A MINOR-PROJECT REPORT

ON

"HOME AUTOMATION SYSTEM"

Submitted to

KIIT, Deemed To be University

In Partial Fulfillment of the Requirement for the Award of

BACHELOR'S DEGREE IN

COMPUTER ENGINEERING

BY

YASH PODDAR, 1505088

MOHIT RAJ, 1505119

SIDDHARTH ANAND, 1505125

PIYUSH RANJAN MAJHI, 1505127

UNDER THE GUIDANCE OF

PROF. MR. PINAKI SANKAR CHATTERJEE

SCHOOL OF COMPUTER ENGINEERING

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY, Deemed To be University

BHUBANESWAR, ODISHA – 751024

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School of Computer Engineering Bhubaneswar,

ODISHA 751024

CERTIFICATE

This is certify that the project entitled

“HOME AUTOMATION SYSTEM “

Submitted by

YASH PODDAR, 1505088

MOHIT RAJ, 1505119

SIDDHARTH ANAND, 1505125

PIYUSH RANJAN MAJHI, 1505127

This is a record of bona fide work carried out by them, in the partial fulfillment of the requirement for the award of Degree of Bachelor of Engineering (Computer Science) at KIIT**,** Deemed To be University**,** Bhubaneswar. This work is done during year 2018-2019, under my guidance.

Date: / /

(PROF. MR. PINAKI SANKAR CHATTERJEE)

Project Guide

Acknowledgements

We are profoundly grateful to Dr. Pinaki Sankar Chatterjee for his expert guidance and continuous encouragement throughout to see that this project rights its target since its commencement to its completion.

YASH PODDAR, 1505088

MOHIT RAJ, 1505119

SIDDHARTH ANAND, 1505125

PIYUSH RANJAN MAJHI, 1505127

ABSTRACT

The past decade has seen significant advancement in the field of consumer electronics. Various “intelligent” appliances such as cellular phone, air conditioners, home security devices, home theaters, etc., are set to realize the concept of a smart home. They have given rise to a Personal Area Network in home environment, where all these appliances can be interconnected and monitored using a single controller.

Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronic systems in a building. These include lighting, temperature control, etc.

This project demonstrates a simple home automation system which contains a remote mobile host controller and several client modules (home appliances). The client modules communicate with the host controller through a wireless device such as a Bluetooth enabled mobile phone, in this case, an android based Smart phone.

Contents

Chapter 1: Introduction

Although home automation today is not a new thing but most advanced home automation systems in existence today require a big and expensive change of infrastructure. This means that it often is not feasible to install a home automation system in an existing building.

1.1 PROBLEM

The original problem is to design and implement a ubiquitous computing project into a home environment: - **HOME AUTOMATION SYSTEM.**

Most advanced home automation systems in existence today require a big and expensive change of infrastructure. This means that it often is not feasible to install a home automation system in an existing building. Home Automation lets the user to control their home from their computing device, but it needs to be economically feasible too. It is containing the design process of the project, starting with brainstorming we had to get the final product idea and finishing with the prototyping within home alike environment.

1.2 ABOUT PROJECT

Home automation systems, or smart home technologies, are systems and devices that can control elements of your home environment- lighting, appliances, telephones, home security and mechanical, entry and safety systems. Home automation systems can be operated by electricity or a computer chip using a range of different types of switches. A simple device, such as a light can be activated by a signal from a mobile Bluetooth environment, or can be part of a computerized home automation system. As a very basic definition, we tend to refer to home automation as anything that gives you remote or automatic control of things around the home.

1.3 AIM

This project presents the overall design of Home Automation System (HAS) with low cost and wireless system. This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Also, the smart home concept in the system improves the standard living at home.

1.4 SCOPE

WHAT CAN HOME AUTOMATION DO?

Home automation can:

#Increase your independence and give you greater control of your home environment.

#Make it easier to communicate with your family.

#save you time and effort.

#Improve your personal safety.

#Reduce your heating and cooling costs.

#Increase your home's energy efficiency.

#Alert you audibly and visually to emergency situations.

#Allow you to monitor your home while you are away.

THE PRIMARY ELEMENTS OF A HOME AUTOMATION SYSTEM:-

1. The operating system (for example, a computer, micro controller).

2. The device being operated (for example, a light or furnace)

3. The interface, or link, between the user and the device. An interface can be a button, a keypad, a motion sensor and soon.

Chapter 2: REVIEW OF LITERATURE AND EARLIER WORKS

The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first Internet-connected appliance, able to report its inventory and whether newly loaded drinks were cold. Mark Weiser's seminal 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as UbiComp and PerCom produced the contemporary vision of **IOT**. In 1994 Reza Raji described the concept in IEEE Spectrum as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories". Between 1993 and 1996 several companies proposed solutions like Microsoft's at Work or Novell's NEST. However, only in 1999 did the field start gathering momentum. Bill Joy envisioned Device to Device (D2D) communication as part of his "SixWebs" framework, presented at the World Economic Forum at Davos in 1999.

