Smart Home Project

Team 14

Project report

Third year – Measurement Project

Under supervision of Dr. Mohamed Ryad

Table of contents

1. Introduction

Smart home technology, also known as **home automation,** provides homeowners security, comfort, convenience and energy efficiency by allowing them to control smart devices, often by a smart home app on their smartphone or other networked device. A part of the **internet of things (IoT)**, smart home systems and devices often operate together, sharing consumer usage data among themselves and automating actions based on the homeowners' preferences.

2. Smart Home idea

One of the most touted benefits of home automation is providing peace of mind to homeowners, allowing them to monitor their homes remotely, saving power and security system

Saving power by turning lights on and off automatically when there is no person in the room

Canceling our old keys and use smart ones as we use RFID to enter the home and to connect between that and our security system as the user have to enter the security system activation password

In our project there is more than one sensor like flames sensor to check if there is no fire also we use PIR sensor and Ultrasonic sensor all synchronized to achieve our goals and a camera to live stream the view we want to see in the time we want

Communication system in our smart home aims to connect the sensors to talk to the main microcontroller wirelessly; we can use this communication system to send our reading from the sensor to mobile application to achieve our target from the project which is using IoT technology

Controllers we used in this project AVR microcontroller, Nodemcu and Raspberry pi

3. Project sections

PCB Design

Communication system

Sensors and camera

LCD and Keypad

Security system

4. PCB Design

PCBs Content :

Three PCBs each PCB has its target
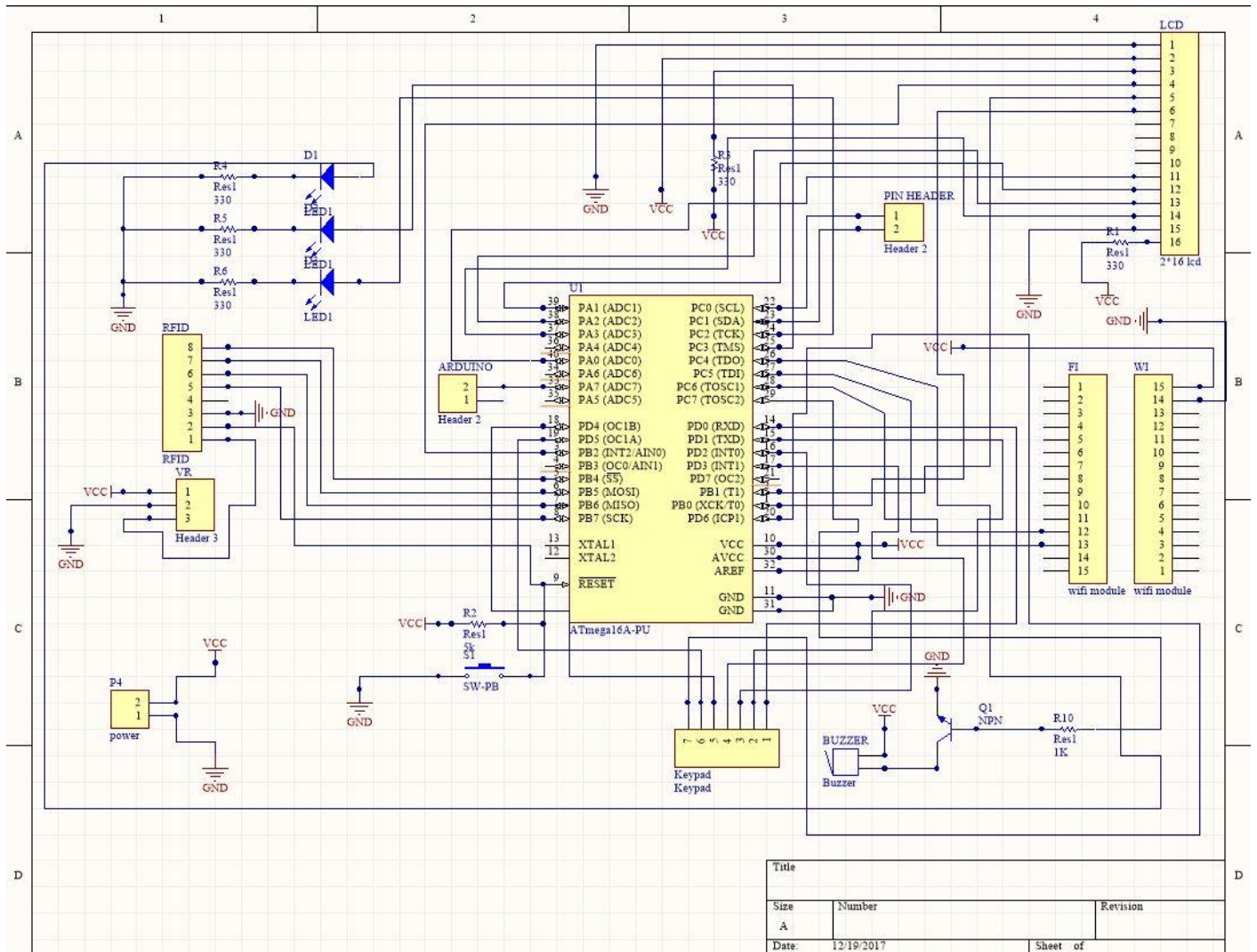
1. Main PCB

