Control Of Appliance By SMS Using Pic18f4550 Microcontroller

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Abstract :

This research is concerned to design electronics circuit which control the appliance using SMS messages by sending with mobile GSM wave to circuits which contain the RX circuit and to convert this wave to input of microcontroller type(PIC18F4550) which programmed by MICRO C language and send to input of array of transistors circuit to operate the relays that connected with the appliance and this messages are written in code received by microcontroller for each address of appliance .The microcontroller programmed to read this messages which stored in Inbox of SIM Card after reading the message the program clear the Inbox contain to stay the inbox empty standing to receive the another message .This system used in wide range to control the home appliance and many embedded control application by using the technology of SMS.

Key Words: PIC18F4550, MICROC language, Microcontroller, Technology of SMS

التحكم بالأجهزة المنزلية بواسطة خدمة الرسائل القصيرة باستخدام المتحكم الدقيق
(PIC18F4550)

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الخلاصة:

يهدف هذا البحث الى تصميم دائرة الكترونية للسيطرة على الأجهزة التطبيقية باستخدام الرسائل القصيرة (SMS) التي يتم إرسالها بواسطة الهاتف المحمول (Mobile) بحزمة (GSM) إلى المنظومة الالكترونية المتكونة من كتلة استقبال إشارة (RX) ثم تحويل هذه الإشارة إلى المتحكم الدقيق نوع (PIC18F4550) والذي تم برمجته بلغة المايكروسي لاستقبال الرسائل المشفرة وتحويلها الى مصفوفة من الترانزستورات لتشغيل مجموعة المرحلات المربوطة بها ودور هذه المرحلات تشغيل الأجهزة التطبيقية المرتبطة بها وتكون هذه المشفرات التي يستقبلها المتحكم الدقيق معنونه لكل جهاز أو مرحل، وتم برمجة المتحكم الدقيق لقراءة الرسالة الأخيرة التي استقبلت من قبل جهاز الاستقبال

والتي تخزن داخل شريحة الاتصال (SIM Card). بعد الانتهاء من القراءة تمسح الرسالة ليبقى صندوق الرسائل (INBOX) في الشريحة فارغا لحين استقبال رسالة أخرى ،وان مجالات استخدام هذه المنظومة واسعة وذلك للسيطرة على الأجهزة المنزلية والعديد من تطبيقات التحكم عن بعد باستخدام تكنولوجيا الرسائل القصيرة (SMS).

Notations:

GSM	Global System for Mobile
SMS	Short Message Service
SIM	Subscriber Identity Module
RAM	Random Axis Memory
EEPROM	Elec. Erasable Programmable Read Only Memory
CPU	Central Processing Unit
A/D	Analog to Digital Converter
CCP	Capture/Compare/PWM
PWM	Pulse Width Modulation
SPI	Serial Peripheral Interfacing
I2C	Inter to Integrated Circuit
USB	Universal Serial Bus
CAN	Computer Area Network
LIN	Local Interconnect Network
IRDA	Infrared Data Association
WDT	Watch dog Timer
POR	Power on Reset
BOR	Brown Out Reset Of Sleep Mode
PBOR	Programmable Brown out Reset of Sleep Mode
LVD	Low Voltage Detector
PLVD	Programmable Low Voltage Detector
ICSP	In Circuit Serial Programming
JTAG	Joint Test Action Group
ICD	In Circuit Debugger
LCD	Liquid Crystal Display
MCU	Microcontroller Circuit Unit

1. Introduction

The rapid growth of wireless communication motivate to use the mobile phones to remotely control appliance which can control different household appliances by sending an SMS message from mobile phone. This controller is extremely handy at places but no wired connection to that place is available. The microcontroller would then control and device based

on the information given to it. The proposed solution will need to be easy to use on most mobile phones.

The important part of system is GSM model which can received the SMS in 8-bit used like control temperature and motors. The GSM based control system implements the emerging applications of the GSM technology. Using GSM network a control system has been proposed that will act as embedded systems which canmonitor and control appliances and other devices locally using built-in input and output peripherals [1].

Remotely the system allows the use to effectively monitor and control house/office and industrial appliance also the equipment via the mobile phone set by sending commands in the form of SMS massages. The main concept behind the project is receiving the sent SMS and processing it further as required to perform depends on the nature of the SMS sent.