The concept of the Internet of things became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications. Radio-frequency identification (RFID) was seen by Kevin Ashton (one of the founders of the original Auto-ID Center) as a prerequisite for the Internet of things at that point. Ashton prefers the phrase "Internet for things." If all objects and people in daily life were equipped with identifiers, computers could manage and store them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

IEEE 802.15 is a working group of the Institute of Electrical and Electronics Engineers (IEEE). IEEE 802 standards committee which specifies wireless personal area network (WPAN) standards. There are 10 major areas of development, not all of which are active. The number of Task Groups in IEEE 802.15 varies based on the number of active projects. The current list of active projects can be found on the IEEE 802.15 web site.

Early home automation began with labor-saving machines. Self-contained electric or gas powered home appliances became viable in the 1900s with the introduction of electric power distribution and led to the introduction of washing machines (1904), water heaters (1889), refrigerators, and sewing machines, dishwashers, and clothes dryers.

In 1975, the first general purpose home automation network technology, X10, was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signaling and control, where the signals involve brief radio frequency bursts of digital data, and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.

Chapter 3: Report on the present investigation

3.1 Components Used

Following components are used in this project:

1. Smart phone

2. Bluetooth Module (HC05)

3. Computer

4. Capacitors

5. Microcontroller (ATMEGA16)

6. LED’s

7. Adaptor (12V)

8. Resistor’s

9. NPN Transistors (for switching)

10. 7805 Voltage Regulator

11. Bread Board

12. Connecting Wires

3.2 MAIN COMPONENT: Microcontroller (ATMEGA16)

3.2.1 Features

• High-performance, Low-power AVR® 8-bit Microcontroller
• Advanced RISC Architecture

– 131 Powerful Instructions – Most Single-clock Cycle Execution

– 32 x 8 General Purpose Working Registers

– Fully Static Operation

– Up to 16 MIPS Throughput at 16 MHz

– On-chip 2-cycle Multiplier

- Nonvolatile Program and Data Memories
  - 16K Bytes of In-System Self-Programmable
    Flash Endurance: 10,000 Write/Erase Cycles
  - Optional Boot Code Section with Independent Lock Bits In-System
    Programming by on-chip Boot Program True Read-While-Write
    Operation
  - 512 Bytes EEPROM
  - 1K Byte Internal SRAM
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities according to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescalers, Compare Mode, and
    Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC

    7 Differential Channels in TQFP Package Only

    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator

- Special Microcontroller Features
  - – Power-on Reset and Programmable Brown-out Detection
  - – Internal Calibrated RC Oscillator
  - – External and Internal Interrupt Sources
  - – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - – 32 Programmable I/O Lines
  - – 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF
- Operating Voltages
  - – 2.7 - 5.5V for ATmega16L
  - – 4.5 - 5.5V for ATmega16
- Speed Grades
  - – 0 - 8 MHz for ATmega16L
  - – 0 - 16 MHz for ATmega16
- Power Consumption @ 1 MHz, 3V, and 25 C for ATmega16L
  - – Active: 1.1 mA
  - – Idle Mode: 0.35 mA
  - – Power-down Mode: < 1 µA

3.2.2 DESCRIPTION

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

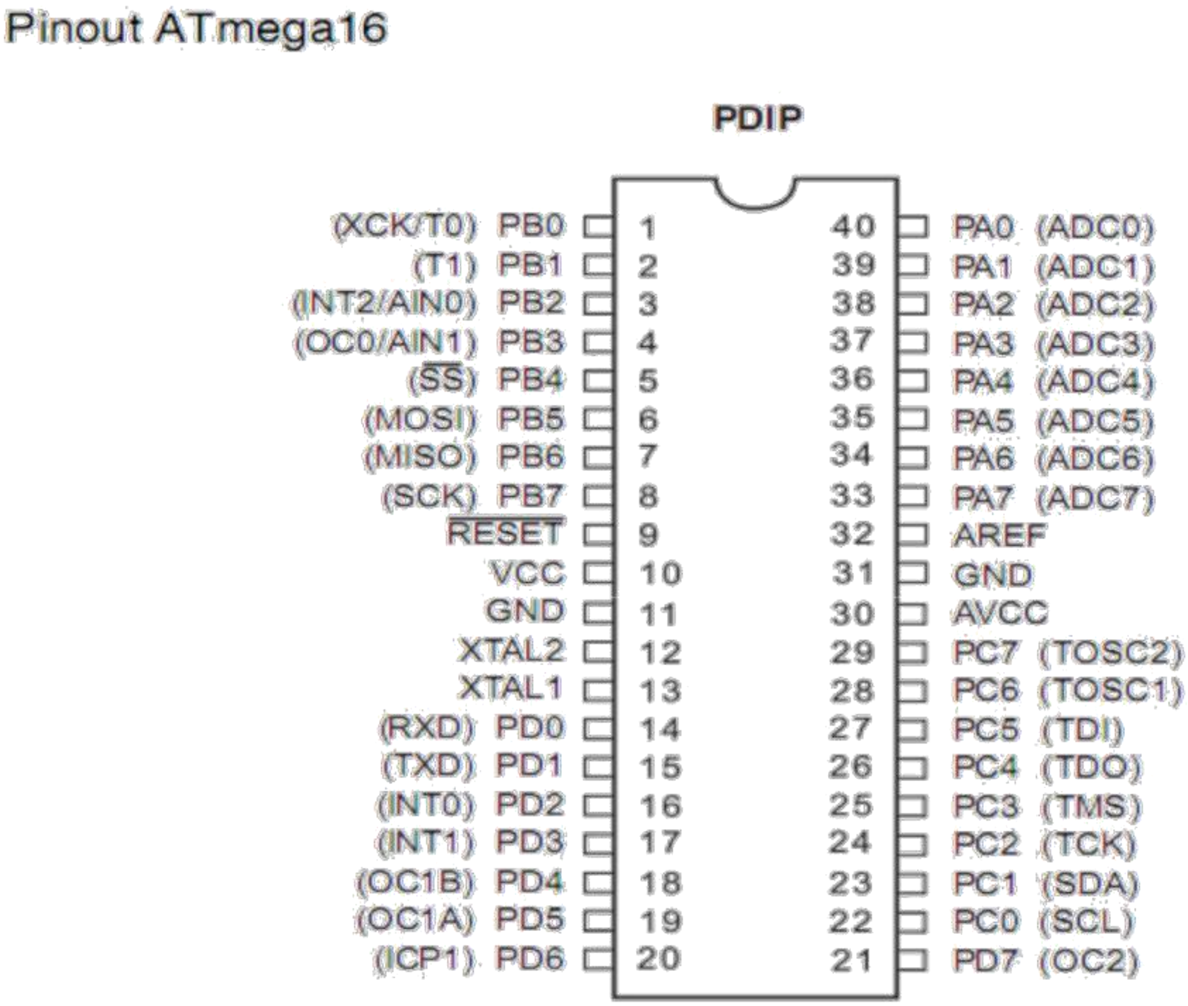
The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega16 provides the following features: 16K bytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1K byte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM; Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register con- tents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel’s high density nonvolatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Soft- ware in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

