**CHAPTER THREE**

**THE DESIGN OF THE DOMESTIC ENERGY SCHEDULER**

INTRODUCTION

In this chapter, the design of the domestic Energy Scheduler Is Done. The block diagram that constitutes the complete system was drawn while expanding it into various different parts. Each part was analysed, explained and calculations were done on each. The concluding article is on the complete circuit diagram as well as the mode of operation.

BLOCK DIAGRAM

The full system can be represented using blocks where each block contains a section of the complete work. The various sections contained in the work are as follows;

* power supply unit
* manual select button unit
* load control
* display
* microcontroller unit
* input unit

The block diagram for the complete system is as shown overleaf:

**POWER SUPPLY UNIT**

**MICROCONTROLLER UNIT**

**INPUT UNIT**

**LOAD CONTROL UNIT**

**MANUAL SELECT BUTTON UNIT**

**DISPLAY UNIT**

POWER SUPPLY UNIT

This is the circuit that supplies power to the full system. The system obtains its power source from a 220voltas ac power supply source, to deliver a 5 volts output

The circuit diagram is as shown below.



**TRI:** This is the step down transformer. A transformer voltage of 12Vac or above is required. The current should be enough to supply the requirement of the circuit.

The transformer (T1) chosen is

12Vac@300mA.

**D1-D4**: These are the rectifier circuit. The diodes chosen must have a peak inverse voltage (PIV) that must be able to withstand twice the peak voltage (Vp) of the transformers output and a forward current (Dc ) of 1.5 times the output current of the transformer.

Vp = √2 Vrms

Where Vp is the peak voltage of the transformer output.

Vrms is the actual output voltage from the transformer = 12Vac

Vp =√2x12

Vp =1.414x12

Vp=16.97Vac

D (piv) = 2 x Vp

Where D (piv) is the PIV of the rectifier diode

Therefore, D (piv) = 2x16.97

D (piv) = 33.94.

And Dc = 1.5 x 300 x 10-3

Dc = 0.45A

Therefore the required diode must have a:

PIV≥ 33.94V

Dc ≥ 0.45A

From diode catalogue, the IN4007 has the following characteristics:

PIV = 50V

DC = 1A

Consequently, the diode chosen is the IN4007

D1-D4 = IN4007

**C1**: This is the filters capacitor. Electrolytic capacitors come with a capacitance and a voltage rating.

3.3.1 Voltage Rating

The voltage of the capacitor (Vc) must be able to withstand 150% of the output voltage from the diode.

VC = 150% of VDP

Where VDP is the peak output voltage from the diodes

But VDP is given as

VDP = Vp - VD

Where Vp is the peak voltage of the transformer

VDis the voltage drop of the diodes (0.7 2)

VDP = 16.97 – 1.4

VDP = 15.57V

Vc=1.5xVDP

Vc is the voltage rating of the capacitor

Vc = 1.5 x 15.57

Vc = 23.6V

3.3.2 Capacitance Rating:

The capacitance of the capacitor must be such that it could reduce the ripple voltage (VR) to about 30% of the output peak voltage from the diodes.

VR = 30% of VDP

From eqn 3.3, VDP is given as 15.57

VR = x 15.57

VR = 4.67V

From the ripple voltage equation, we could get the capacitance

VR =

Where VR is the ripple voltage

Imax is the maximum current from the diodes/ transformers (300mA)

f is the frequency of supply (50Hz)

C is the capacitance of the capacitor in Farads.

VR = 4.67V (from eqn 3.6.1)

VR (2FC) = Imax

C1=

Substituting,

C1 =

C1 =

C1 = 6.42 x 10-4 F

Converting to µF

C1 =

C1 = 642.4 µF

= 642.4μF

This value cannot be obtained in the market and due to the fact that we require a highly filtered circuit, a capacitor with a high than calculated capacitance can be choosen. Therefore the capacitance chosen is:

C1 = 1000μF @35V

U1: This is the voltage regulator.