2. Sensors PCB

3. Ultrasonic PCB

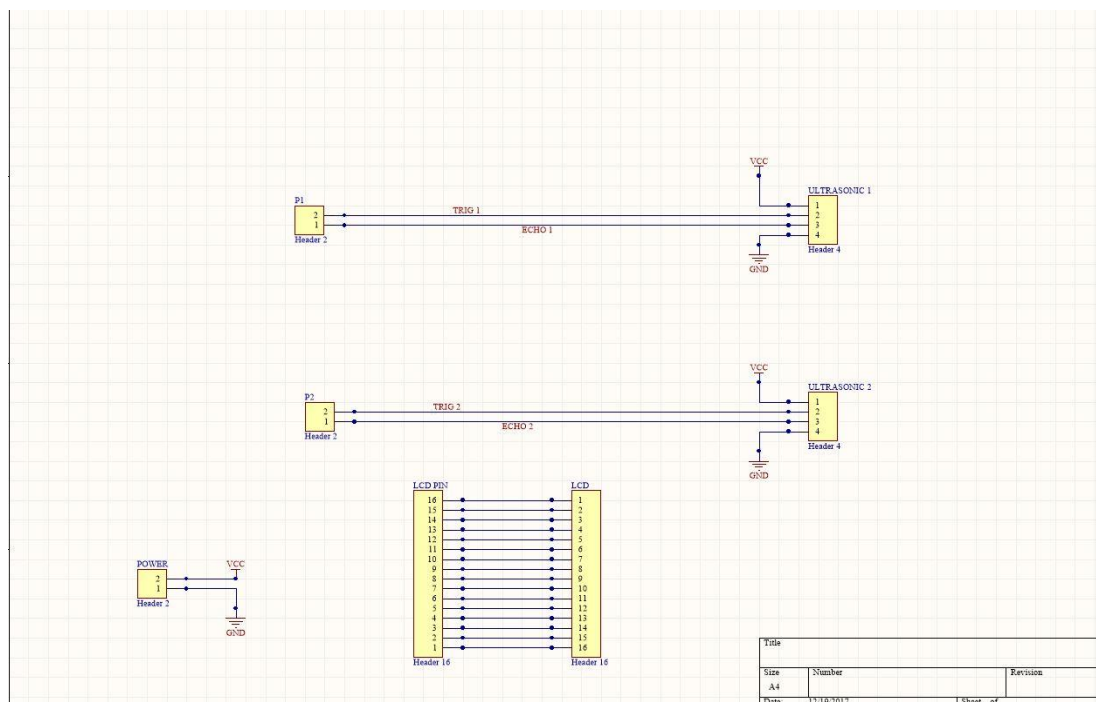Main PCB: atmega16 AVR controller, RFID, LCD, Keypad, LEDs, Buzzer, nodeMCU

