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Iot Base Home Automation Sytem Using Arduino

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supervision. We would like to thank her for providing the necessary information and resources for this project.
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ABSTRACT:
Wearelivingin21st centurywhereautomationofanyform i.e.homeorindustrialplaysanimportantroleinhuman life. When it comes to industrial automation, the concept is applied to large machines or robots which helps in increasing the efficiency in terms of production, energy andtime.
Home automation on the other hand involves automating the household environment. This is possible because of thesmartphonesandinternetthatwearewidelyusing.Homeautomationcanbeagaindividedintojustcontrolling the appliances using a smartphone from a remote location and another type filled with sensors and actuatorswhich controlsthelighting,temperature,doorlocks,electronicgadgets,electricalappliancesetc.usinga"Smart"system.
In this project, we will design a simple home automation project using simple components using which different electrical appliances can switched on or off. The project is based on Arduino and we have used Arduino UNO for the project.
Keywords: Home Automation, Bluetooth module, Relay, Arduino Uno.

LIST OF ABBREVIATIONS

AC	Alternating Current
ARM	Advanced RISC machines
CPU	Central Processing Unit
DC	Direct Current
EEPROM	Electrically Erasable Programmable Read Only Memory
GSM	Global System for Mobile Communications

International Journal of Advances in Engineering and Management (IJAEM)
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HVAC	Heat, Ventilation and Air Conditioning
IC	Integrated Circuits
LAN	Local Area Network
PC	Personal Computer
IJETER	International Journal of Emerging Technologies in Engineering Research
RFID	Radio Frequency Identification
RISC	Reduced Instruction Set Computing
TCP/IP	Transmission Control Protocol/ Internet Protocol
WPAN	Wireless Personal Area Network
Arduino IDE	Arduino Integrated Development Environment
LED	Light Emitting Diode
IOT	Internet Of Things
IEEE -	Institute of Electrical and Electronics Engineers

I. INTRODUCTION

Home automation systems have gained popularity in recent years, paralleling the advances in the concept of the Internet of Things. Although automation for commercial buildings is a mature technology, automation applications for residences are a relatively new development, which is gradually being adopted by consumers. Home automation involves the monitoring and control of activities such as lighting,heating, ventilation, air conditioning (HVAC), electrical appliances, sound systems, security cameras, door locks, and alarms. Home automation has various advantages, such as comfort, increased security, and energy efficiency. Figure 1 shows the general home automation system. The figure shows the various home appliances such as security sensors, thermostat etc. which is controlled throughcentral

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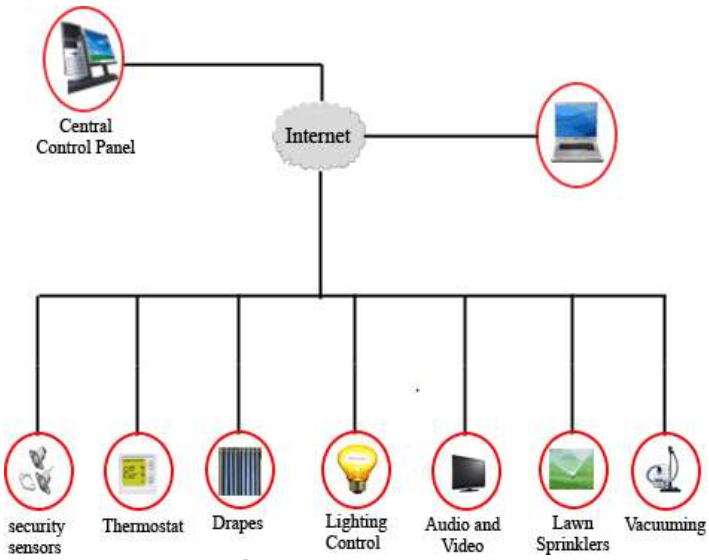

Figure 1. A General Home Automation System

Thewidespreaduseofhomeautomationcanb eseenincoldcitiessuchasMilwaukee, wherepeoplesetthe heating of the house to go off when they leave and switch on the heater 15 minutes before they return. The system is known as HVAC and is the best option for homeautomation.
InanerawithwirelesstechnologysuchasBluetooth,Wi Fi,Zigbee,andGSM,userswanthomeappliancesto be connected wirelessly. Each of these wireless technologies has its own significance and specifications. This project successfully uses Bluetooth with an available frequency of 2400 Hz, a range of 100 meters, and a speed of approximately 3Mbps.
There are a few concerns to be addressed when designing a home automation system. The system should be designedinamannerthatintegratesnewdevices,sothatt hesedevicesshouldnotbeaproblematalaterstage.Onth e hostside,thesystemshouldbeuser-friendly,sothatthedevicescanbemonitoredandcontrol ledeasily.Incaseofany problemsinthefuture,theinterfaceofthesystemshould providediagnosticservices.Finally,thesystemshould becost- effectivesothatitcanbewidely used byanyone inthemarket.control panelviatheInternet.

Problem Statement

The primary motive of this project is to build up a system that helps elderly and handicapped people live a more independent life. The objective of this project is to take into consideration all the domestic systems that are difficult to control by elderly people and the handicapped. The project will allow any person who has a Bluetooth enabled Android mobile phone to download an application from the Google Play Store. With the help of this application, a user can control all the appliances in the house via Bluetooth receivers. The proposed system allows the clients to have access to all the appliances in the house including air conditioners, and lights, with a single click on a mobile phone to turn it either ON or OFF.

Themostimportant consideratiointheapplicationisthat ithastobeuserfriendlyandsimpletooperate.By opening the application, the user can also check the status of the appliances to see whether they are ON or OFF. To developauserfriendlyapplication andfulfillalltheobjectivesofthisproject,theGUIofthe applicationhastobethe foremostpriority.Theinterfaceoftheapplicationwillpr ovehoweasytheapplicationistouseaswellasgiveflexi bility to theuser.

Objective ofstudy

The following list of objectives must be fulfilled to successfully help elderly and disabled individuals.

