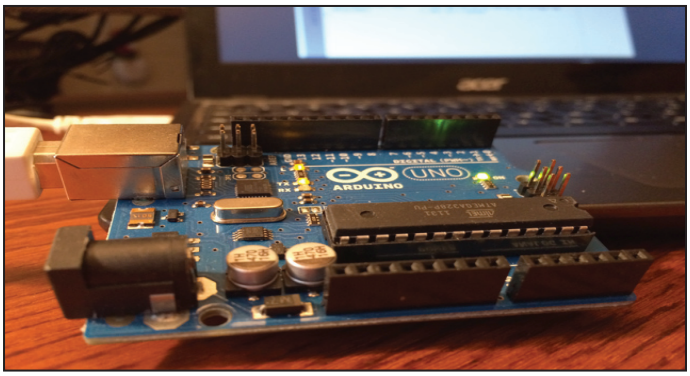


Fig. 6: ARDUINO board

(i). Install the Board Drivers

- Click on the Start Menu, and open up the Control Panel.
- While in the Control Panel, navigate to System and Security. Next, click on System. Once the System window is up, open the Device Manager.
- Look under Ports (COM & LPT). You should see an open port named "Arduino UNO (COMxx)". If there is no COM & LPT section, look under "Other Devices" for "Unknown Device".
- Right click on the "Arduino UNO (COmxx)" port and choose the "Update Driver Software" option.
- Next, choose the "Browse my computer for Driver software" option.

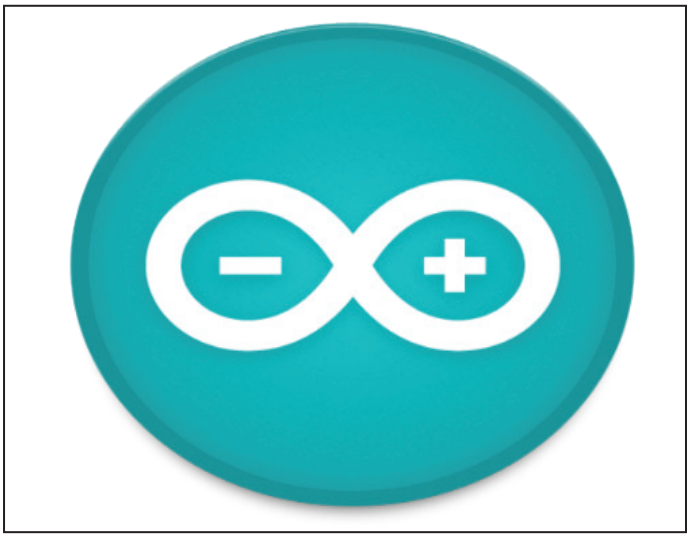
» Finally, navigate to and select the driver file named "arduino.inf", located in the "Drivers" folder of the Arduino Software download (not the "FTDI USB Drivers" sub-directory). If you are using an old version of the IDE (1.0.3 or older), choose the Uno driver file named "Arduino UNO.inf"

» Windows will finish up the driver installation from there.

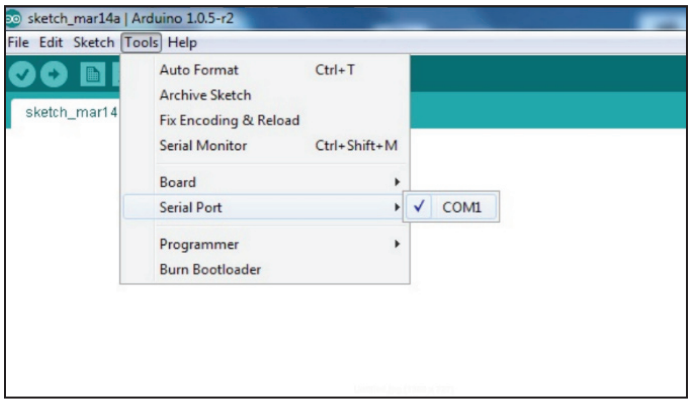
C. Configuring Arduino Software

The required configuration is done in Software so we can dump program in Arduino

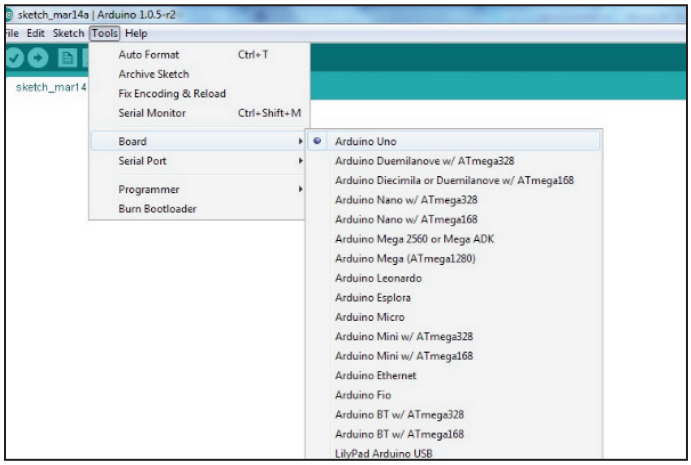
- Launch the Arduino Software by double clicking the Arduino icon (arduino.exe) created by the installation process.