Sensors PCB: atmega16 AVR controller, Flame sensor, BIR sensor, nodeMCU
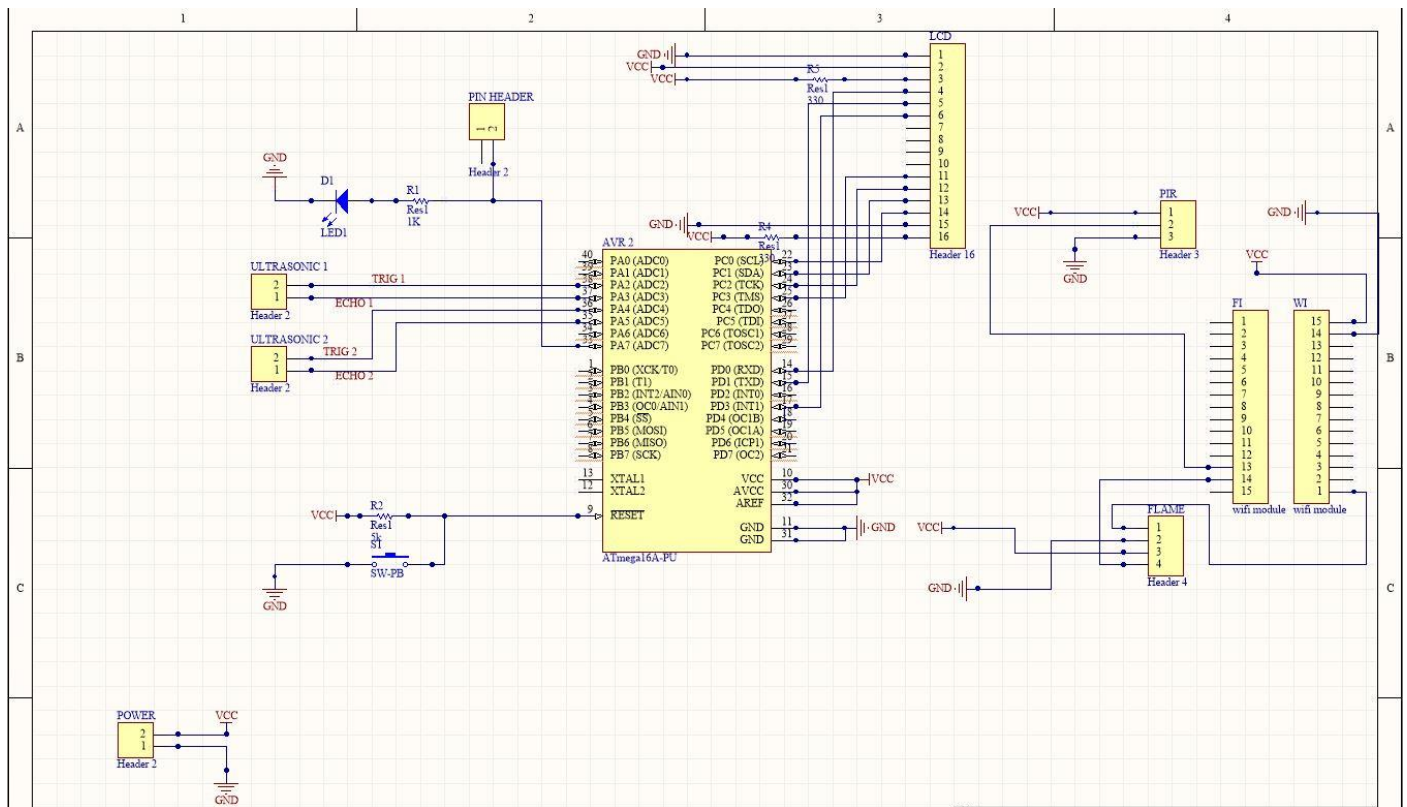
Ultrasonic PCB: Ultrasonic sensor and LCD

Main PCB

Ultrasonic PCB

Sensors PCB

5. Security system

RFID

Discussion

Replacing ordinary key by tags and cards like in pic

A card/ tag passes in front of the reader in which we stored this tag / card id . usually RF Tags id consists of 8 bytes designed by the manufacturer. If the ID is right, it rotates the motor and opens the door .

Specifications for RFID-RC522 reader :

Frequency 13.56 MHz

Write / read

Protocol : SPI

Current : 13-26mA

DC volt :3.3volt

Card reading distance : 60mm

Card specification :

Price : 0.48$

data transfer : 106 kbit per sec

data integrity : 16 bit CRC, parity , bit coding , bit counting

internal EEPROM : 1kbyte 16 sectors 4blocks 16 bytes each / data retenation :

1 years
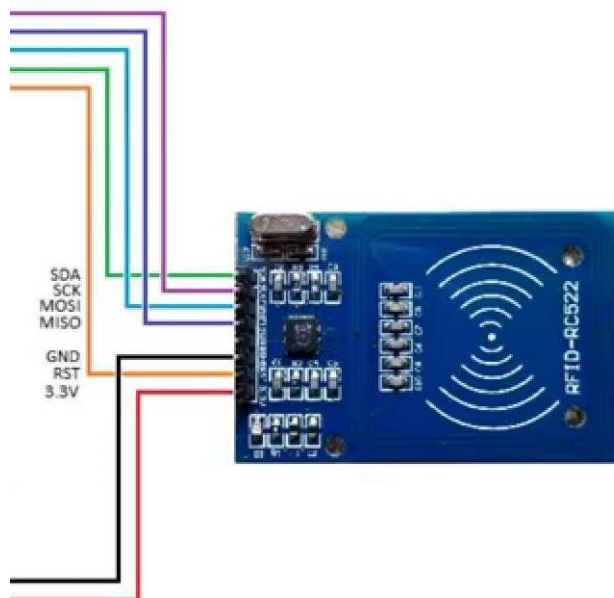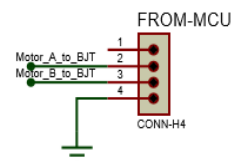
Operating Voltage 8V-12V