Regulator specifications I:

* Maximum input voltage = 30V
* Maximum output voltage = 5.5V
* Operating temperature = 0℅- 150℅

For effective Voltage regulation, the minimum input voltage should be:

V min =V out + V ref

V min – Minimum input voltage

V out – required output voltage: 5V

V ref – Datasheet Stipulated reference voltage; 3V

V min = 5 + 3

V min = 8V

The output voltage after the capacitor is 15.57 volts. This is enough to supply the minimum input voltage (8 volts) Therefore, the voltage regulator could be comfortably used. The regulator chosen is

U1 = 7805

**C2** is a transient capacitor. The rating is stipulated in the 78XX voltage regulator’s data sheet as 0.1uF

Hence,

C2=0.1uF

This capacitor helps for smoothening of the output from the voltage regulator. It is also to prevent spikes in the DC output voltage waveform in the event of transient disturbances. It is known as a buffer capacitor whose value is gotten from the data sheet of the regulator.

Current limiting resistor calculation:

R1=

R1 = 300Ω

This value of resistor is not in the market, so the appropriate value to use is:

R1=330Ω

Light emitting diode characteristics:

Forward current of…..10×10-3A to 10×10-3A

Voltage drop of…….2V

INPUT UNIT

This is s circuit that the system uses to alter the time on and off duration of the loadsThe circuit diagram is as shown below



R: these are pull up resistors. Pull up resistors are always given a range of values from

470Ω to 22kΩ

For the sake of our project, the value chosen for the pull up resistors values are

R = 10kΩ each

MANUAL SELECT BUTTON UNIT

This is the button that the user uses to set the system from automatic back to manual. The circuit diagram is as shown below



R: these are pull up resistors. Pull up resistors are always given a range of values from

470Ω to 22kΩ

For the sake of our project, the value chosen for the pull up resistors values are

R = 10kΩ each

LOAD CONTROL UNIT

This is the circuit that the system uses to control the loads. The circuit diagram is as shown below



The control part of the load actually turns it off or on. This is basically a switch that is built around a static relay using a triac fired by another triac based opto-isolator. An NPN transistor is used to control the low voltage side of the isolator from signals transmitted from a microcontroller terminal.

= a pull up resistor. This is a resistor that is basically used to set a terminal temporarily high. The value is usually from a range of

470Ω to 10,000Ω

For this circuit, the value of 1,000Ω was used.

= this is a current limiting resistor for the light emitting diode inside the low voltage side of the Optoisolator. The formula to calculate the value of current limiting resistors is given thus

R14 =

From the MOC3021 datasheet, the following characteristics of the low voltage side light emitting diode is given as

Forward current, 10 mA

Voltage drop = 2V

While the supply voltage for the system is = 5V

R14 = 300Ω

This value of resistor is not in the market, so the appropriate value to use is:

R14 = 330Ω

= this is the biasing resistor for the NPN transistor. For the transistor to work in the saturation mode, we use the equation

= 10 x

Where is base resistor (330Ω)

Substituting

= 10 x 330Ω

= 3300Ω

= snubber resistor for the triac on inductive loads

Datasheet stipulates the collective resistance to 1kΩ

Therefore

= 1,000Ω

DISPLAY UNIT

This is the unit that the system uses to inform the user on the status and progress of the complete circuit. It serves as an interface between the circuit and the user. The circuit diagram is as shown below



The LCD is 16 x 2 screen display. This means that it can display 16 alphanumeric characters on 2 lines.

RV2: is a resistor to set the contrast of the display.

A 1kΩ variable resistor is the usual value used

MICROCONTROLLER UNIT

The microcontroller unit circuit is the heart of the project. This is where the program for the control part of the project is written and burned using assembly language and a universal programmer, respectively. The circuit diagram is as shown below



THE CIRCUIT DIAGRAM FOR THE MICROCONTROLLER UNIT

The 8052 microcontroller hardware circuit is usually a very flexible one and all the surrounding components are given a recommended range of values, by the datasheet but the actual values can be chosen by the programmer.