This work designs hardware which consists ofmicrocontroller type 18F4550 and tilt antenna system for received the signal type GSM and this system provides a development environment and connection between the microcontroller and a device is established by relays [2].

2. Project Description
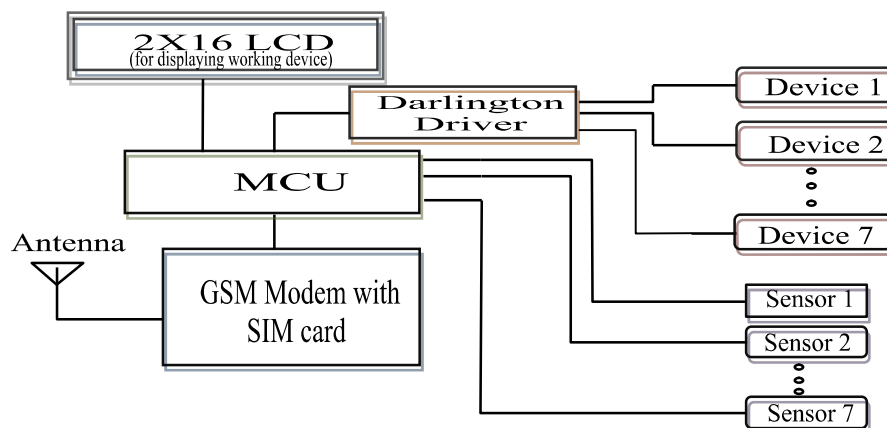
Fig .(1) Block diagram of the project

Initially the SMS is received from the GSM modem then is transferred to the microcontroller(MCU) unit and the control signal is extracted and used to control the devices which function from signal of programmed sensor of each devices connected with microcontroller and in this case the signal which coming from GSM modem must be convert septet of the phone because the microcontroller need bytes with 8 bit length so the septet is 1 byte with 7 bits length and octet is 1 byte with 8 bits length .All the process is must be decode the message from SMS [3].

A program for extracting the control signal part which received by SMS is loaded into microcontroller then the microcontroller now tries to read the SMS from the inbox message of SIM card and after reading microcontroller give order to clear the message in inbox [4].

For controlling the devices, the message will be converting to hex decimal format. The hex data is converted to the equivalent binary. For example if the message is "Device 1" the equivalent binary is "11010111" the implies that the output port (B,C) of microcontroller are enabled and the remaining pins of ports are disabled. Each pins of port (B,C) which connected with relays by Darlington drivers of control device have LED signal light to display the output and their status indicates whether the ports are set to "ON" or "OFF" [5].

The microcontroller is also programmed to control device after incoming the SMS message to operate that device connecting with sensor which give the order that the device operates on condition of sensors of each device. The block diagram of system showing in figure(1) [6],[7].

3. Device Description

3.1 Microcontroller PIC18F4550 (Datasheet)

The PIC18F4550 is type of microcontroller from the microchip which can program by using the USB pin connection to PC and loading the program using way of boot loader. The characteristic of the microcontroller is [8] :

Architecture: 8 bit
- Pin   : 40 (Pin I/O : 35 Pin)
- Program Memory (Flash) :   32 kB (16 k Word)
- RAM   : 2048 byte ,   EEPROM : 256 byte
- MAX CPU frequency   :   48 MHz(12MIPS)
- Internal Oscillator   : 8 MHz , 32 kHz

Peripherals:
- A/D Converter   : 1 (13 Channels) , Comparators : 2
- CCP Module   : 1XCCP , 1XECCP , 10-bit PWM resolutions
- Timer   : 1X8-bit , 3X16-bit.
- Comm. Peripherals   : 1XA/E/USART , 1XMSSP(SPI/I2C).