Power = 2.5V-3.6V DC
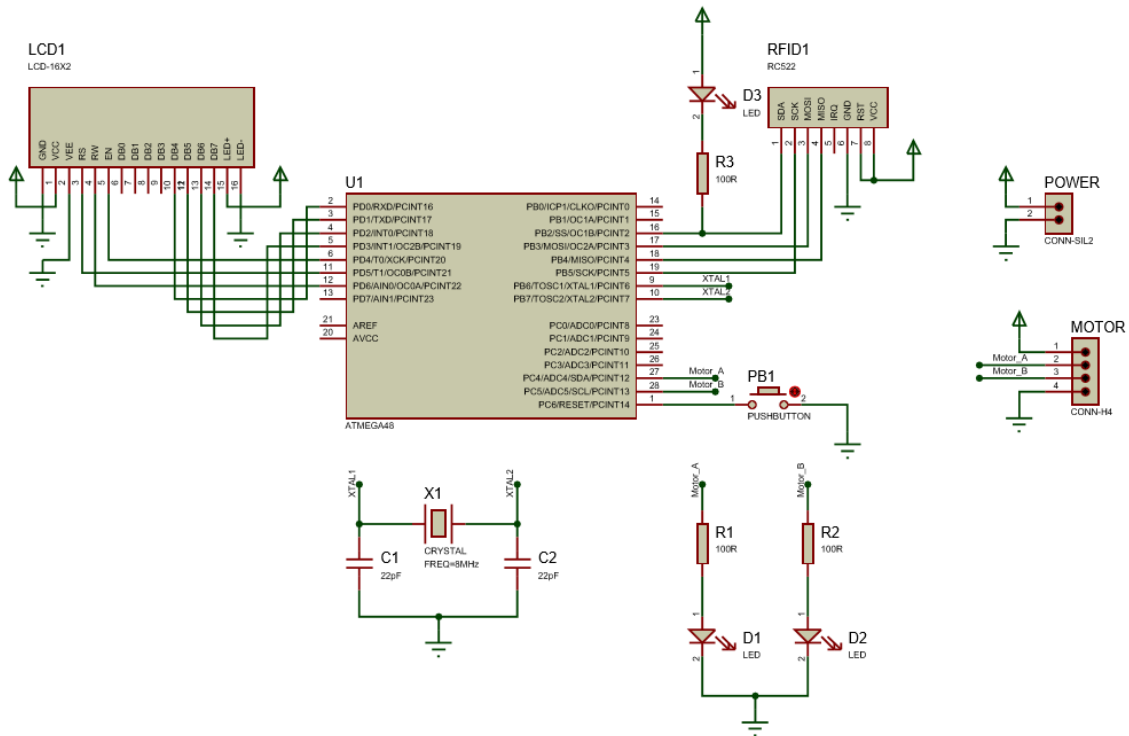
Hardware:

RF522 reader module

AVR atmega16

LEDs

Cards /tags

LD293 motor driver IC

BC548 transistors

Keypad and lCD

Security is a prime concern in our day-today life. Everyone wants to be as much secured as possible. Keypad based password is one of the many method and the most common and easy one to provide security to any system.