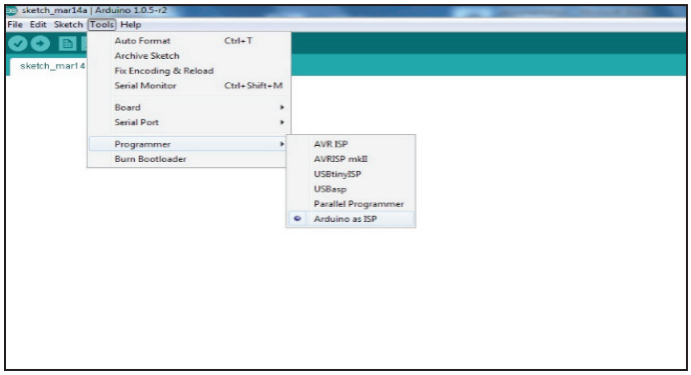
- Connect the Arduino board to the PC then a com will appear select the com in tools i.e TOOLS> PORT > COM and click on it.



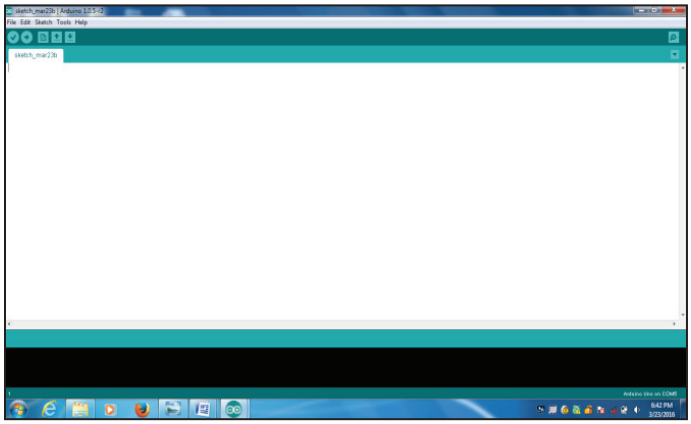
- Select your boardyou'll need to select the entry in the Tools > Board menu that corresponds to your Arduinoboard. Our board is UNO so we have selected UNO here



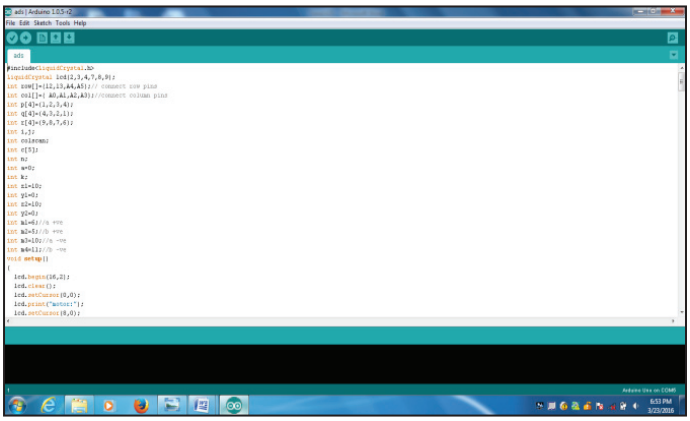
- Select the programmer as Arduino as ISP



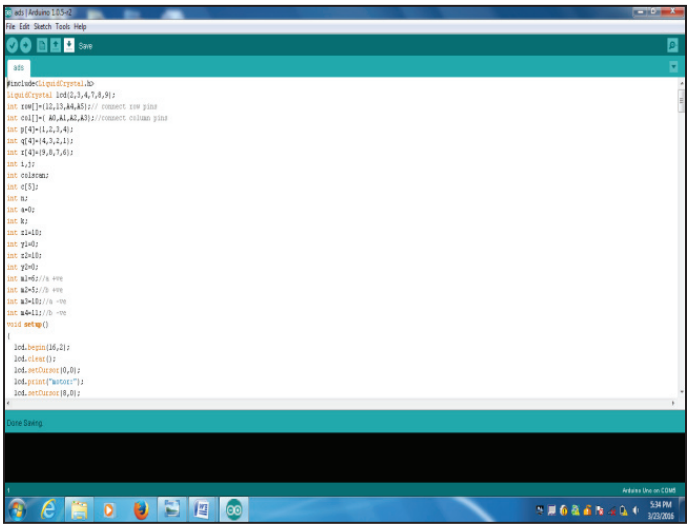
- Now in the blank page we shall type the programme.