1. Develop Bluetooth appliance controller: The Bluetooth will interface with the microcontroller to perform the desired automation. The microcontroller will get the signals from the Bluetooth enabled mobile phone and it will beprocessed.
2. Develop an application for a mobile phone: An application needs to be developed for the mobile phone, which needs to communicate with the Bluetooth receiver HC05.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

3. Integrate the device to the controller: The foremost priority that has to be kept in mind when developing a Smart Home is that it has to be cost-efficient. The appliance controller has to be inexpensively integrated with the appliances in the house with an easyinstallation.
4. Testthesetup andanalyzethedata:Afterthesystemisset-up,withthehelpofamobiledeviceand a controller, tests are conducted while data is recorded andanalyzed.

Scope Of TheStudy

- In future more, home appliances can be controlled by incorporating those devices with newer versions of Bluetooth module, such as in Elevator, TV remote controls, day today buttons in public areas such as parking lots, pedestrian crossing etc.
- This project work is complete on its own in remotely and automatically switching on and off of any electrical appliance not limited to household appliances. It does not implement control of multiple appliances or automating detection of faults in the controlledappliances.
- In future this Bluetooth technology also can be used in the big industrial companies and the big MNC offices to overcome the situation of the pandemic.

II. CHAPTER 2

2 LITERATURE REVIEW

A Review Of BasicTechnique

Home automation was first introduced into the world market in the 1970s, but it failed to meet the expectations of people and was unsuccessful. There were various reasons associated with the failure of the home automation system. The system was neither user friendly nor cost efficient. Currently, the foremost point to be kept in mind when designing a home automation system is that it should be cost-efficient and easy to install.

K. Y. Lee and J. W. Choi [1], in their research on the Housing Learning and Improvement Network in 2003, defined a Smart Home as a "unit where all the appliances of the house are connected together and controlled and monitored remotely." The following paragraphs will give a summary of the previous research works in the field of Smart Homes.

The motive behind the project was to monitor the health of the disabled and older people living in the home, thereby improving their quality of life. The project used sensors to detect the state of the environment, and with the helpofcontrollers,tookthenecessaryactiontomaintain equilibrium.Thesesensorsformanad-hocnetworktomake thedecisions.

The project made use of cell phones and inexpensive sensors. It worked by making use of wireless protocols such as Bluetooth, ZIGBEE, as well as GSM and analyzing data through an adaptive architecture. The researchhadanarchitecturethatconsistedofthreemain parts.First,sensorscollectedthemedicaldataandtrans mitteditviasensors to mobile devices. Second, an a led J2ME on mobile devices processed thecollecteddata.

The major benefit of this project is that it could be implemented at an inexpensive price in a short span of time.

Recent advance intechnique

In the past few years, significant research has been conducted in the field of Smart Homes to make the technology better for handicapped and elderly people. N. Liang et. al. [5] have described challenges related to Smart Homes and conducted research at the University of Erlangen, Germany, for the betterment of these populations and identified the benefits in-order to help them lead more independent lives.

Fortheimplementationoftheseprojects,ther earevarioussub-networksusedsuchastheBluetoothmodule, Wireless LAN, RFIDs, and TCP/IP. A Bluetooth network transports the sensor data and interconnects the network. As per the location of the occupancy recorded, the RFID system transmits data from the RFID tags. The messages are transmitted via Bluetooth using Bluetooth modules. This reduces the cost, as no further hardware is required for theimplementation.

The project focuses on the design of a home automation system using the Atmega 328 microcontroller.

Theprojectdoes,however,emphasizetheadv antagesofusingawirelessstandard.Toconnecttoawide range of devices, Bluetooth is a global standard and is easily available in almost all devices, for it is easy to set up and use. It also encrypts data using a 128 bit long shared key, making it a secured connectionaswell.

With the advancements in RF Technology, such as Zigbee and Bluetooth, these systems have also become popular in the market. The previous infrared systems had numerous security issues and there were interferences between signals, making it unsecured and less popular in the market. Research

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is still occurring in this field; various systems have been proposed, but very few of them have been implemented in the market.

III. CHAPTER DESCRIPTION OF THE WORK

Introduction

Home automation is to make your home environment more intelligent.

Here we control home appliances Remotely through BluetoothWireless data transfer.

Home Automation, or Smart Home, has benefited from the critical innovations of Bluetooth technology can be used to connect devices such as mobile phones and laptops. Wired devices require a point to point connection but communication can be established between multiple devices with Bluetooth. A group of Bluetooth devices is called a piconet and this technology is apt for building a Smart Home. Figure 3 shows the different appliances of the house (light, fan, etc.) which are controlled via Bluetooth. Bluetooth provides a good platform as it is readily available in almost all the smart phones which are present in the market today and is easy to understand and use. This provides the flexibility to people of all ages to use Bluetooth in a handy manner

Bluetooth is a wireless connection, so the transmsignals between the devices is performed at a frequency of 2.4GHz, which is common throughout the world. Apart from data, Bluetooth also gives the voice recording transmission accessibility on three channels available. The transfer of data takes place at a speed of up to one megabit per second. Bluetooth innovation provides the opportunity to transmit voice recordings, pictures, music and text messages between devices.

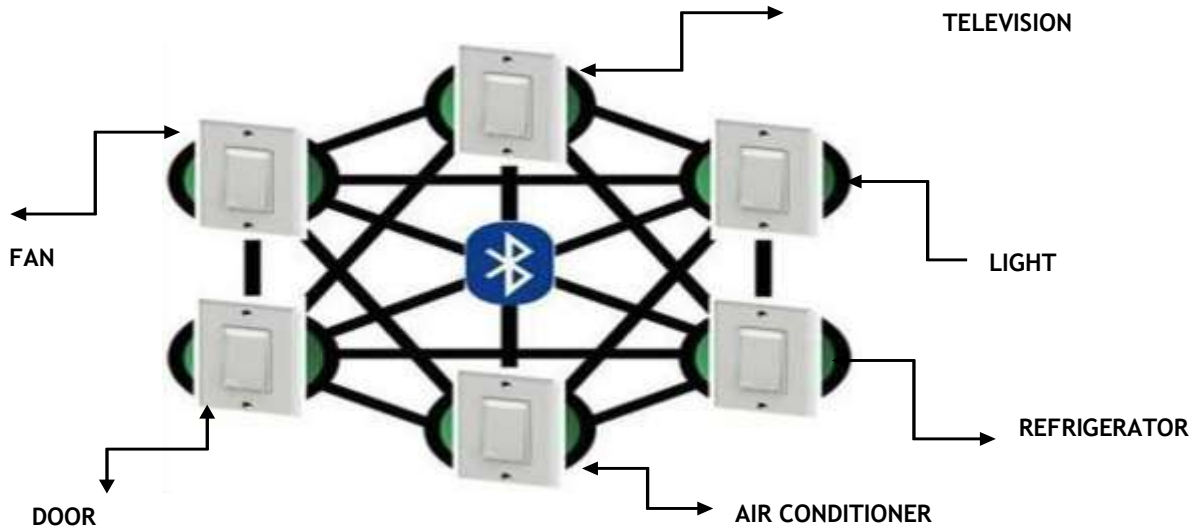


Figure 2: Bluetooth For HomeAutomation.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