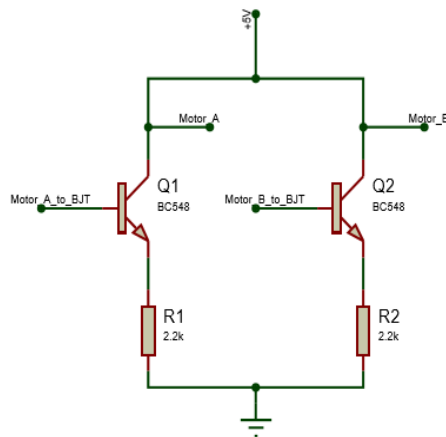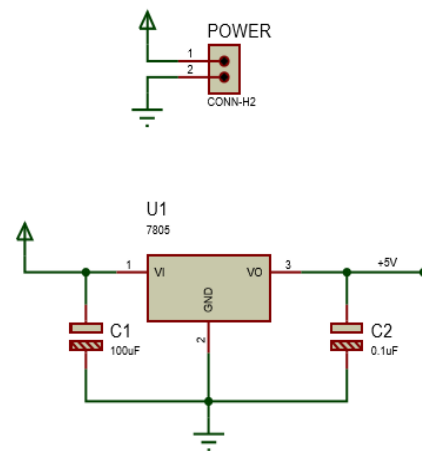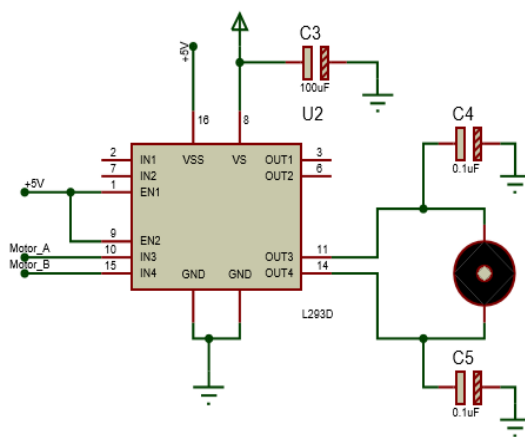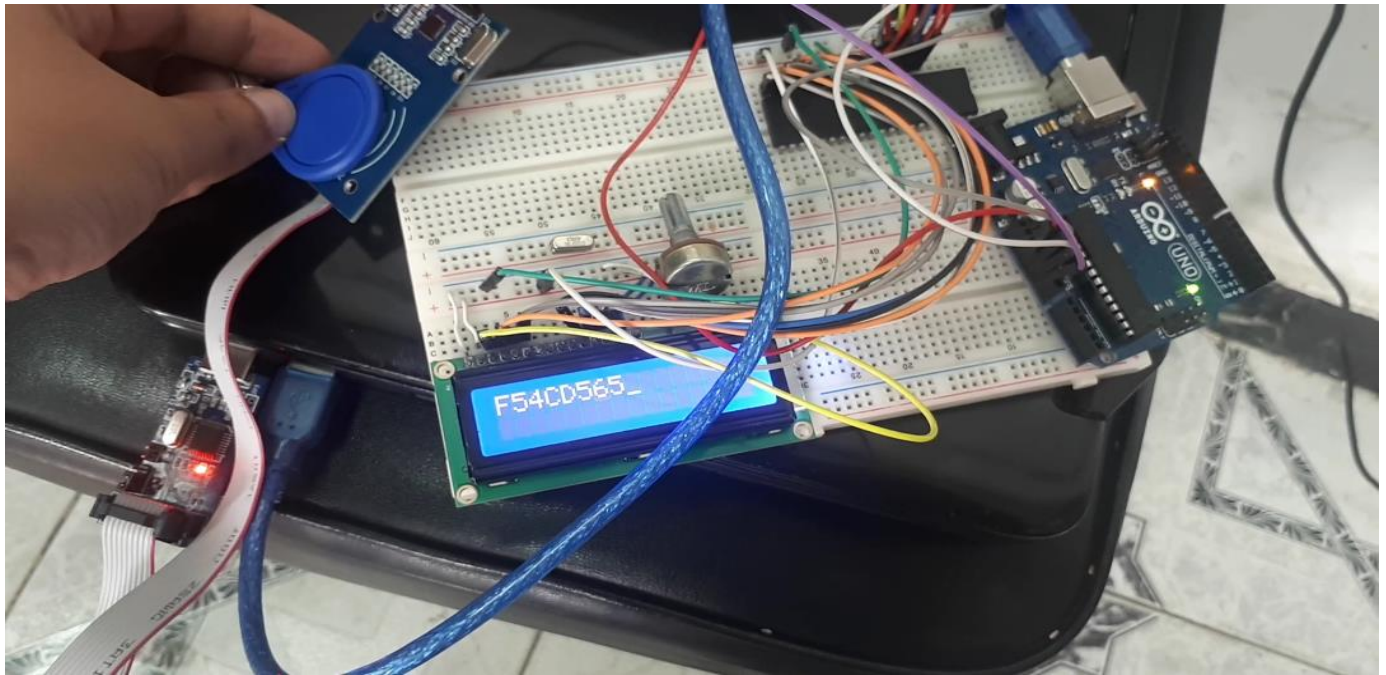In this project, we design a password protected system using a 3x3 keypad with AVR ATmega16 microcontroller. Here, the user will enter a 7 digit numeric password to gain access of the system. The user enters the 4 digit numeric password by pressing different keys of the 3x3 keypad one by one. For each key pressed, a * is displayed in the 16X2 alphanumeric LCD. After entering 7 digits of the password, the microcontroller compares the entered password with the set password and displays the result of the comparison in the 16X2 alphanumeric LCD as Correct Password or Wrong Password. Once the correct password is entered, the green led will light and the alarm will stop.