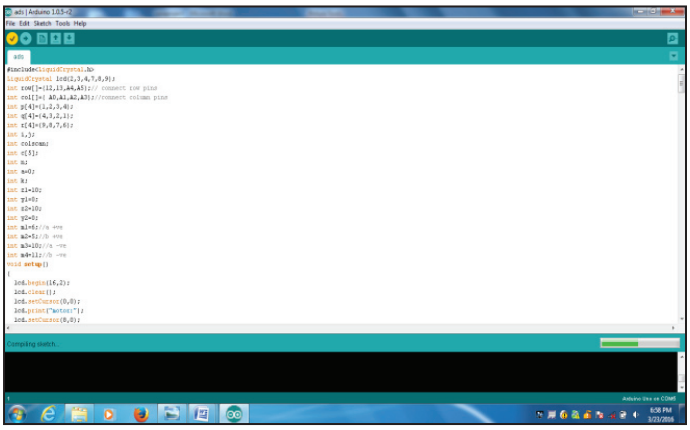
- After typing the program we shall see it like below



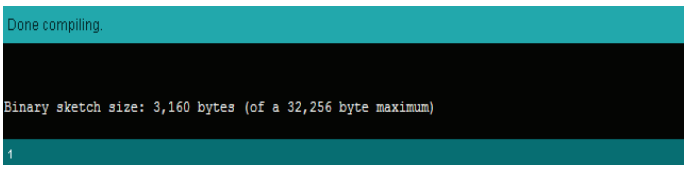
- After typing the program we shall save it by pressing the saving button



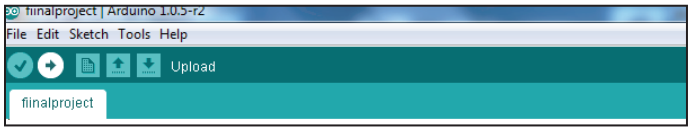
- After saving we shall compile it by pressing the compile button



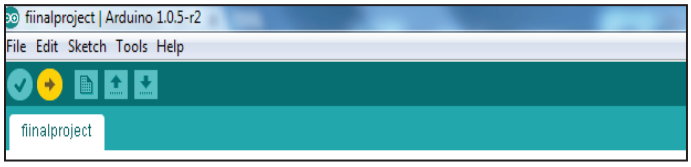
- After compilation if there are no errors we will get a message saying done compiling as below



- Now we shall upload the program by pressing the upload button. Arduino has auto reset ability so there is no need to press the reset button during the upload



- When the button is pressed



- After the uploading is completed we will get a message as DONE UPLOADING

- Now the program is burned in the microcontroller.

D. Blynk

- Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet.
- It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.
- It's simple to set everything up and you'll start tinkering in less than 5 mins.
- Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things.

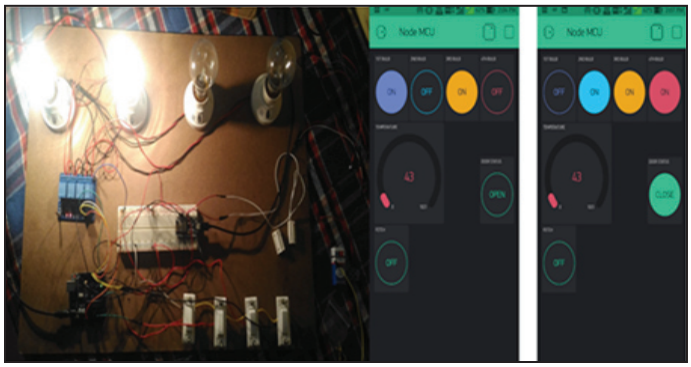


Fig. 6: Final Output of the Project

V. Conclusion

As per the project we implemented how to control the home automation system with connecting external appliances using 4-channel relay board. Here we can operate the appliances not only with the connected switches but also with connecting through the remote through Wi-Fi via Internet. Here we used blynk application which is a drag and drop application.

VI. Future Enhancement

In future we are hoping implement not only by connecting switches and wifi module, we can add sensors for which the appliances automatically operate. We can add to get alert through SMS to your phone weather any appliances are being running while you are not at home. So that we can immediately take actions on the appliances. We can add voice recognition for home automation

and sensor that which automatically controls the fan speed based on room temperature and ready to operate appliances through Internet of Things.

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