Arduino

Arduino is an open source physical processing hardware, which is based on a microcontroller board andanincorporateddevelopmentenvironmentfortheboardtobeprogrammed.Arduinoissimpleandcanbeeasilylearned by beginners. Arduino can run on any platform that includes Windows, Linux Operating System, and Macintosh, unlike other microcontrollers, which run only in the Windows operatingsystem.

The Arduino can be used to develop an interactive interface, get inputs from a diverse collection of switches as well as sensors, and simultaneously control the output from various physical devices including lights and other appliances. Arduino is focused on an environment, which needs to be programmed with a language that is executed via wiring: a physical computing platform. Figure 2 shows the symbol of the Arduino Uno, which is considered for this project.

Figure 3. Arduino Logo[7].

Reasons for Choosing Arduino

TherearevarioussuccessfulmicrocontrollersincludingMIT"sHandyboard,Phidgets, andNetmedia"sBX-24 but the Arduino offers numerous advantages for individuals, including

Advantages Of The Arduino UNO

1. Less expensive: Arduino boards are inexpensive compared to other microcontrollers that areavailable in the market. A preassembled Arduino board is available for as low as$50.
2. Compatible: Arduino is compatible with all the operating systems including Linux, Macintosh, and Windows, whereas other microcontrollers are restricted toWindows.
3. Easy to program: The environment used to program Arduino and the ways to perform the coding areuser friendly even forbeginners.
4. Expandable programming and open source: The programming language of an Arduino is an opensource and can incorporate the Arduino code into the AVR-C code ifneeded.
5. Allows easy and fast prototyping: There are a number of pre-wiring and free code libraries, which help to test an idea instead of spending time in building and creating an excessive amount of lowlevelcodes.

Block Diagram and itsDescription

BLOCK DIAGRAM

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

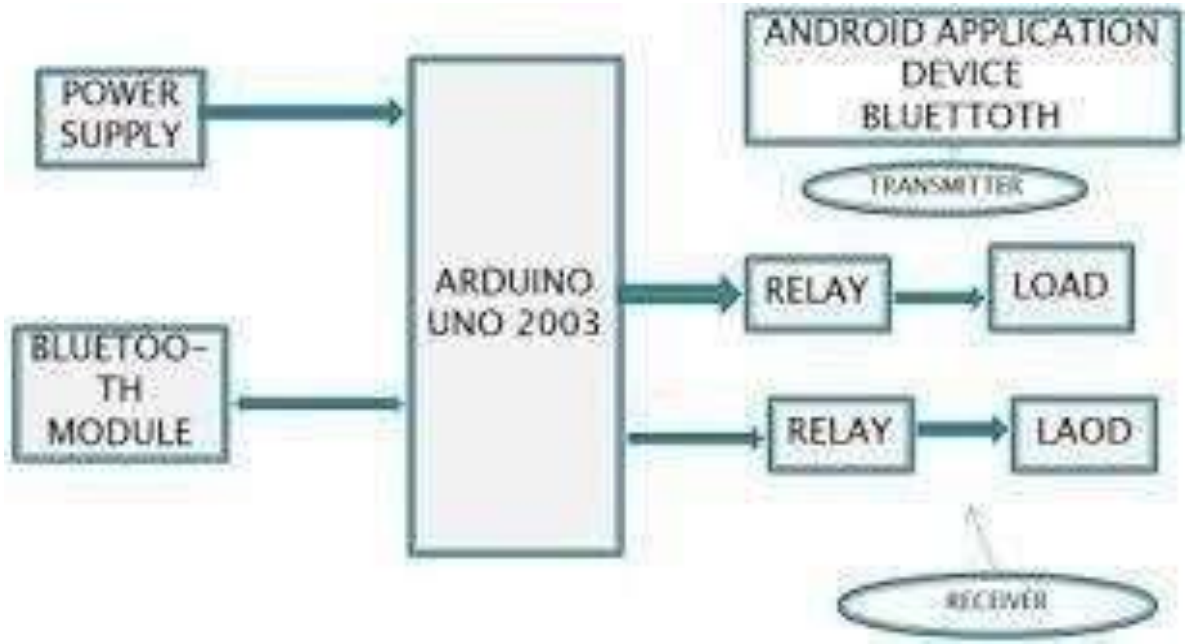


Fig 4: Block Diagram Of Home Automation System Using Arduino And Bluetooth Module

Description

InthisprojectweusedBluetoothmodu leHC-05whichneedsonly3.3vtowork.Bluetooth module send the signal to the Arduino uno 2003. And Arduino uno 2003 sends the signal to the relay module. and it gives to theload.