Software's Required

- AVR Studio 4 Software
- WinAVR 2010 Software
- SinaProg Hex Downloader Software
- USBasp Driver
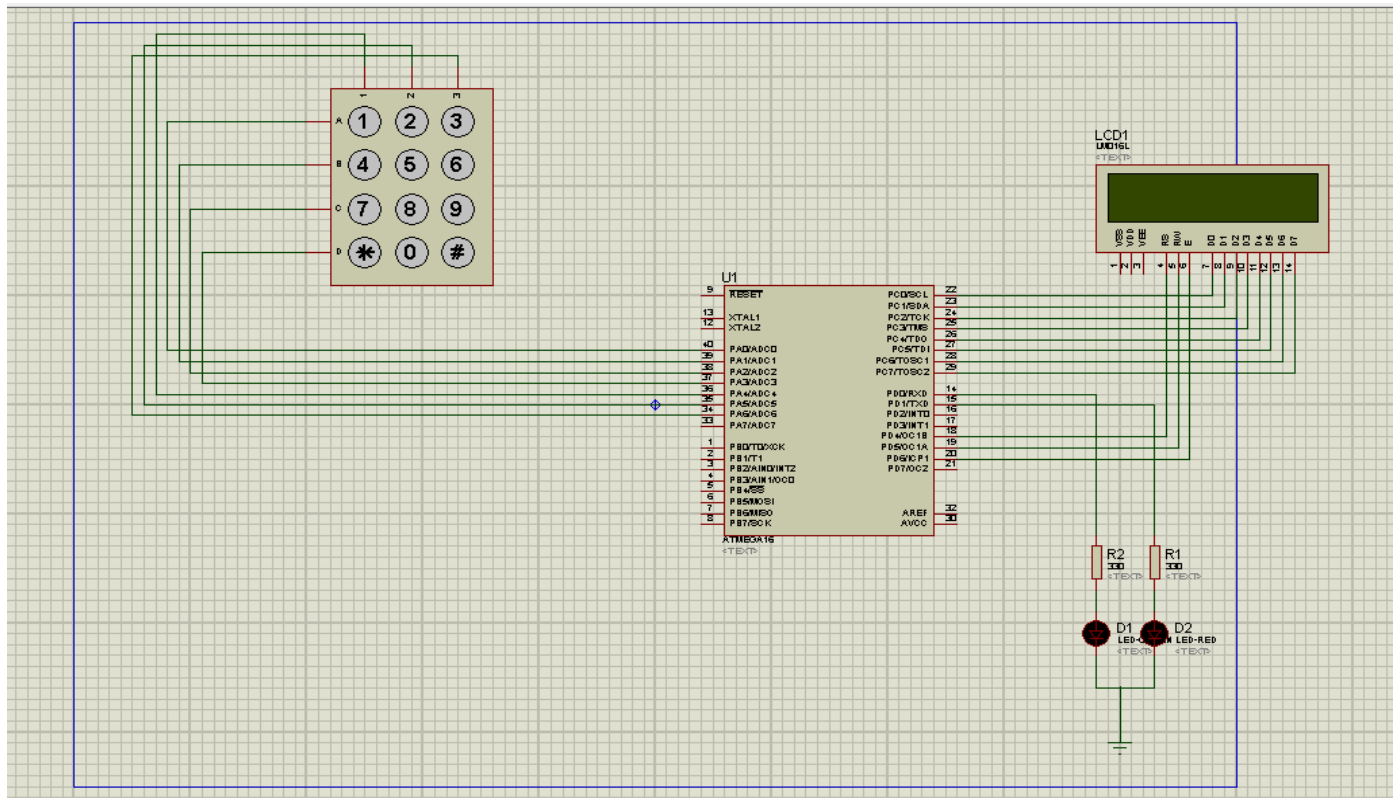
Required hardware:

Name / Unit Price	Quantity	Total Price
AVR Trainer Board-100 with ATmega16 Rs. 700.00	1pc	Rs.700.00
AVR USB Programmer Rs. 350.00	1pc	Rs.350.00

12V, 1A DC SMPS Adaptor Rs. 130.00	1pc	Rs.130.00
RG1602A 16X2 Alphanumeric LCD Green Rs. 150.00	1pc	Rs.150.00
3x3 Keypad Rs. 120.00	1pc	Rs.120.00
1 to 1 Connector-Female to Female Rs. 4.00	3pc	Rs.12.00
10 to 10 FRC Female to Female Connector Rs. 15.00	3pc	Rs.45.00

Wi-Fi System

Transmitting data between PCBs wirelessly:

The data is transmitted between sensors and main AVR wirelessly using Esp8266 NodeMCU.