3.2.3 PIN DIAGRAM



3.2.4 PIN DESCRIPTION

VCC Digital supply voltage.

GND Ground.

Port A (PA7...PA0) Port A serves as the analog inputs to the A/D Converter.
Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up

resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B (PB7...PB0)	Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.
Port C (PC7...PC0)	Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5 (TDI), PC3 (TMS) and PC2 (TCK) will be activated even if a reset occurs.
Port D (PD7...PD0)	Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

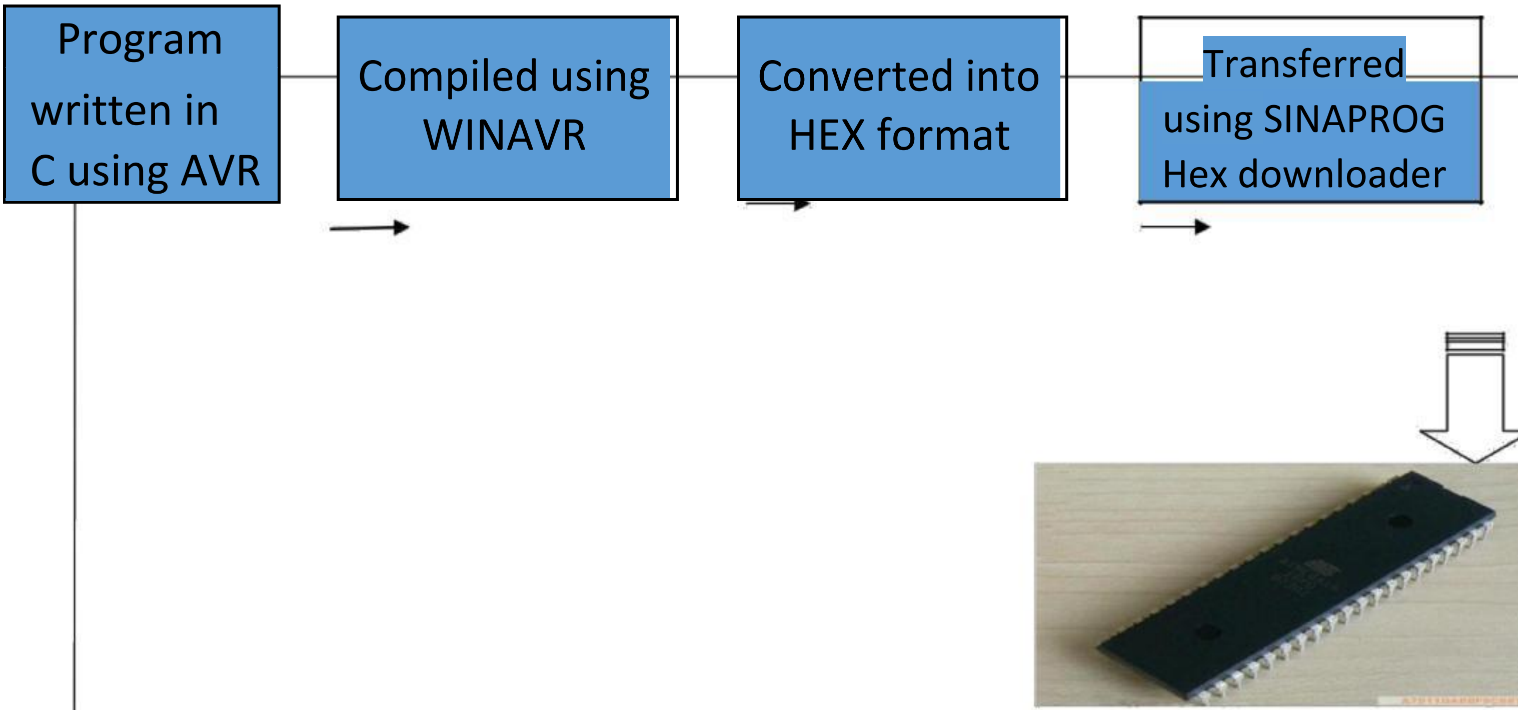
RESET	Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.
XTAL1	Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.
XTAL2	Output from the inverting Oscillator amplifier.
AVCC	AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.
AREF	AREF is the analog reference pin for the A/D Converter.