Connectivity:
- USB   : USB 2.0 Full Speed , CAN : 0XNore
- LIN   : Yes , IRDA : No

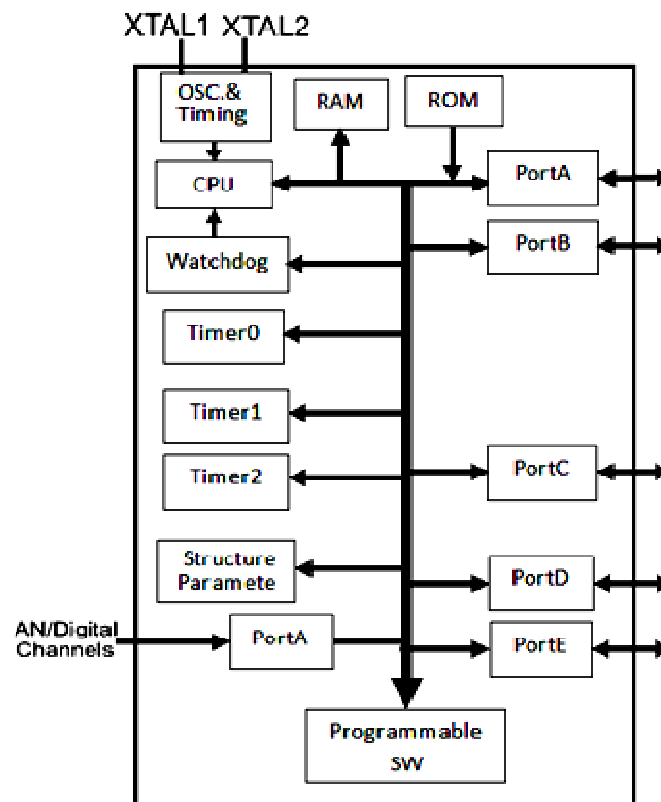**System Mgmt Features:**
- Nanowatt   : Yes , WDT : Yes , POR : Yes ,
- BOR   : PBOR , LVD : PLVD

Debug/Development Features:

- ICSP   : Yes , ICD : Yes
- JTAG : No
- Temperature   : (- 40 / +85) C , Voltage: (2 – 5.5) V

The pin configuration of PIC18F4550 microcontroller with the function all pins show in **Figure (2)** and the **Figure (4)** [8].

Fig .(3) MCU –Schematic diagram

3.2 GSM Module

A GM862-Quad module which shown in figure(4) can be connected with microcontroller to receive the signal (RX) from GSM module to MCU by reading the message that stored in SIM card inbox message after then transmit the signal (TX) from the MCU to SIM card to clear the messages in the inbox. The connection between the GSM module and MCU used some transistors to amplification the signal between them the schematic circuit shows that in figure [3],[9].
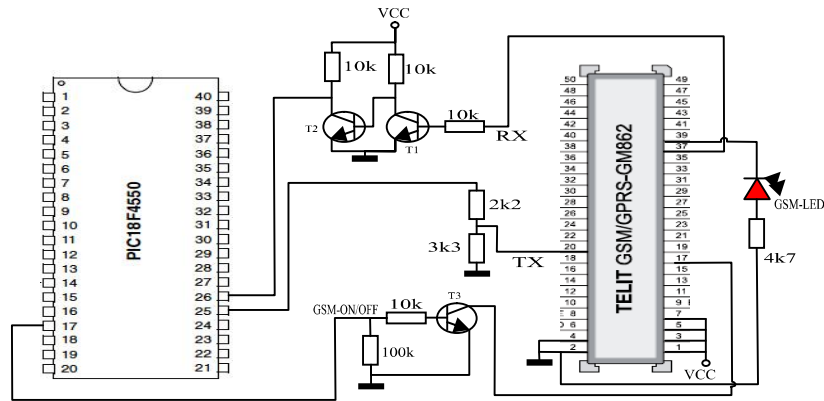
Fig .(4) schematic circuit connection GSM module with MCU