The ranges of values given for the 8052 microcontroller hardware are as follows

* Reset capacitor: 4.7µF to 10µF
* Reset resistor: 8.2KΩ to 15 KΩ
* Crystal oscillator: 4MHz to 32MHz
* Crystal capacitors: 27pF to 47pF

For the programming of the domestic energy scheduler, the chosen values are as follows

* Reset capacitor (C1): 10µF
* Reset resistor (R1): 10 KΩ
* Crystal oscillator (X1): 12MHz
* Crystal capacitors (C2 & C3): 33pF

The program codes for the circuit is as follows

;THIS IS A CIRCUIT THAT WILL CONTROL THE TURNING ON AND OFF OF INDUSTRIAL ELECTRICAL EQUIPMENT VIA RESPONSE FROM SWITCHES

;AT START, THE USER WILL BE PROMPTED TO SET THE TIME ON AND TIME OFF OF THE LOADS AS WELL AS THE TIME OF THE DAY.

;THE CIRCUIT WILL PICK UP AND RESPOND APPRIOPRIATELY.

;THIS TIME ON AND OFF AS WELL AS THE TIME OF THE DAY, CAN BE EDITED ANYTIME BY THE USER.

;DECLARATIONS FOR SIMULATION

;LCD\_PORT EQU P2

;RS\_BIT EQU P3.5

;RW\_BIT EQU P3.6

;EN\_BIT EQU P3.7

;LOAD1 EQU P1.0

;LOAD2 EQU P1.1

;LOAD3 EQU P1.2

;LOAD4 EQU P1.3

;STAT\_LED EQU P1.4

;YES\_UP EQU P0.0

;NO\_DOWN EQU P0.1

;ENTER EQU P0.2

;DECLARATIONS FOR real life

LCD\_PORT EQU P2

RS\_BIT EQU P3.4

RW\_BIT EQU P3.6

EN\_BIT EQU P3.5

LOAD1 EQU P0.3

LOAD2 EQU P0.2

LOAD3 EQU P0.1

LOAD4 EQU P0.0

STAT\_LED EQU P0.5

YES\_UP EQU P1.5

NO\_DOWN EQU P1.4

ENTER EQU P1.3

LOAD1\_ON\_HR EQU 40H ;THESE ARE WHERE THE SET VALUES OF ON AND OFF TIME ARE STORED. COLLECTED FROM PHONE

LOAD1\_OFF\_HR EQU 41H

LOAD1\_ON\_MIN EQU 42H

LOAD1\_OFF\_MIN EQU 43H

LOAD2\_ON\_HR EQU 44H

LOAD2\_OFF\_HR EQU 45H

LOAD2\_ON\_MIN EQU 46H

LOAD2\_OFF\_MIN EQU 47H

LOAD3\_ON\_HR EQU 48H

LOAD3\_OFF\_HR EQU 49H

LOAD3\_ON\_MIN EQU 4AH

LOAD3\_OFF\_MIN EQU 4BH

LOAD4\_ON\_HR EQU 4CH

LOAD4\_OFF\_HR EQU 4DH

LOAD4\_ON\_MIN EQU 4EH

LOAD4\_OFF\_MIN EQU 4FH

HOUR EQU 60H ;COLLECTED TIME FROM PHONE

MINUTE EQU 61H

SECOND EQU 62H

LOAD\_ON\_HR EQU 63H ;USED TO SET THE STATUS OF THE LOADS

LOAD\_OFF\_HR EQU 64H

LOAD\_ON\_MIN EQU 65H

LOAD\_OFF\_MIN EQU 66H

HR1 EQU 67H ;for display

HR2 EQU 68H

MIN1 EQU 69H

MIN2 EQU 6AH

SEC1 EQU 6BH

SEC2 EQU 6CH

ADJ EQU 6DH ;SET THE DURATION OF THE CLOCK

SET\_REG EQU R6 ;REGISTER TO SET TIME

LOAD\_STATUS EQU 6EH ;DETERMINES IF THE LOAD WILL ON OR OFF

ORG 0000H

LJMP MAIN

ORG 000BH

LJMP INTERUPT

ORG 0030H

MAIN:

;INITIALIZATION

SETB LOAD1 ;TURN OFF ALL THE Loads

SETB LOAD2

SETB LOAD3

SETB LOAD4

CLR STAT\_LED

SETB YES\_UP ;MAKE INPUT

SETB NO\_DOWN

SETB ENTER

MOV ADJ,#18

;PROGRAM STARTS HERE

LCALL PROJ1

LCALL HALF\_SEC

LCALL PROJ2

LCALL ONE\_SEC

REJOIN: LCALL PROJ3

LCALL HALF\_SEC

LCALL PROJ4

SETB STAT\_LED

LCALL LONG\_DELAY

;TURN ON ALL THE LOADS, THEN TURN EM OFF AGAIN

CLR LOAD1

LCALL ONE\_SEC

CLR LOAD2

LCALL ONE\_SEC

CLR LOAD3

LCALL ONE\_SEC

CLR LOAD4

CLR STAT\_LED

LCALL LONG\_DELAY

CLR STAT\_LED

SETB LOAD1

LCALL HALF\_SEC

SETB LOAD2

LCALL HALF\_SEC

SETB LOAD3

LCALL HALF\_SEC

SETB LOAD4

LCALL ONE\_SEC

SETB STAT\_LED

LCALL HALF\_SEC

;set the time off/on of the loads and also the clock

MOV SET\_REG,#00H ;EMPTY REGISTER FIRST

LCALL SET\_LOAD1\_ON ;DISPLAY SETTING OF ON TIME

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1 ;SUBROUTINE TO SET TIME ON/OFF

MOV LOAD1\_ON\_HR,HOUR

MOV LOAD1\_ON\_MIN,MINUTE

MOV SET\_REG,#00H

LCALL SET\_LOAD1\_OFF

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD1\_OFF\_HR,HOUR

MOV LOAD1\_OFF\_MIN,MINUTE

;FOR LOAD 2

MOV SET\_REG,#00H

LCALL SET\_LOAD2\_ON

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD2\_ON\_HR,HOUR

MOV LOAD2\_ON\_MIN,MINUTE

MOV SET\_REG,#00H

LCALL SET\_LOAD2\_OFF

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD2\_OFF\_HR,HOUR

MOV LOAD2\_OFF\_MIN,MINUTE

;FOR LOAD 3

MOV SET\_REG,#00H

LCALL SET\_LOAD3\_ON

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD3\_ON\_HR,HOUR

MOV LOAD3\_ON\_MIN,MINUTE

MOV SET\_REG,#00H

LCALL SET\_LOAD3\_OFF

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD3\_OFF\_HR,HOUR

MOV LOAD3\_OFF\_MIN,MINUTE

;FOR LOAD 4

MOV SET\_REG,#00H

LCALL SET\_LOAD4\_ON

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD4\_ON\_HR,HOUR

MOV LOAD4\_ON\_MIN,MINUTE

MOV SET\_REG,#00H

LCALL SET\_LOAD4\_OFF

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

MOV LOAD4\_OFF\_HR,HOUR

MOV LOAD4\_OFF\_MIN,MINUTE

LCALL RESET\_CLOCK ;THIS SETS THE TIME OF THE DAY

MOV SET\_REG,#00H

MOV HOUR,#00

MOV MINUTE,#00

MOV SECOND,#00

LCALL CONVERSIONS

LCALL TIME\_DIS

LCALL SETTING1

LCALL SETTING\_DONE

LCALL LONG\_DELAY

DONE: MOV R2,ADJ ;REPEAT A PROCESS 18 TIMES

MOV IE,#82H ;ENABLES TIMER0 OVER FLOW INTERUPT

RELOAD: MOV TMOD,#01H ;SELECT MODE 1 OF TIMER ZERO

MOV TL0,#0B0H ;LOADS THE TIMER TO BE ABLE TO

MOV TH0,#03CH ;MAKE A 50MS DELAY

SETB TR0

LCALL THE\_TIME\_IS

REAL\_LOOP: LCALL LOAD\_OPERATION

JB ENTER,REAL\_LOOP

MOV IE,#00

CLR TR1

LCALL SYSTEM\_RESET

LCALL YES\_NO

LCALL ONE\_SEC

IMPLY: JNB YES\_UP,BOLD

JNB NO\_DOWN,CHICKEN

SJMP IMPLY

CHICKEN: LCALL INVALID\_COMMAND

LCALL LONG\_DELAY

SJMP DONE

BOLD: LJMP REJOIN

;