Circuit Diagram And ItsDescription

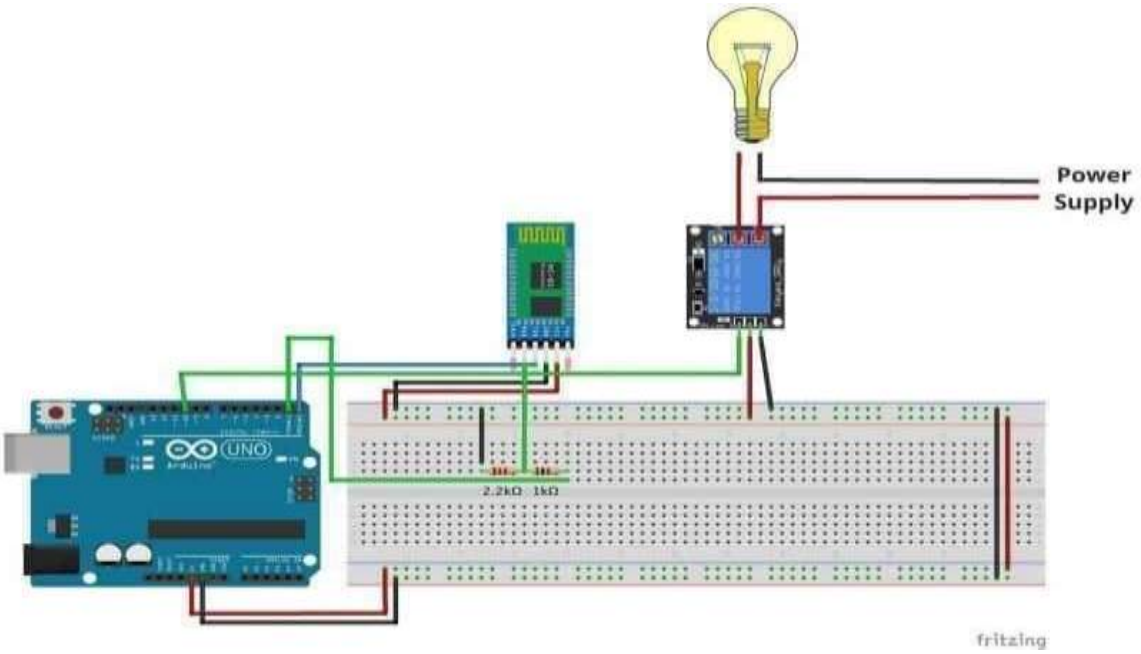


Figure 5 Circuit Diagram For Home Automation

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

Working principle

Based on the Bluetooth module , we can control home appliances within the range of Bluetooth .

We can control our home appliances by using Bluetooth .

HereweusedHC-05Bluetoothmoduletoconvertmyelectricalsignaltoinformationsignal.The Arduino uno takes the signal from Bluetooth module and converts in to output. The relay module takes the signal and gives to the appliances.

ComponentUsed

1. HardwareComponent

The list of components mentioned here is specifically for controlling 4 different loads.

- ArduinoUNO
- HC — 05 BluetoothModule
- 5 V Relay X2
- Breadboard
- Connectingwires
- Bluetooth enabled smartphone ortablet
- 5V PowerSource

2. SoftwareComponents

- Arduino 1.8.5compiler
- Androidapplication

Hardware Components

1. ARDUINOUNO

Arduino is an opensource computer hardware and software company, project, and user community that designs and manufacturessingle-board microcontrollersandmicrocontrollerkitsforbuildingdigitaldevicesandinteractiveobjectsthatcansense andcontrolobjectsinthephysicalanddigitalworld.The project'sproductsaredistributedasopen-sourcehardwareandsoftware,whicharelicensedunder theGNULesserGeneral PublicLicense (LGPL)orthe GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY)kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards(shields)andothercircuits.Theboardsfeatureserialcommunicationsinterfaces,including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino projectprovidesanintegrateddevelopmentenvironment(IDE)basedontheProcessinglanguageproject.

Features of the Arduino UNO:

- Microcontroller:ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V Input Voltage (limits):6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output) Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA DC Current for 3.3V Pin: 50mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader SRAM: 2 KB(ATmega328)
- EEPROM: 1 KB(ATmega328)
- Clock Speed: 16MHz

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

2. Bluetooth ModuleHc-05

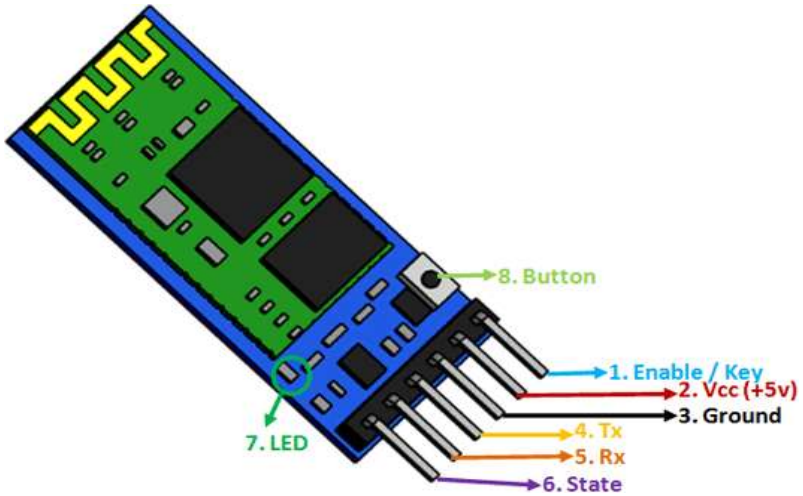


Fig 7 : Bluetooth module HC- 05

TABLE 1. Pin Description Of Bluetooth Module

Pin Number	Pin Name	Description
1	Enable / Key	This pin is used to toggle between Data Mode (set low) and AT command mode (set high). By default it is in Data mode
2	Vcc	Powers the module. Connect to +5V Supply voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX – Transmitter	Transmits Serial Data. Everything received via Bluetooth will be given out by this pin as serial data.
5	RX –Receiver	Receive Serial Data. Every serial data given to this pin will be broadcasted via Bluetooth
6	State	The state pin is connected to on board LED, it can be used as a feedback to check if Bluetooth is working properly.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

7	LED	Indicates the status of Module Blink once in 2 sec: Module has entered Command Mode Repeated Blinking: Waiting for connection in Data Mode Blink twice in 1 sec: Connection successful in Data Mode
8	Button	Used to control the Key/Enable pin to toggle between Data and command Mode

HC-05 Default Settings:-
Default Bluetooth Name: ‚HC-05' Default Password: 1234 or 0000 Default Communication: Slave Default Mode: Data Mode
Data Mode Baud Rate: 9600, 8, N, 1
Command Mode Baud Rate: 38400, 8, N, 1 Default firmware: LINVOR

HC-05 Specification:
- **Bluetooth Protocal:** BluetoothSpecification
- **Modulation:** GFSK(Gaussian Frequency Shift Keying)
- **Emission Power:** ≤4dbm, Class2
- **Sensitivity :**≤-84dbm At 0.1%BER
- **Speed:** Asynchronous: 2.1Mbps(Max) / 160 Kbps, Synchronous:1Mbps/1Mbps
- **Security:** Authentication AndEncryption
- **Profiles:** Bluetooth Serial Port Power**Supply:** +3.3VDC 50ma
- **Working Temperature:** -20~ +75Centigrade
- **Dimension:** 26.9mm X 13m
- **V2.0+EDR Frequency:** 2.4ghz ISM Band

2CHANNEL RELAYMODULE
Wecancontrolhighvoltageelectronicdevicesusingrelays. ARelayisactuallyaswitchwhich is electrically operatedbyanelectromagnet.
Theelectromagnetisactivatedwithalowvoltage, forexample 5voltsfromamicrocontrolleranditpullsa contacttomakeorbreakahighvoltage circuit.
This is a 2 channel isolated 5V 10A relay module Optocoupler for Arduino PIC. ARM. It can be used to control various appliences and other types of equipment witha large current.
It can be controlled directly with 3.3V or 5V logic signal from microcontroller (Arduino , 8051 , AVR , PIC , DSP , ARM , MSP430,TTL logic).