3.3 Darlington Drivers and Relays

Industrial devices and appliance usually utilize more power than the microcontroller can provide via its I/O ports. To enable microcontroller to be connected to such device, the system provide with (10) relays by means of which it is possible to provide up to 250v power supply. Each relay has one normally open (W0,W1,…) and one normally closed (NW0,NW1,…) contact. Ten relays are divided in two groups and half each consist of four groups and half consist of two relays. Relays of one group are connected to one common contact. Accordingly, there are a COMA, COMB and COMC common contact. Darlington Drive type ULN2003 which consist of (7) Darlington connection transistors connect between the microcontroller and relays for each groups. **Figure (5)** show the connection between one group of relays and the relevant COMA contact[10].
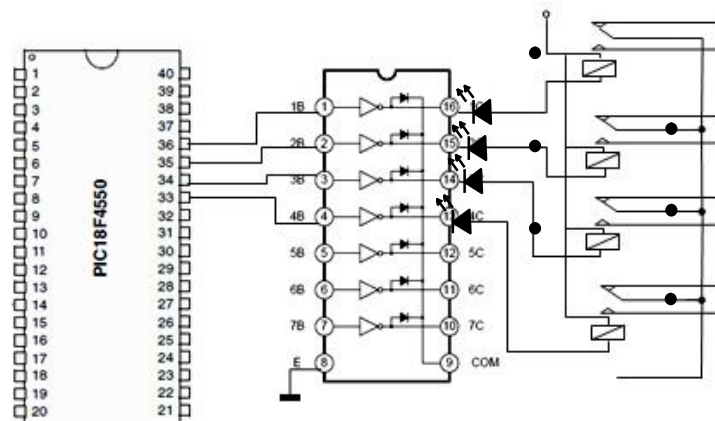

Fig .(5) Relay and microcontroller connection schematic group COMA

3.4 LCD and Sensors

Used Liquid crystal display LCD to representing the information of each devices(on/off) which controlled with microcontroller and this information display on LCD by press the

button which connect to port C of MCU .This type of display is made from Microchip Company and has two rows consist of 16 character fields. Each field is 7X5 pixel dot matrix [11].

Communication with microcontroller is done with port D , **Figure (6)** show the circuit connection all pins of LCD with MCU.
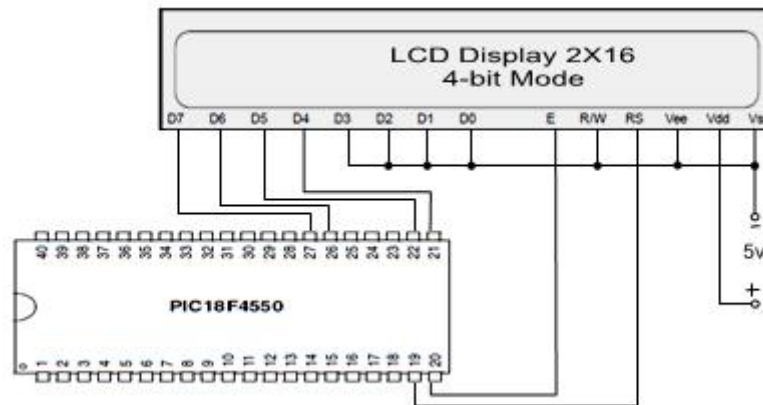
Fig .(6) Circuit Connection LCD with MCU

The sensors which used to control of devices by SMS each sensor connected to the MCU by using duel optocoupler (HCPL 2630) the function of which galvanic ally isolate signals brought to the microcontroller inputs from the devices.

As can be seen in **Figure (7)** the circuit connection of optocoupler with the MCU using the port A digital input [12][13].
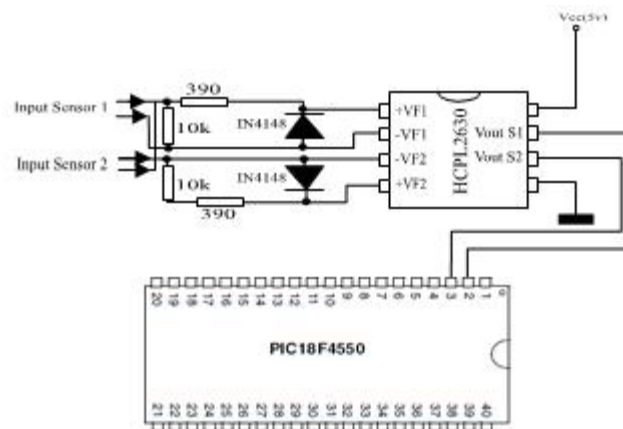
Fig .(7) Circuit Connection of Optocoupler with the MCU