3.3 PROGRAMMING: THE SOUL OF OUR PROJECT

3.3.1 PROCEDURE

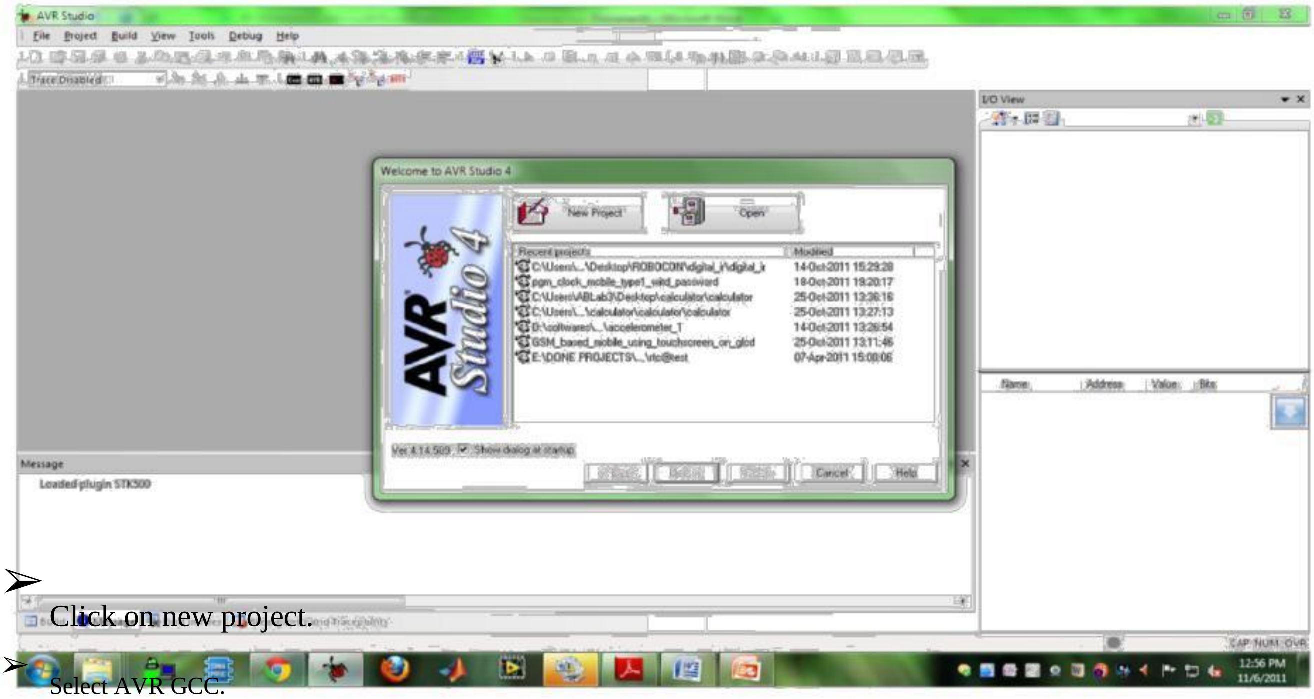
The Software which we are using for the coding of embedded projects are:

- AVR Studio
- WIN AVR
- SINAPROG Hex downloader
- USBasp

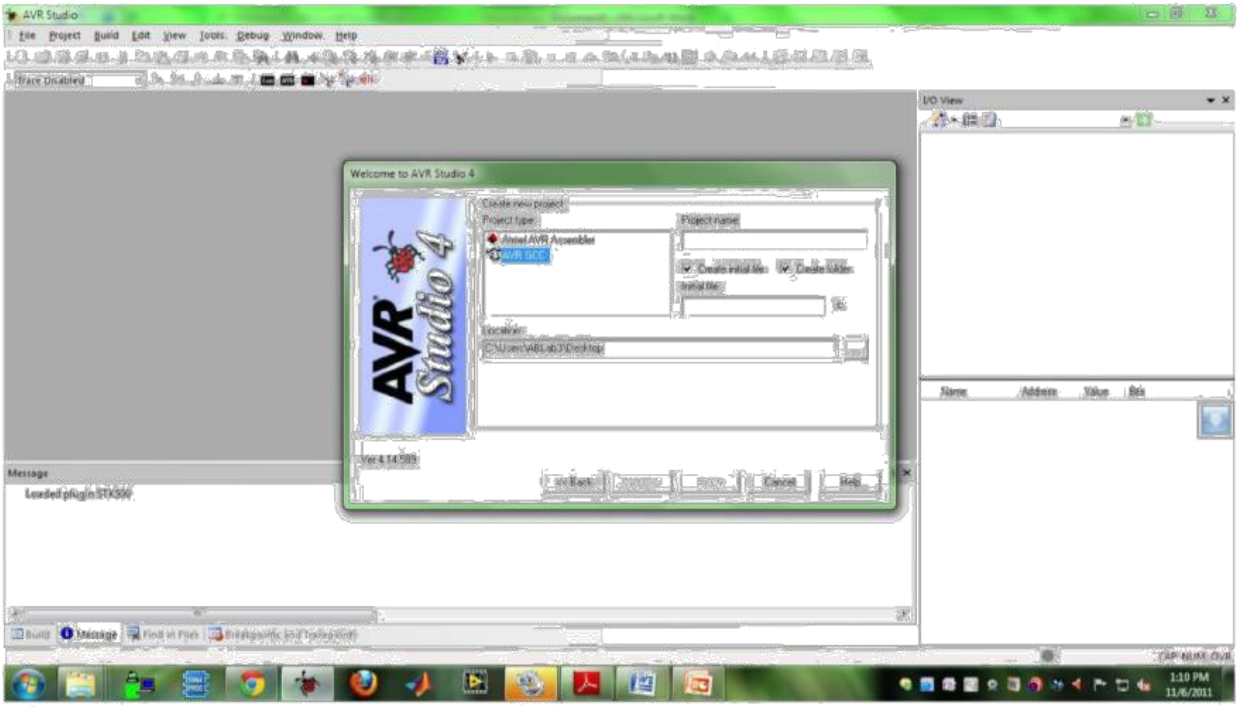


How to create a new project using AVR studio?

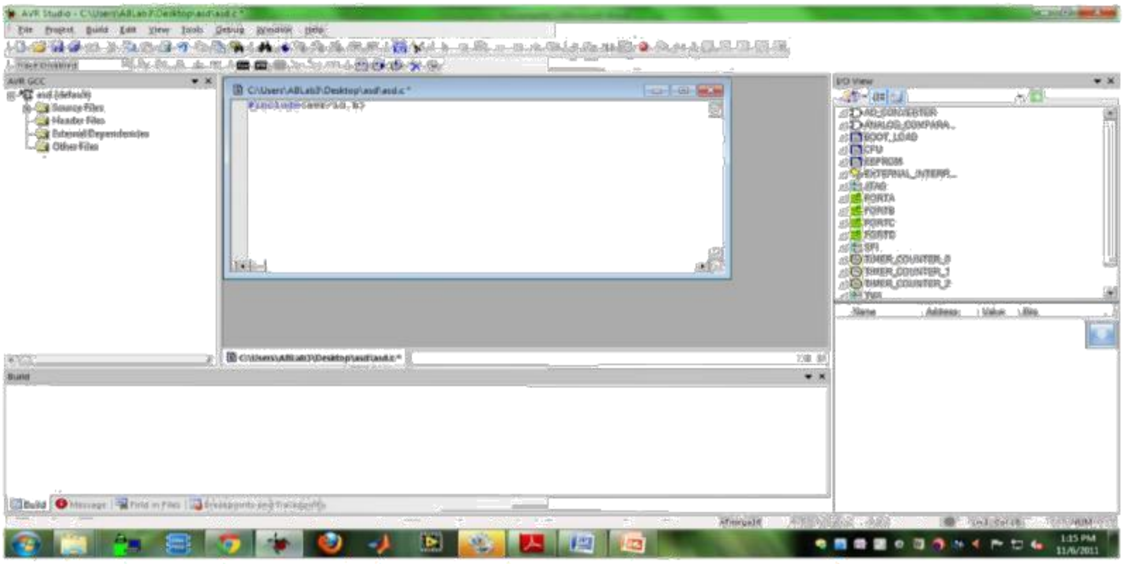
- Click on AVR studio shortcut or icon.



- Click on new project.
- Select AVR GCC.
- Write project name and click next.