Fig 8: 2 Channel Relay

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

Features

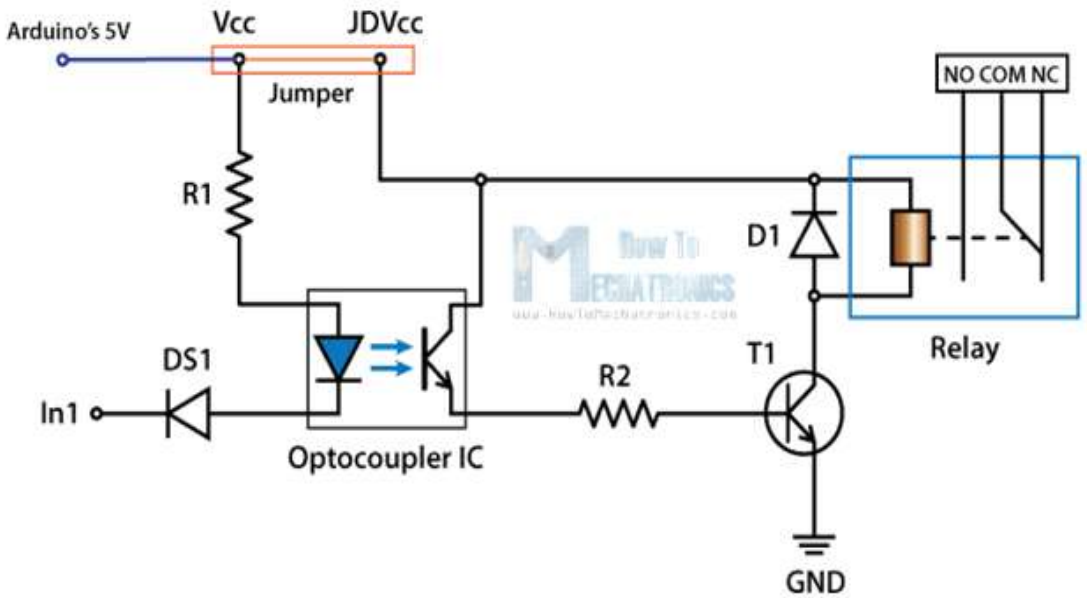
- Good for safe control of higher amperage circuits. ...
- 2-channel high voltage system output, meeting the needs of dual channelcontrol.
- Brand new and highquality.
- Standard interface that can be controlled directly by microcontroller (Arduino , 8051, AVR, PIC,DSP, ARM)]

Application Of Relay

- Relaysareusedwhereveritisnecessarytocontrola highpowerorhighvoltagecircuitwithalow powercircuit,especiallywhengalvanicisolationis desirable.
- Thefirstapplicationofrelayswasinlongtelegraphl ines,wheretheweaksignalreceivedatan intermediatestationcouldcontrolacontact,regene ratingthesignalforfurthertransmission.
- High-voltageorhigh-currentdevicescanbecontrolledwithsmall,lowvo ltagewiringandpilots switches.
- Operators can be isolated from the highvoltagecircuit.
- Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts intheignitionkey.
- Theuseof relaysforthelogicalcontrolofcomplexswitchin gsystemsliketelephoneexchanges wasstudiedbyClaudeShannon,whoformalize dtheapplicationofBooleanalgebratorelay circuitdesigninASymbolicAnalysisofRelaya ndSwitchingCircuits.
- Relays can perform the basic operations of Boolean combinatorial logic. For example, the booleanANDfunctionisrealisedbyconnectingn ormallyopenrelaycontactsinseries,theOR functionbyconnecting

CIRCUITDIGRAM

Forbetterunderstandinglet'sseethecircuitschematics of therelaymoduleinthisconfiguration.Sowe canseethatthe5voltsfromourmicrocontrollerconnect edtotheVccpinforactivatingtherelaythrough theOptocouplerICarealsoconnectedtotheJDVccpin whichpowerstheelectromagnetoftherelay.So inthiscasewegotnoisolationbetweentherelayandthe microcontroller.