;SUBROUTINE STARTS HERE

;SUBROUTINE STARTS HERE

;PROG TO ACTUALLY USE THE STATUS TO TURN ON OR OFF OF THE LOAS

LOAD\_OPERATION: MOV LOAD\_ON\_HR,LOAD1\_ON\_HR

MOV LOAD\_ON\_MIN,LOAD1\_ON\_MIN

MOV LOAD\_OFF\_HR,LOAD1\_OFF\_HR

MOV LOAD\_OFF\_MIN,LOAD1\_OFF\_MIN

LCALL ROUTINE1

JC ONS1

SJMP OFFS1

ONS1: CLR LOAD1 ;CLR MEANS TURN ON

SJMP LOAD2\_OPERATION

OFFS1: SETB LOAD1 ;SETB IS TURN OFF

LOAD2\_OPERATION: MOV LOAD\_ON\_HR,LOAD2\_ON\_HR

MOV LOAD\_ON\_MIN,LOAD2\_ON\_MIN

MOV LOAD\_OFF\_HR,LOAD2\_OFF\_HR

MOV LOAD\_OFF\_MIN,LOAD2\_OFF\_MIN

LCALL ROUTINE1

JC ONS2

SJMP OFFS2

ONS2: CLR LOAD2

SJMP LOAD3\_OPERATION

OFFS2: SETB LOAD2

LOAD3\_OPERATION: MOV LOAD\_ON\_HR,LOAD3\_ON\_HR

MOV LOAD\_ON\_MIN,LOAD3\_ON\_MIN

MOV LOAD\_OFF\_HR,LOAD3\_OFF\_HR

MOV LOAD\_OFF\_MIN,LOAD3\_OFF\_MIN

LCALL ROUTINE1

JC ONS3

SJMP OFFS3

ONS3: CLR LOAD3

SJMP LOAD4\_OPERATION

OFFS3: SETB LOAD3

LOAD4\_OPERATION: MOV LOAD\_ON\_HR,LOAD4\_ON\_HR

MOV LOAD\_ON\_MIN,LOAD4\_ON\_MIN

MOV LOAD\_OFF\_HR,LOAD4\_OFF\_HR

MOV LOAD\_OFF\_MIN,LOAD4\_OFF\_MIN

LCALL ROUTINE1

JC ONS4

SJMP OFFS4

ONS4: CLR LOAD4

SJMP LOAD\_OPERATION\_DONE

OFFS4: SETB LOAD4

LOAD\_OPERATION\_DONE: NOP

RET

;02:05:53

;subroutine that loads the registrer that will control the turn off an turn on of the load

ROUTINE1: MOV A,LOAD\_ON\_HR ;when its set to 3, and time is 2. load should off

CJNE A,HOUR,ASK1A

MOV A,LOAD\_ON\_MIN

CJNE A,MINUTE,MIN\_CHECK1

SJMP ON\_LOAD

MIN\_CHECK1: JNC OFF\_LOAD

MOV A,LOAD\_OFF\_HR

CJNE A,HOUR,ASK1C

SJMP MIN\_CHECK1A

ASK1A: JNC OFF\_LOAD

MOV A,LOAD\_OFF\_HR ;if its not up to the off time, then load should on. if it is, load should off

CJNE A,HOUR,ASK1C

MIN\_CHECK1A: MOV A,LOAD\_OFF\_MIN

CJNE A,MINUTE,MIN\_CHECK2

SJMP OFF\_LOAD

MIN\_CHECK2: JC OFF\_LOAD

SJMP ON\_LOAD

ASK1C: JC OFF\_LOAD

SJMP ON\_LOAD

OFF\_LOAD: CLR CY

SJMP STOPS1

ON\_LOAD: SETB CY

SJMP STOPS1

STOPS1: MOV A,#00H

MOV LOAD\_ON\_HR,A

MOV LOAD\_OFF\_HR,A

MOV LOAD\_ON\_MIN,A

MOV LOAD\_OFF\_MIN,A

NOP

RET

;on,00:00..off,23:59.....................1:20,1:30,1:35, FOR 2,3,4,5

INTERUPT: CLR TR0 ;STOPS THE TIMER

CLR TF0 ;CLEARS THE OVERFLOW FOR THE TIMER, WAITING FOR THE NEXT ROUND

DEC R2 ;VALUE TO ENSURE ONE SEC COUNT DOWN

MOV TL0,#0B0H ;RELOADS LOADS THE TIMER TO BE ABLE TO

MOV TH0,#03CH ;MAKE A 50MS DELAY

CJNE R2,#00,EXIT0 ;IS IT ONE SEC YET? NO,REPEAT PROCESS,YES,TAKE ACTION

ACALL OUTS ;CALL UP THE SUBROUTINE TO COUNT (SHOULD REFILL THE R2 REGISTER)