Esp8266 nodeMCU:

It is an open-source and programmable board and provides an Internet feature that allows to connect things together and understanding among themselves through the Internet.

Esp8266 NodeMCU programming:

With just a few lines of code you can establish a Wi-Fi connection and define input/output pins according to your needs exactly like Arduino, turning your ESP8266 into a web server and a lot more. It is the WiFi equivalent of Ethernet module. Now you have internet of things (IoT) real tool.

With its USB-TTL, the nodeMCU Dev. board supports directly flashing from USB port. It combines features of WIFI access point and station + microcontroller. These features   make the NodeMCU extremely powerful tool for Wi-Fi networking. It can be used as access point and/or station, host a webserver or connect to internet to fetch or upload data.

Features:

- Finally, programmable Wi-Fi module.
- Arduino-like (software defined) hardware IO.
- Can be programmed with the simple and powerful Lua programming language or Arduino IDE.
- USB-TTL included, plug & play.
- 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board.
- Wi-Fi networking (can be used as access point and/or station, host a web server), connect to internet to fetch or upload data.
- Event-driven API for network applications.
- PCB antenna.

DEVKIT

Left labels		Left pins		Center pins	Right pins		Far right
TOUT	ADC0	A0		D0	GPIO16	USER	WAKE
	NC	RSV		D1	GPIO5		
	NC	RSV		D2	GPIO4		
	NC	RSV		D3	GPIO0	FLASH	
5V POWER	NC	RSV		D4	GPIO2	TXD1	
3.3V POWER	NC	RSV		3V3	3.3V		
GROUND	NC	RSV		GND	GND		
GPIO WITH PWM	GND	GND		D5	GPIO14		HSPICLK
GPIO WITHOUT PWM	3.3V	3V3		D6	GPIO12		HSPIQ
UART	GND	GND		D7	GPIO13	RXD2	HSPID
HSPI	3.3V	3V3		D8	GPIO15	TXD2	HSPICS
KEY	EN	EN		D9	GPIO3	RXD0	
SYSTEM	RST	RST		D10	GPIO1	TXD0	
ADC	GND	GND		GND	GND		
NOT CONNECT	5V	5V		3V3	3.3V		

15

Sensors

Ultrasonic
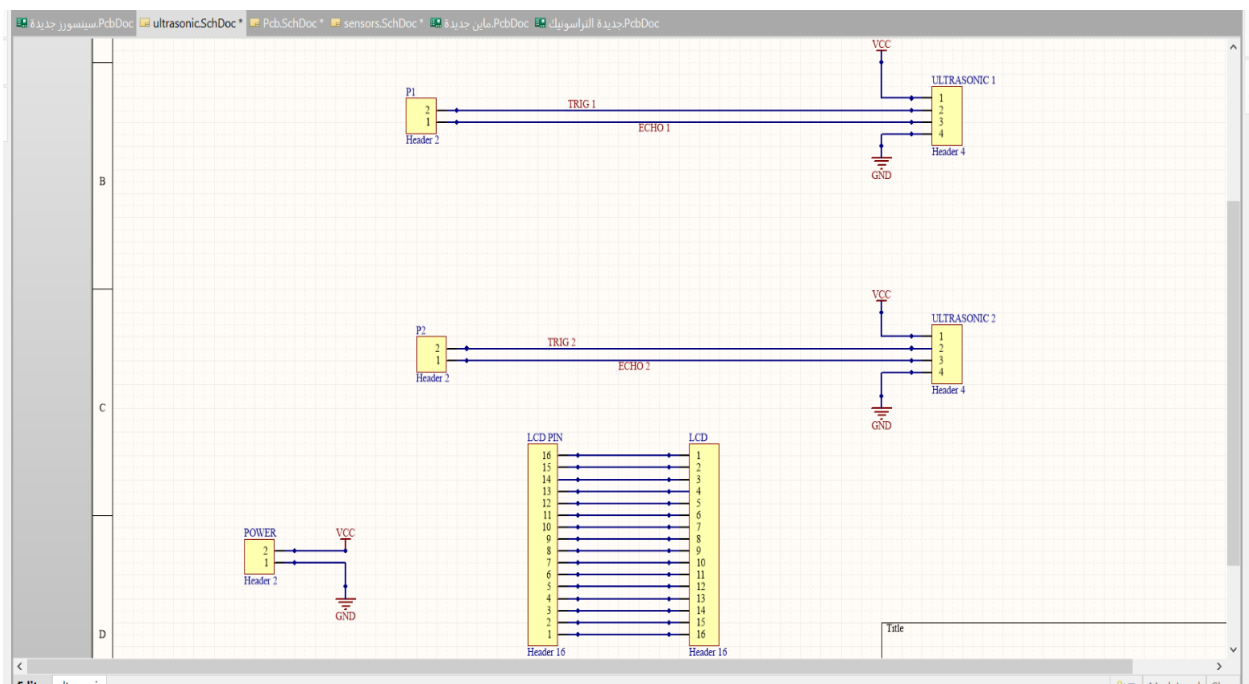
 We used two ultrasonic to detect if there is a person in the room or not ,when someone enter the room the lights goes on