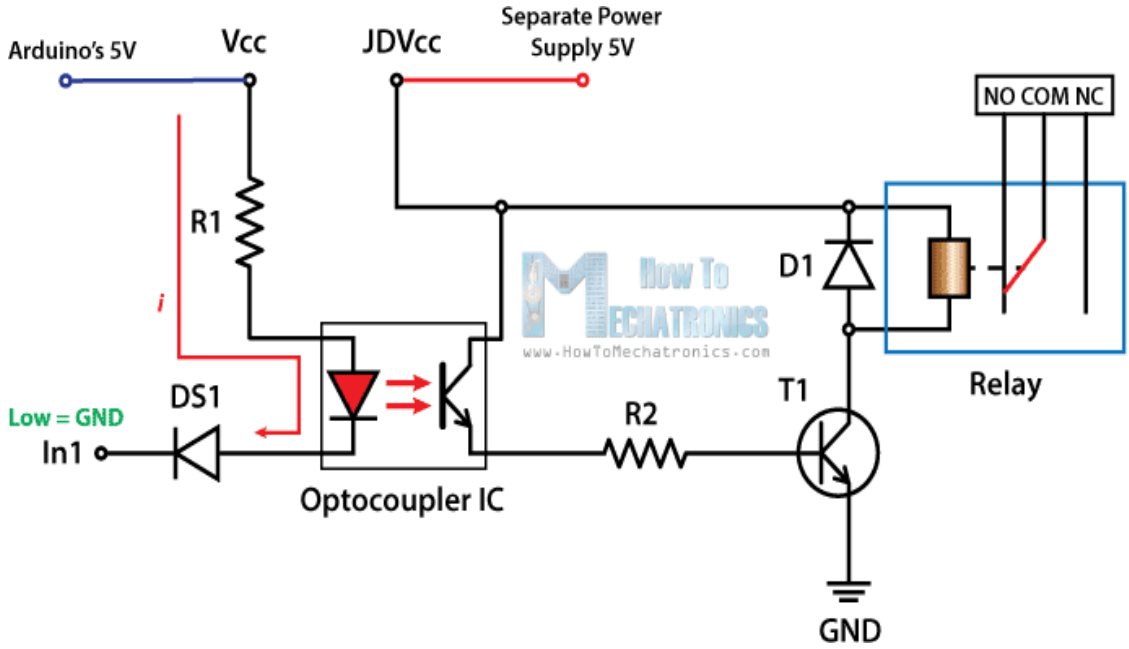


Inordertoisolatethemicrocontrollerfromtherelay,we needtoremovethejumperandconnectseparate powersupplyfortheelectromagnettotheVccandtheGr oundpin.Now withthisconfigurationthemicrocontrollerdoesn'thav eanyphysicalconnectionwiththerelay,itjustuses theLEDlightoftheOptocouplerICtoactivatetherelay.

There is one more thing to be noticed from this circuit schematics. The input pins of the module work inversely. As we can see the relay will be activated when the input pin willbeLOWbecauseinthatwaythecurrentwillbeablet

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

oflowfromtheVCCtotheinputpinwhichis low or ground, and the LED will light up and active the relay. When the input pin will be HIGH there willbenocurrentflow,sotheLEDwillnotlightupandth erelaywillnotbeactivated.

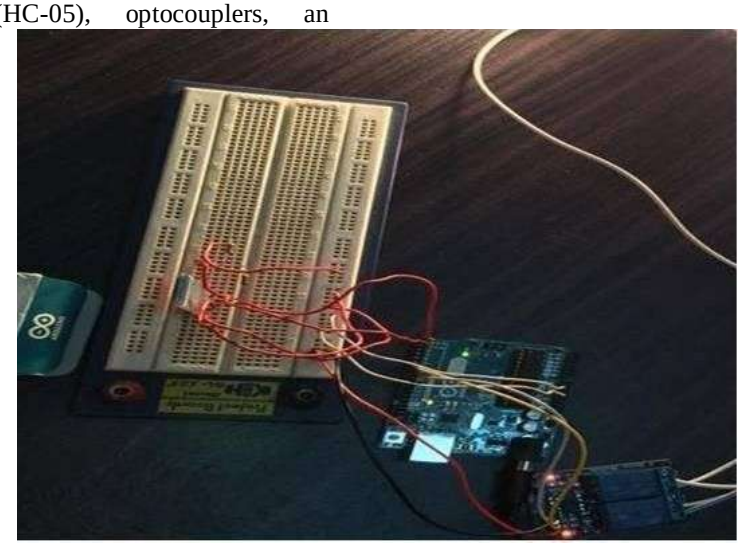


IV. CHAPTER

Implementation of theHardware

This section describes the overall hardware needed to design this project. The system is designed using the Arduino Uno Board, the Bluetooth module(HC-05), optocouplers, an Android mobile phone, and an Android applicationtocontroltheArduinoboardasshowninfigu re6.Italsousesvariouselectroniccomponentsinvolved .

figure 9. hardware implementation. Arduino uno



ArduinoUnoisamicrocontrollerboardbased ontheAtmega328.Ithasaceramicresonatorthatis16M Hz, fourteen digital input/output pins (six of which can be used as PWM outputs), a reset button, a USB connection, a powerjackandsixanaloginputs.It isan8-bitmicrocontrollerbased onRISCarchitecture.TheArduinoUnoboardis shown in figure 8 with the partslabeled.

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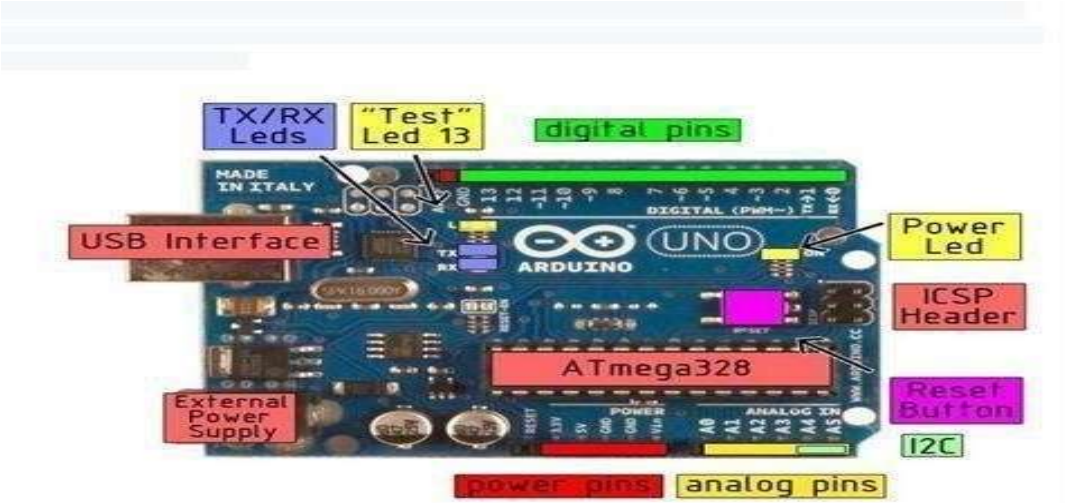

Figure 10. Arduino UNO[8].

TABLE 1. Specifications of Arduino Uno

Microcontroller	Atmega 328
Operating Voltage	5V
Input Voltage(Recommended)	7-12V
Input Voltage Limitation	6-12V
Digital Input/Output Pins	14
Analog Input Pins	6
Clock Speed	16MHz
EEPROM	1KB

ARDUINO SOFTWAREPART:-

IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java.

It originated from the IDE for the languages Processing and Wiring.

The Arduino IDE supports the languages C and C++ using special rules of code structuring.