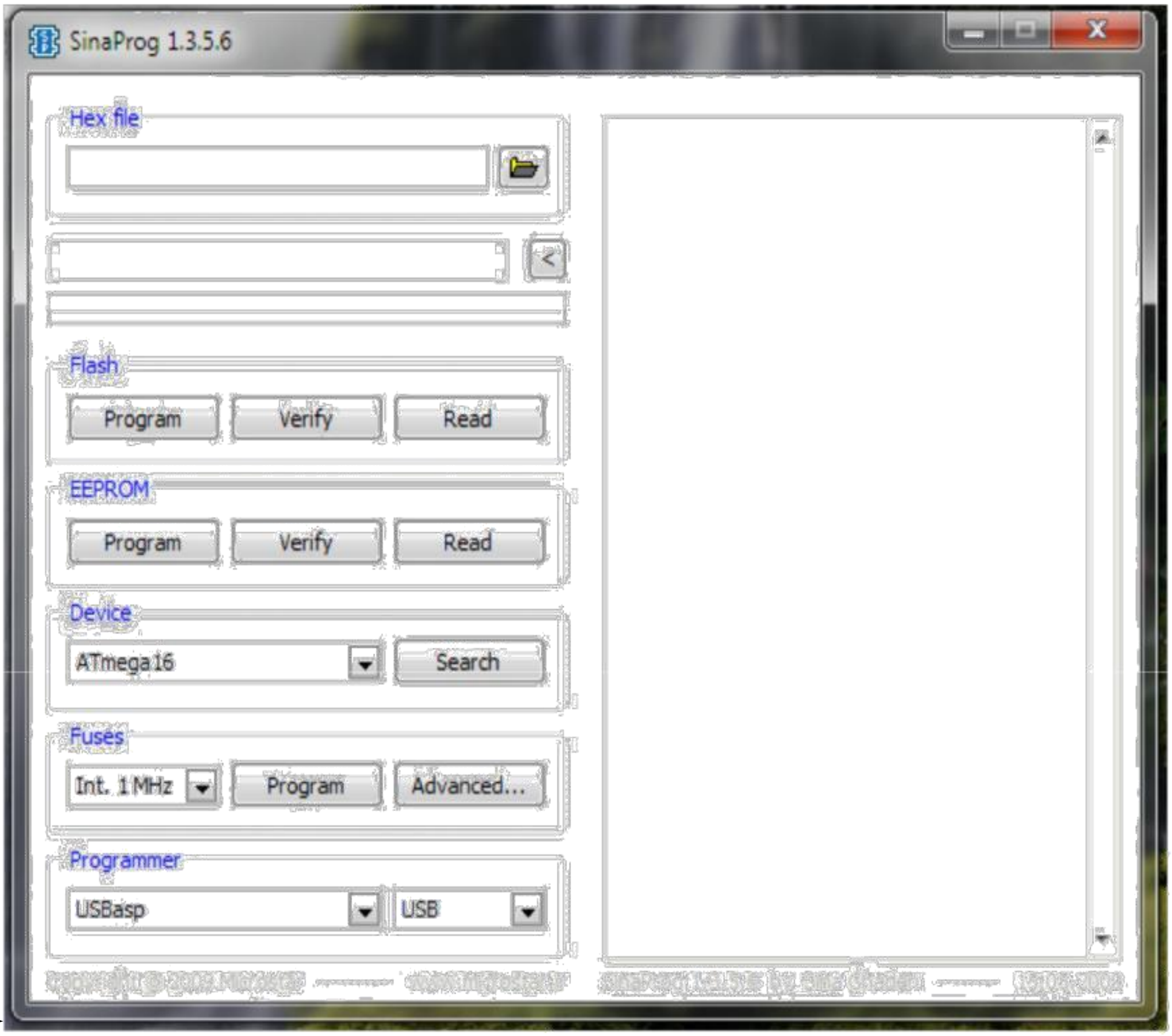


- Select AVR simulator then select AT mega 16.
- Click finish. The following window appears.



How to download the hex file to microcontroller?

- Open Sinaprog by clicking on the shortcut or icon.



- Specify the path of your hex file from the folder icon in the first line.
- Specify the device as AT mega 16
- Click on program in the flash memory line.

3.3.2 CODE

```
#include<avr/io.h>
#defineF_CPU        8000000
#include<util/delay.h>
#define     LCD_DATA_PORT       PORTC
#define     LCD_CONT_PORT       PORTB
#define     LCD_RS          PB0
#define     LCD_RW          PB1
#define     LCD_EN          PB2
#include<avr/lcd.h>
void usart_init();
void usart_data_transmit(unsigned char data );
unsigned char usart_data_receive( void );
void usart_string_transmit(char *string);
char *usart_string_receive(char *receive_string,unsigned char terminating_character);
int main(void)
{
DDRB=0x07;
DDRC=0xff;
DDRA=0x0f;
char rcv;
usart_init();
lcd_init();
lcd_command_write(0x0c);
lcd_command_write(0x01);
lcd_string_write("Bluetooth Based");
lcd_command_write(0xc0);
lcd_string_write("Home  Automation");
_delay_ms(500);
lcd_command_write(0x01);
lcd_command_write(0x80);
lcd_string_write("D1-");
```