Schematic:

Flame sensor

We use it to detect if there's a fire in the room, if there's a fire the sensor will send data to the main AVR by Wi-Fi module and a buzzer goes on

PIR sensor

We use it to detect if there's a movement in the room for security system

Camera

Our security camera system based on raspberry pi3 controller using its module TTL Mini camera

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Data transmission:

1. The pipeline that the data flow into it is:

1.1 from the camera itself which connected with parallel data lines that is needed to make the cam faster at sending data to the control unit in the raspberry pi and it's a problem in the same time cause of that the data transmission lines must be short so the controller must be in the same block that contains the camera.

1.2 Second unit is the raspberry pi itself:

We use a pipelined program called G-STREAMER we also have tried another one that called MOTION but it wasn't good enough, cause it wasn't real time streaming program there was a 3 minuets delay and that wasn't efficient enough for us.

1.3 the third unit is the wireless channel its self :

as our application is sharing the frames of the camera by uploading them in a local server opened by the rasp and can be shared with any number of devices that is logged in the same local network.

2. Features of our application:-

The camera can take pictures and store them in the rasp and turn them into local online on the same shared website that any one of the house members can access that data and download the pictures on his logged in device, with max resolution 5MP.

It can record videos with length of hours and also make that data is online and allowed to be access by any local connected device also with quality of 1080p30, 720p60 and 640×480p60/90 and also has max 120FPS.

Streaming system has no lag factor that it is in the worst case will be live too then it's efficient enough to be trusted in

Cause of the low operating voltage that the camera runs on, its bit rate can reach 1GBps and the most practical is 800MBps so its faster and better than the webcams

What makes us unique:-

Our camera system isn't static one, that you can control your camera angles by fantastic wireless gamepad that is connected to the raspberry pi3 through the USB port that is run on 2.7 GHZ and can be run from 20 feet along the control unit, the controller only can allow you to change angles in the x-y plane so how can we access the z pane angle

History of our efforts:-

We have been try to use web cams and connect them by the USB port of the rasp and it work but wait delay that cannot be trusted as a good security system with low bit rate as the USB isn't good as parallel buses that is used in the raspberry pi camera.

Coast

Name / Unit Price	Quantity	Total Price
Atmega16	2	80
LCD	2	90
Keypad	1	20
RFID	1	150
NodeMCU	2	240
Ultrasonic	2	96
PIR	1	45
LEDs	3	5
Buzzer	1	5
Raspberry Pi	1	1200

Without using Camera System; Total coast approximately: 750 L.E

Including Camera System; total coast approximately: 2000 L.E

Raspberry pi is the difference that makes that big difference in coast but for the future adds it is deserve but and the final decision will be for the user for sure and he we designed the project so it can be easily modified

Project team members

Name	Sec.	B.N.
محمد عيد ابراهيم	3	50
اروى عبد العزيز عبد الغنى عبد العزيز	1	24
اسراء سعيد محمد احمد عبد العليم	1	27
ابانوب حربى مرزوق متهني	1	1
دعاء كمال عبد الرحمن حسين	2	13
نرمين محمد عليوه	4	36
فيروز يحيي زكريا	3	17
محمود خالد أحمد	4	4
محمد طارق عبدالحميد	3	44
على عصام على	2	50
ميرنا هشام صلاح سيد	4	27
مياده عصام على محمود	4	24
مياده زكى محمد مصطفى	4	23
مى طه على متولى	4	20
زينب عادل ابراهيم على	2	23
ياسر محمد علي عوض الله	4	47
كريم أحمد فاروق محمد	3	20
عمر عصام محمد رمضان	3	4