EXIT0: SETB TR0 ;RESTARTS THE TIMER

RETI

OUTS: MOV R3,SECOND

MOV R4,MINUTE

MOV R5,HOUR

CJNE R3,#59,ASK13

ASK13: JNC RESETS1

INC R3

SJMP LOST

RESETS1: MOV R3,#00 ;RESETS THE SECONDS

CJNE R4,#59,ASK23

ASK23: JNC RESETS2

INC R4

SJMP LOST

RESETS2: MOV R4,#00 ;RESET THE MINUTES

CJNE R5,#23,ASK33

ASK33: JNC RESETS3

INC R5

SJMP LOST

RESETS3: MOV R5,#00 ;RESET THE HOUR

LOST: MOV SECOND,R3

MOV MINUTE,R4

MOV HOUR,R5

MOV R2,ADJ

CPL STAT\_LED

LCALL CONVERSIONS

LCALL TIME\_DIS

NOP

RET

SETTING1: JNB YES\_UP,UP\_HR ;SETTING THE TIME

JNB NO\_DOWN,LO\_HR

JNB ENTER,DONE1

SJMP SETTING1

UP\_HR: LCALL HALF\_SEC

CJNE SET\_REG,#23,GOOD1

MOV SET\_REG,#00

SJMP READY1

GOOD1: INC SET\_REG

SJMP READY1

LO\_HR: LCALL HALF\_SEC

CJNE SET\_REG,#00,GOOD2

MOV SET\_REG,#23

SJMP READY1

GOOD2: DEC SET\_REG

SJMP READY1

READY1: MOV HOUR,SET\_REG

LCALL CONVERSIONS

LCALL TIME\_DIS

SJMP SETTING1

DONE1: CLR STAT\_LED

LCALL ONE\_SEC

SETB STAT\_LED

MOV SET\_REG,#00H ;EMPTY REGISTER FIRST

LCALL CONVERSIONS

LCALL TIME\_DIS

SETTING2: JNB YES\_UP,UP\_MIN ;SETTING THE TIME

JNB NO\_DOWN,LO\_MIN

JNB ENTER,DONE2

SJMP SETTING2

UP\_MIN: LCALL HALF\_SEC

CJNE SET\_REG,#59,GOOD1B

MOV SET\_REG,#00

SJMP READY2

GOOD1B: INC SET\_REG

SJMP READY2

LO\_MIN: LCALL HALF\_SEC

CJNE SET\_REG,#00,GOOD2B

MOV SET\_REG,#59

SJMP READY2

GOOD2B: DEC SET\_REG

SJMP READY2

READY2: MOV MINUTE,SET\_REG

LCALL CONVERSIONS

LCALL TIME\_DIS

SJMP SETTING2

DONE2: CLR STAT\_LED

LCALL ONE\_SEC

SETB STAT\_LED

NOP

RET

CONVERSIONS: MOV A,HOUR

MOV B,#10

DIV AB

MOV HR2,B

MOV HR1,A

MOV A,MINUTE

MOV B,#10

DIV AB

MOV MIN2,B

MOV MIN1,A

MOV A,SECOND

MOV B,#10

DIV AB

MOV SEC2,B

MOV SEC1,A

MOV A,HR1

ORL A,#30H

MOV HR1,A

MOV A,HR2

ORL A,#30H

MOV HR2,A

MOV A,MIN1

ORL A,#30H

MOV MIN1,A

MOV A,MIN2

ORL A,#30H

MOV MIN2,A

MOV A,SEC1

ORL A,#30H

MOV SEC1,A

MOV A,SEC2

ORL A,#30H

MOV SEC2,A

NOP

RET

TIME\_DIS: MOV DPTR,#DISCOM

COM01: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2 ;CALL COMMAND SUBROUTINE