4. Software Algorithm (Flowchart and Main Program)

The algorithmic flow chart to send the SMS message to control the appliance must programming the Microcontroller to read the message which received by GSM module then operate the device number after that the program delete the message .The flowchart shown in **Figure(8)** written step by step to proceeded the control main program of microcontroller , show the main program below in Micro C language.
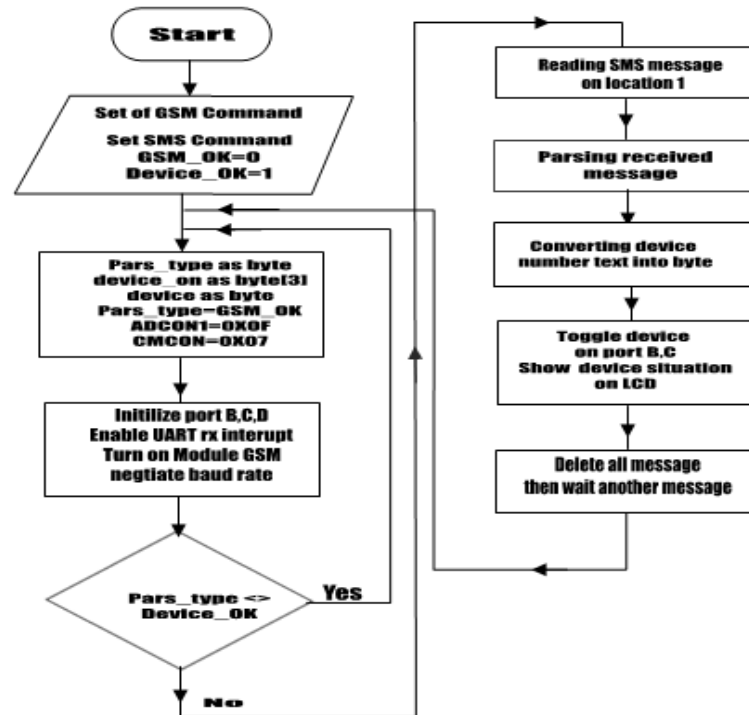
Fig .(8) Algorithmic flowchart of program

4.1 Software introduction

The following software was developed using a Micro C. The software extracts the sent message from the SIM location at a regular interval and processes it to control the different appliances connected within the interface. The connection can be used for controlling just about all functions of the phone, as well as uploading new firmware etc. This bus willallow us to send and receive SMS message [14].

4.2 The main Program in micro C language

In this progr; Main Program

```
      void main() {
      parse_type = GSM_OK;
        ADCON1 = 0x0F;
```

```
        CMCON  = 0x0
;  Used RX & TX
        TRISE = 0;
        LATE = 0;
        TRISB = 0;
        TRISC = 0;
        TRISD = 0;
        LATB = 0;
        LATC = 0;
        LATD = 0;
;Enable Uart RX Interrupt
        RCIE_bit = 1;
        PEIE_bit = 1;
        GIE_bit  = 1;
;Turn on GSM module
        LATC2_bit = 1;
        delay_ms(2000);
        LATC2_bit = 0;
        UART1_init(19200);
        Wait();
; Negotiate baud rate
        while(1) {
        send_atc("AT");
        Delay_ms(100);
          if (get_response() == GSM_OK)
            break;  }
;Set text mode
        send_atc(atc1);
        wait_response(GSM_OK);
        send_atc(atm1);
        wait_response(GSM_OK);
 ;Read SMS message,Get Device number,Delete all messages
        while(1) {
        parse_type = DEVICE_OK;
        send_atc(atm2);
         if (get_response() == DEVICE_OK){
        device = Get_Device_Number();
         if(device<= 8)
         LATB = PORTB ^ (1 << (device-1));
         else
```

```
        LATD = PORTD ^ (1 << (device- 9));
        while(1){
    parse_type = GSM_OK;
    send_atc(atm3);
    if (get_response() == GSM_OK)
            break;
            wait();
        }  }
        wait();
    }
}
```

Am any messages is not define for device like melody messages in this situation the program immediately clean these messages to stay the location one in box of SIM card message empty. Because of the pin of each port contain form 8 pin so the program give the condition that in situation the number of device big from 8 then these totally devices connect to the next port [15],[16].