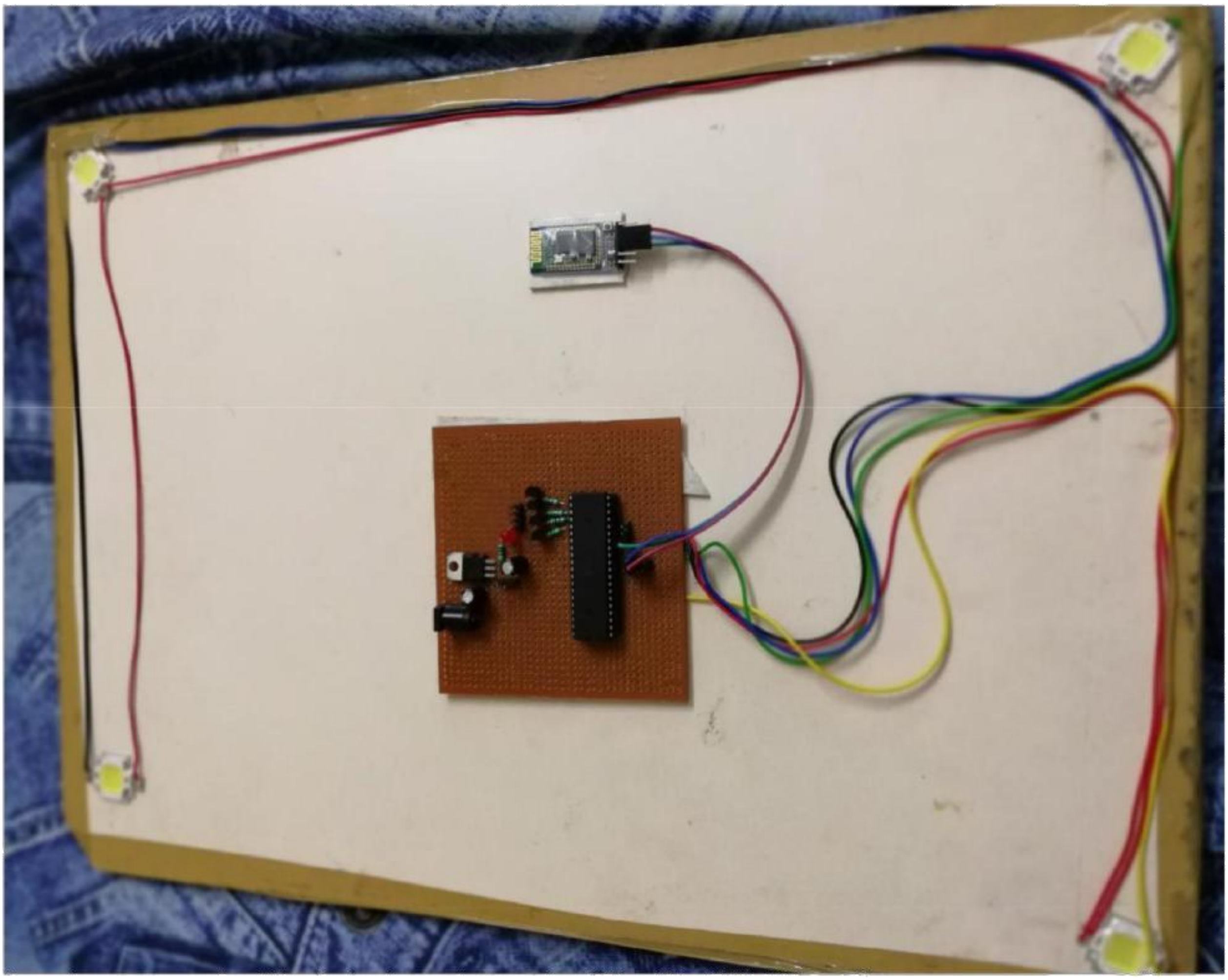
```
lcd_command_write(0x88);
lcd_string_write("D2-");
lcd_command_write(0xc0);
lcd_string_write("D3-");
lcd_command_write(0xc8);
lcd_string_write("D4-");
lcd_command_write(0x83);
lcd_string_write("OFF ");
lcd_command_write(0x8b);
lcd_string_write("OFF ");
lcd_command_write(0xc3);
lcd_string_write("OFF ");
lcd_command_write(0xcb);
lcd_string_write("OFF ");

while(1)
{
        rcv=usart_data_receive();
         if(rcv== '1')
        {
                PORTA |=0x01;
                lcd_command_write(0x83);
                lcd_string_write("ON ");
        }
        else if(rcv== 'A')
        {
                PORTA &=0x0e;
                lcd_command_write(0x83);
                lcd_string_write("OFF ");
        }
```