The Arduino IDE supplies a software library from the Wiring project, which provides many common inputandoutputprocedures.User-writtencodeonlyrequirestwobasicfunctions,forstartingthesketch andthemainprogramloop,thatarecompiledandlinked withaprogramstubmain()intoanexecutable cyclicexecutiveprogramwiththeGNUtoolchain,alsoincludedwiththeIDEdistribution.

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Figure 11. Arduino Software (IDE)

Minimal Arduino C/C++ program consist of only two functions:

SETUP(): Thisfunctioniscalledoncewhenasketchstartsafterpower-uporreset.Itisusedtoinitialize variables,inputandoutputpinmodes,andotherlibrariesneededinthesketch.

LOOP(): After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

Blink example

Most Arduino boards contain a light-emitting diode (LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions. A typical program for a beginning Arduino programmer blinks a LED repeatedly. This program uses the functionspinMode(),digitalWrite(),anddelay(),whichareprovidedbythe internallibrariesincludedin the IDEenvironment.

Thisprogramisusuallyloadedintoanew Arduino boardbythe manufacturer.

Android application and Mobile Phone

The Android mobile phone used for this Project is Google Nexus 5 with an installed application called LMBT. TheLMBTapplicationisasimpleapplicationonAndroidandisusedtocontrolthepinsoftheArduino-UnofromanAndroidphoneinawirelessmanner.AsimpleAndroiduserinterfaceisemployedbyLMBTtocontrol digital pins of Arduino Uno and PWM pins, to send commands to Arduino Uno in the form of text and reception of data over a Bluetooth serial module from Arduino.

Programming the Arduino Uno

TheArduino-Unoboardneedstobeprogrammedwithacodesothatitisabletointeractwiththeapplication.Arduino provides a flexible platform, which helps to write a code for any function to be performed by the Arduino Uno and upload to theboard.

InterfacingtheAtmega328withElectrically ErasableProgrammableReadOnlyMemory(EEPROM)isdoneusing the Universal Synchronous Asynchronous Receiver Transmitter (USART)protocol.

The code is written in Embedded C using Atmel studio 6.0. The code is then compiled and converted to HEX code. Afterwards, the HEX code is then burned to the Atmega 328 microcontroller.

Integrating the Bluetooth Module to Arduino Uno

For the Arduino Uno to be controlled, a connection is required between the Bluetooth module and the Arduino Uno.

TheVCCportontheArduinoUnoboardisconnectedtotheVCCpinontheBluetoothmodule(HC-05).The GNDportontheArduinoUnoisconnectedtotheGNDpinontheBluetoothmodule(HC-05).Finallythetransmitter

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oftheBluetoothmoduleisconnectedtothereceiverofth eArduinoUnoaswellasthetransmitteroftheArduinoU no tothereceiveroftheBluetoothmoduleneedtobeconnec ted.Table2showstheconnectionbetweentheArduino Uno and the Bluetoothmodule.

TABLE 2. Connection Between Arduino Uno and the Bluetooth Module

Arduino Uno Board	Bluetooth Module
GND port	GND pin
VCC port	VCC pin
Transmitter Pin	Receiver Port
Receiver Pin	Transmitter Port

The connection between the Arduino Uno and the Bluetooth module is the fundamental connection in the circuit.

Connection Between the Bluetooth Module and ArduinoUno

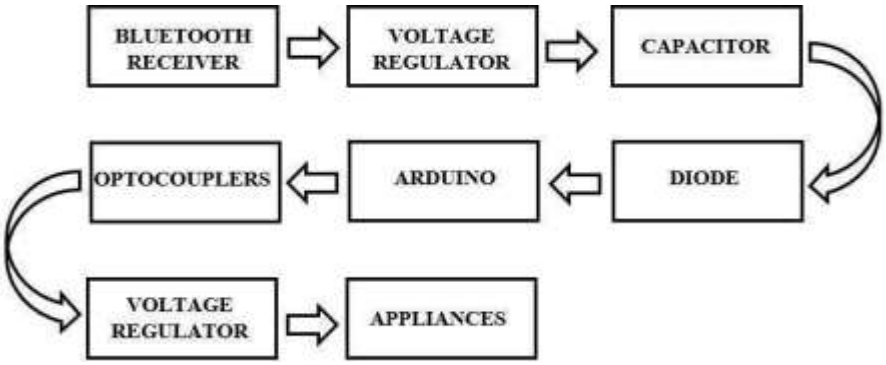

Figure 12. Connection between the Bluetooth module and the Arduino Uno.

The Bluetooth receiver transfers the signal to the voltage regulator, which then regulates the voltage and forwardsittothecapacitor.Twocapacitorsareusedinth iscircuit.Onecapacitorisof1000microfaradforapplia nces, thatrequires highpowertooperateandtheotherisof 10microfarad, whichrequireslowpowertooperate.Thesignal fromthecapacitorgoestothediodethatrestrictstheflow ofcurrenttoonesideandallowsthecurrenttoflowonlyi n a single direction. The Arduino board then receives the signal from the diode, which goes to the optocouplers. Afterwards, the optocoupler is connected to the voltage regulator before being connected to the appliances. This connection is due to the optocoupler having a maximum power of 9000 watts, which if directly connected to the appliancesmaycausedamage.Theoptocouplerisconn ectedtoavoltageregulatorthatregulatesthevoltageand drives theappliances.

Communication Between Android Phone and the Appliances

The application on a mobile phone is coded with an integer value of 49, 50, 51, 52, 53, 54, 55, and 56. Afteropeningtheapplication,1and49arepressedand convertedtothebinaryvalueaswellassenttothereceive r of the Bluetooth module (HC-05) via the Bluetooth on a cell phone. The binary value from the Bluetooth module goestotheArduino.Arduinochecksinitsdatabasethee quivalentofthebinarycode.IfitisHIGH,thelightshoul d be turned ON and if it is LOW, the light should

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be turnedOFF.
The block diagram in Figure 11 explains the steps needed to establish the connection.