5. Working the system

In the first give the supply to all parts of hardware about (5v) from the regulator (7805/0.5A) to all parts except relays must supply about (12v) from regulator (7812/1A) before connect the power supply must push the SIM card in GSM module and in the first must clear all messages in inbox of SIM card the put it in GSM module then connect the power supply for the system .The led diode which connect with GSM module give signal light that the module ready to receive the message from mobile by using the number of SIM card.

Sending the message which title of number of device for example to activate the relay the device(1) the message is contain "device01", this message after received from GSM module will keep it for short time in inbox of SIM card to be read and send data to microcontroller to write on LCD (div.1-ON), after received the microcontroller this data send data to GSM module to clear all messages in inbox of SIM card because the program which written in MCU able to read only the last one of message in inbox of SIM card, after reading it will send all time to clear all messages . The hardware constructs and schematic circuit with pin configuration of MCU look shown in figure(12)&(13).The MCU after received the data of message it will be addressed by program to send signal about (5v) to pins of ports B.C which connect with peripheral of each device to operate that device. To cut the power supply of device that is operated by the system must send the same message to the system to stop operate same device and write on LCD (div.1-OFF).The LCD show by sequence from right to left the mode connection of each device (ON/OFF).

6. Conclusion and Future work

   To be control the all appliance using GSM module which use the SIM card mobile communication by sending addressable SMS message from each mobile and receive this SMS message using the GM-862 (GSM module) which connected with programmable (PIC18F4550) microcontroller that help to function it all appliance by sensors or without sensors this project help peoples that can controller the owner appliances far distance switch ON or switch OFF more than (30) appliances whether the house or industrial appliances. This project has helped that we have done to get a better perspective on the various aspects related to this study, as well as practical knowledge of electronic equipment and communications. We have become familiar with the software analysis, design, implementation, testing and maintenance involved with our project. The system has extensive capabilities and making it so interesting, including:

- From a simple cell phone, a user is able to control and monitor virtually any   electrical devices. This makes it possible for users to rest assured that their appliances are secure when they left the house to just list a few of the many uses of this system.
- Using the SMS message in mobile phone, which is very famous by the mobile user, this make this system be very effective and attractive method.
- The SMS from the master unit sent from the remote unit was successfully processed by Micro C software and sent to micro controller through interfaces and successfully controlled the electronic devices connected to microcontroller.by using timer in both in micro c code and Microcontroller .
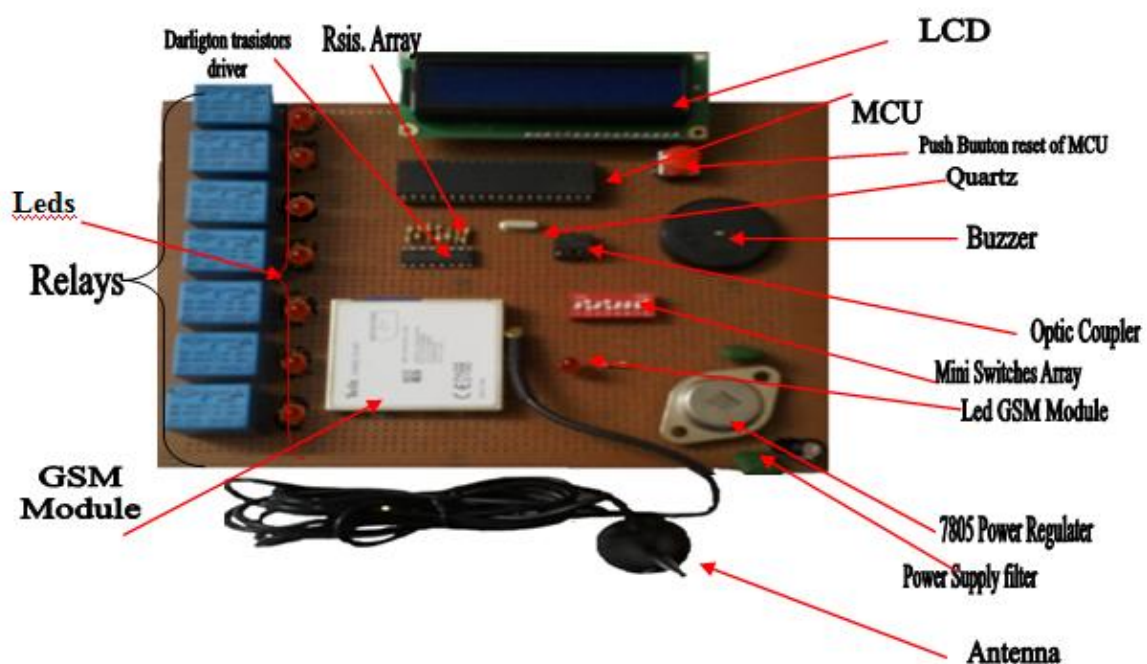