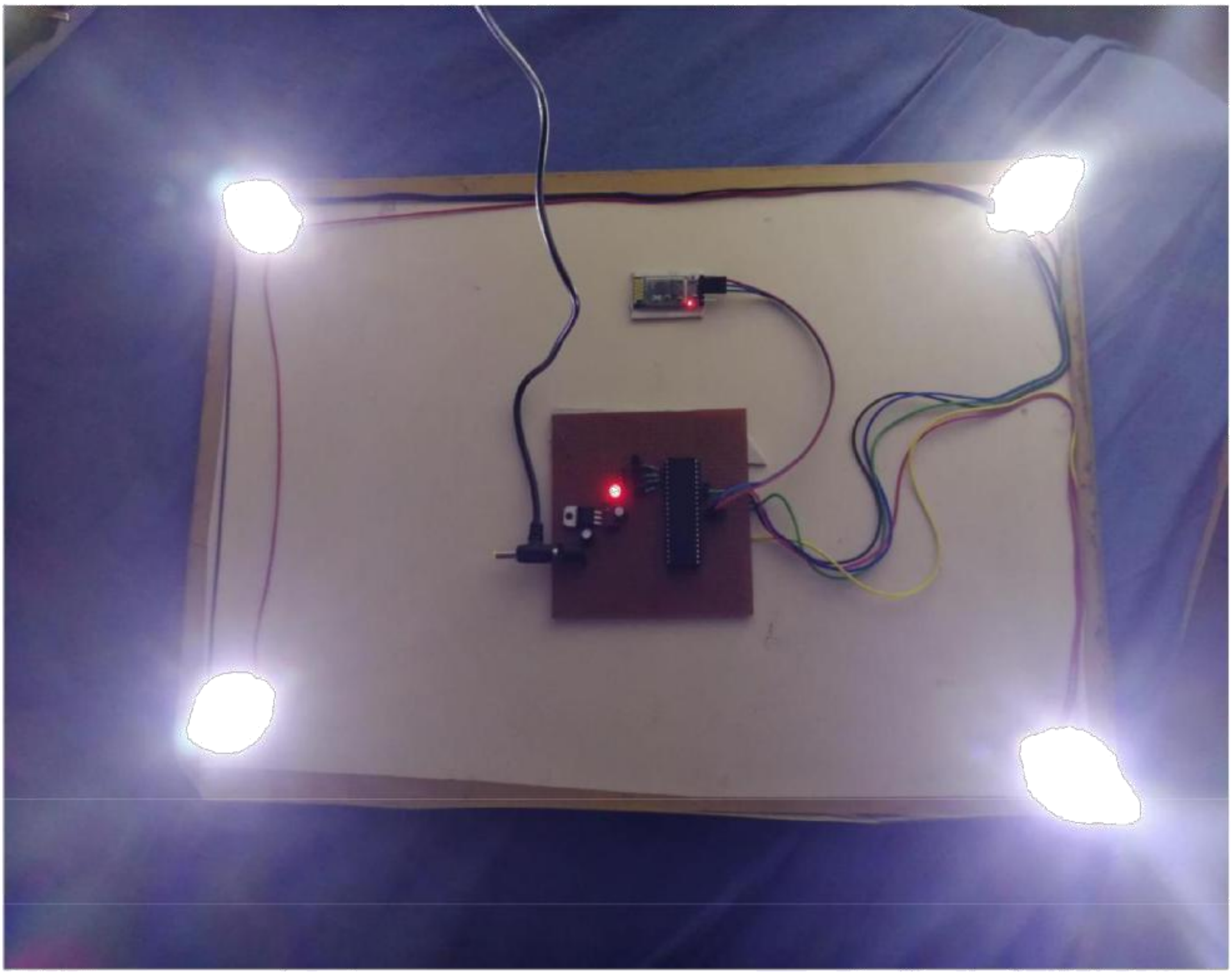
```
else if(rcv== '2')
 {
        PORTA |=0x02;
        lcd_command_write(0x8b);
        lcd_string_write("ON ");
 }
 else if(rcv== 'B')
 {
        PORTA &=0x0d;
        lcd_command_write(0x8b);
        lcd_string_write("OFF ");
 }
 else if(rcv== '3')
 {
        PORTA |=0x04;
        lcd_command_write(0xc3);
        lcd_string_write("ON ");
 }
 else if(rcv== 'C')
 {
        PORTA &=0x0b;
        lcd_command_write(0xc3);
        lcd_string_write("OFF ");
 }
 else if(rcv== '4')
 {
        PORTA |=0x08;
        lcd_command_write(0xcb);
        lcd_string_write("ON ");
 }
```

```
else if(rcv== 'D')
{
        PORTA &=0x07;
        lcd_command_write(0xcb);
        lcd_string_write("OFF ");
}
else if(rcv== '9')
{
        PORTA=0x0f;
        lcd_command_write(0x83);
        lcd_string_write("ON ");
        lcd_command_write(0x8b);
        lcd_string_write("ON ");
        lcd_command_write(0xc3);
        lcd_string_write("ON ");
        lcd_command_write(0xcb);
        lcd_string_write("ON ");
}
else if(rcv== 'I')
{
        PORTA=0x00;
        lcd_command_write(0x83);
        lcd_string_write("OFF ");
        lcd_command_write(0x8b);
        lcd_string_write("OFF ");
        lcd_command_write(0xc3);
        lcd_string_write("OFF ");
        lcd_command_write(0xcb);
        lcd_string_write("OFF ");
 }
    }
}
```

Chapter 4: RESULTS

Using the methodology of computation for micro controller and using electronic components we developed a working prototype for home automation.





Chapter 5: CONCLUSION & FUTURE SCOPE

5.1 CONCLUSION

The home automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device. The Bluetooth client was successfully tested on a multitude of different mobile phones from different manufacturers, thus proving its portability and wide compatibility.

This project will not only provide convenience to the common man but will be a boon for the elderly and disabled.

5.2 APPLICATIONS

The project designed is very practical in nature because everything can be controlled with the help of just a mobile phone which is widely available nowadays and also proves to be handy.

Also the project is feasible because the cost of the project is very less as compared to the expensive Wi-Fi based home control systems presently available in the market which require an additional cost of internet services.

5.3 FUTURE SCOPE

This project can be further developed by integrating it with the internet to monitor your home while sitting in a remote area. By doing this, one can keep an eye on his or her home through an internet connected to the user’s mobile phone or PC or laptop. This will not only improve the security of your home in this modern day world but will also assist in conservation of energy like if you left any home appliance switched on by mistake, then you can check the status of the appliance on the graphical interface made on your mobile and can switch it off using the internet connectivity.

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