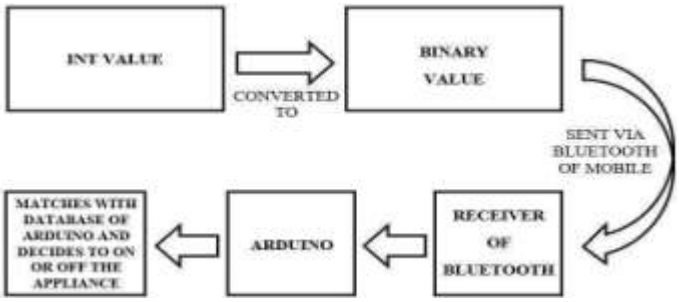

Figure 13. Communication between Android Phone and the Appliances How to Test the Connection

After the application is installed on the mobile phone and the Bluetooth module is connected to theArduino Uno,the connectionis tobetestedtomakesurethatthe phoneisinteracting withtheArduino Uno via the Bluetooth module(HC-05).
The steps to test the connection are as follows:

1. Open the application installed on the mobilephone.
2. With the help of the application, search for the Bluetoothdevices.
3. Connect to the Bluetooth module(HC-05).
4. If the blinking of the light stops in the Bluetooth module, then it is working correctly, and the connection is established. If the light continues to blink, the connection needs to bechecked.

Connecting the Appliance to the Arduino Board
After all the connections are done, the home appliances should be connected to the Arduino.
The positive end of the home appliance has to be connected to the anode port of the optocoupler and negative end of the appliance has to be connected to the power source using wires.
Using different optocouplers and Arduino ports, the connections is made for other appliances. Finally, with the help of a Bluetooth connected Android phone, all of the appliances in the house are controlled wirelessly.

Figure 14 shows the prototype of the system.

Limitations and Problems Encountered
This project encountered certain difficulties that are describedbelow.
Initially, when all the connections were done, the major problem was the connection between the BluetoothmoduleandtheArduinoUno.It wasrepeatedlyunsuccessfulbecausetheZGBEEmodulewasusedin the project. When the ZGBEE module was replaced with the HC- 05, the connection was only established after reading about the specifications of the ZGBEE module and the HC-05online.

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Volume 3, Issue 7 July 2021, pp: 1295-1312 www.ijaem.net ISSN: 2395-5252

A second problem was also encountered with the use of the fixing of the optocouplers on the board.

V. CHPTER

ADVANTAGE AND APPLICATION

ADVANTAGE

Energy-saving

Homeautomationmanagescontrolelementsthatcontributetosavingwater,electricity,andgas.Thatis,wecanprogramallthedevicestoturnonoroffatthenecessarytime.Homeautomationcontroloflightingandairconditioningcontrols the management of 70% of energy consumption. **Most air conditioners suffer from the same issues**causing them to use up additional units. The automation can keep that incheck.

It is possible to guarantee that all the lights in the house are turned off and that the reference temperature of the air conditioningisinsavingmodewhennobodyisinthehouse.Whengoingtosleep,lightsandblindsareswitchedoffand the reference temperature is changed for the night. Detecting the presence or not in each area of the home can activate other savings policies. This produces effects in the domestic economy and contributes to beingmoreecological.

Security

Another of its important advantages is being able to detect fires, intruders, gas leaks or a water leak. You can see everything that happens from anywhere through cameras and simulate presence by turning lights on and off remotely.

Communication

It is essential nowadays to establish correct communication between people and housing. New technologies and the Internetareanaturalpartofhomeautomationandbecomeintuitive andpracticaltools.Eventherecognitionofvoiceor bodymovementscanbecomeachannelofcommunicationwithourhome.Withalltheseelements,thehousecaninteract with people through the home automation elements of the installation, text messages, emails, andvoicecalls.

Comfort

The tasks to be carried out in our homes are much easier, and you can do many actions comfortably from a screen.

Wellness

Throughhomeautomation,wecanautomaticallyclosetheblinds,detectingtheamountofsunlightthatenterstherooms or the wind that causes it; control the degree of light in the different rooms, and be able to direct the different environments of thehome.

Telecare

The system consists of a set of sensors that monitors the user's life habits, such as the time spent in bed, bath, taking medications. The parameters obtained by these sensors configure a profile that is stored on a central server supervised by healthcare professionals 24 hours a day.

Disadvantages Of Homeautomation:

Initial cost

The price of the home automation installation is still very high. The initial investment that must be made is very important since the entire home must be wired.

Maintenance

In the event of some type of breakdown, its repair can be complex and expensive. In addition to this, it ispossiblethatanimportantpartofthesystemwillbeblockedandmorefunctionswillbecanceled.Therefore,the costofany type of breakdown can be veryhigh.

Data transmission speed

Dependingonthenumberofsystemsthatareconnected,whentransferringalargeamountofdata,thenetworkcan become congested and decrease the transmission speed, causing the functions to slowdown.

Ring connection

When the information is connected in the form of a ring, there may be some delay that will also depend on the number of points that are connected to the network, which gives little reliability to the system.

APPLICATION

- Usingthisproject,wecanturnonoroffappliances remotelyi.e.usingaphoneortablet.

- The project can be further expanded to a smart home automation system by including some sensors like light sensors, temperature sensors, safety sensors etc. and automatically adjust differentparameterslikeroomlighting,airconditioning(roomtemperature),doorlocksetc. and transmit the information to ourphone.
- Additionally, we can connect to internet and control the home from remote location over internet and also monitor thesafety.

FUTURE WORKS

Thoughoverallthe projectiscompletedsuccessfully,furtherstudycouldbeconductedtoconsiderincreasingtherangeofthesignaltodiscoveramethodtoamplifyitsrangefrom the Bluetooth module. Furthermore, rather than using optocouplers and connecting them to the breadboard, further study could consider the use of a relay module to connect the modules.

VI. RESULT

Withtheproceduresmentioned,theimplementationoftheproject"HomeAutomation via Bluetooth using the Arduino Uno Microcontroller" is successfully completed and implemented.Theprojectiscostefficientanduserfriendlybecauseitcanbeusedbyanyone withasimpleclickonanAndroidbasedmobiledevice.Alltheusedbyanyonewithasimple click on an Android based mobile device. All the appliances of the house are controlled successfully via Bluetooth using an Android mobilephone.

VII. CONCLUSION

The current project presented the implementation of an inexpensive home automation system, within the framework of assistive technology. The system implementation is based on the Arduino microcontroller, which has been programmed to control a range of home automationdevicesbasedonsensorsignalsandondirectcommandsbytheuser.Thesystem has been programmed to have Bluetooth communication capability. Demonstrations of the systemshowthatitfacilitatesthecontrolofhome-baseddevicessuchaselectricalappliances, lights, heating, cooling systems and security devices by the intended users, i.e., the elderly and thedisabled.

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