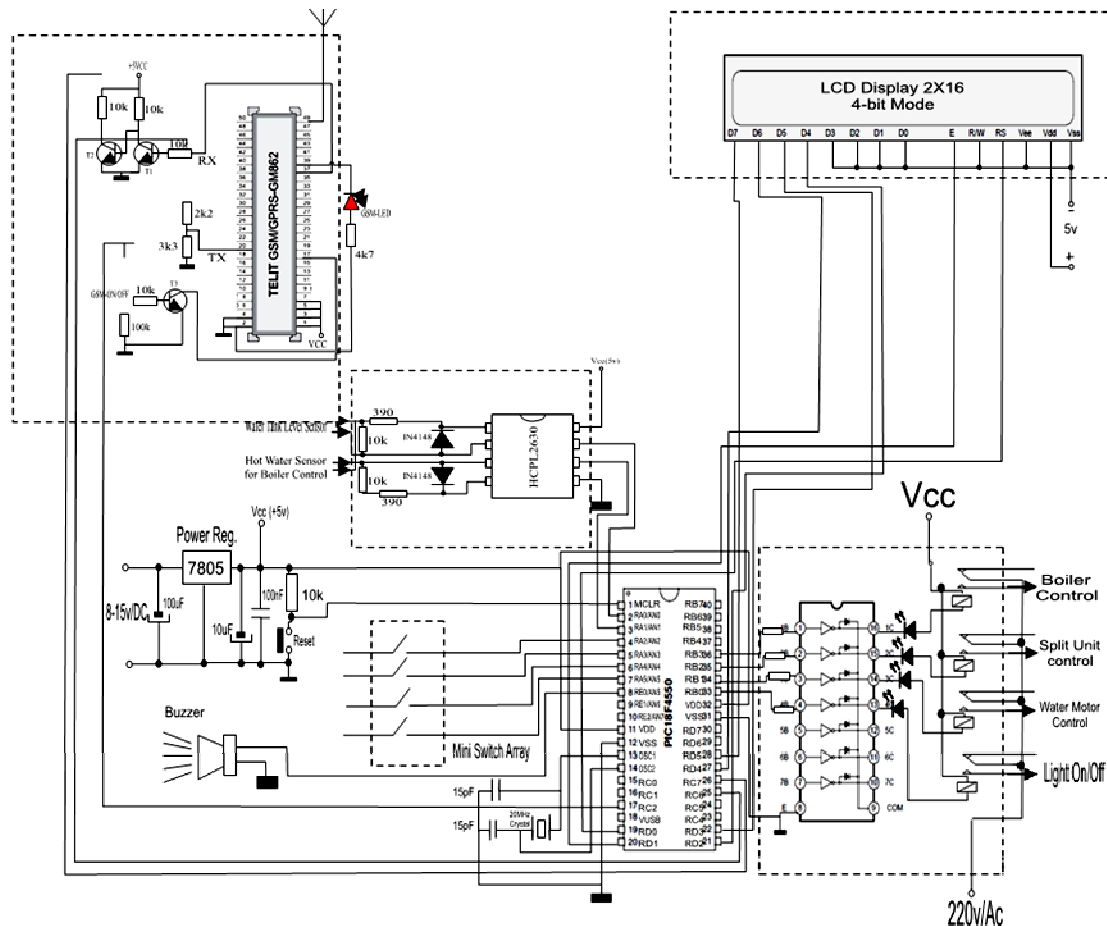**Fig .(12) Hardware Construct of System**

Fig .(13) Electronic Schematic circuit

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