LCALL SHORT\_DELAY ;GIVE THE LCD SOMETIME

INC DPTR

JZ DAT01

SJMP COM01

DAT01: MOV A,HR1

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,HR2

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,#':'

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,MIN1

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,MIN2

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,#':'

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,SEC1

LCALL DATAWRT2

LCALL SHORT\_DELAY

MOV A,SEC2

LCALL DATAWRT2

LCALL SHORT\_DELAY

NOP

RET

;DISPLAY SUBS

PROJ1: MOV DPTR,#UPCOM

C01: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT01

SJMP C01

SEND\_DAT01: MOV DPTR,#MYDATA1 ;DISPLAYS " DESIGN AND"

D01: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT01

SJMP D01

EXIT01: NOP

RET

PROJ2: MOV DPTR,#DOWNCOM

C02: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT02

SJMP C02

SEND\_DAT02: MOV DPTR,#MYDATA2 ;DISPLAYS " CONSTRUCTION OF"

D02: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT02

SJMP D02

EXIT02: NOP

RET

PROJ3: MOV DPTR,#UPCOM

C03: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT03

SJMP C03

SEND\_DAT03: MOV DPTR,#MYDATA3 ;DISPLAYS " A GSM BASED BABY "

D03: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT03

SJMP D03

EXIT03: NOP

RET

PROJ4: MOV DPTR,#DOWNCOM

C04: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT04

SJMP C04

SEND\_DAT04: MOV DPTR,#MYDATA4 ;DISPLAYS " MONITOR DEVICE"

D04: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT04

SJMP D04

EXIT04: NOP

RET

TIME\_IS: MOV DPTR,#UPCOM

C05: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT05

SJMP C05

SEND\_DAT05: MOV DPTR,#MYDATA5 ;DISPLAYS " BY "

D05: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT05

SJMP D05

EXIT05: NOP

RET

SEE\_CLOCK: MOV DPTR,#DOWNCOM

C06: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT06

SJMP C06

SEND\_DAT06: MOV DPTR,#MYDATA6 ;DISPLAYS " ADIYU NNEKA JOY "

D06: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT06

SJMP D06

EXIT06: NOP

RET

SET\_LOAD1\_ON: MOV DPTR,#UPCOM

C07: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT07

SJMP C07

SEND\_DAT07: MOV DPTR,#MYDATA7 ;DISPLAYS " MAT NUMBER "

D07: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT07

SJMP D07

EXIT07: NOP

RET

SET\_LOAD1\_OFF: MOV DPTR,#UPCOM

C08: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT08

SJMP C08

SEND\_DAT08: MOV DPTR,#MYDATA8 ;DISPLAYS " DEPARTMENT OF EEE"

D08: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT08

SJMP D08

EXIT08: NOP

RET

SET\_LOAD2\_ON: MOV DPTR,#UPCOM

C09: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT09

SJMP C09

SEND\_DAT09: MOV DPTR,#MYDATA9 ;DISPLAYS " UNIBEN "

D09: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT09

SJMP D09

EXIT09: NOP

RET

SET\_LOAD2\_OFF: MOV DPTR,#UPCOM

C10: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT10

SJMP C10

SEND\_DAT10: MOV DPTR,#MYDATA10 ;DISPLAYS " SCANNING "

D10: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT10

SJMP D10

EXIT10: NOP

RET

SET\_LOAD3\_ON: MOV DPTR,#UPCOM

C11: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT11

SJMP C11

SEND\_DAT11: MOV DPTR,#MYDATA11 ;DISPLAYS " AREA...."

D11: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT11

SJMP D11

EXIT11: NOP

RET

SET\_LOAD3\_OFF: MOV DPTR,#UPCOM

C12: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT12

SJMP C12

SEND\_DAT12: MOV DPTR,#MYDATA12 ;DISPLAYS " AREA.... "

D12: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT12

SJMP D12

EXIT12: NOP

RET

SET\_LOAD4\_ON: MOV DPTR,#UPCOM

C13: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT13

SJMP C13

SEND\_DAT13: MOV DPTR,#MYDATA13 ;DISPLAYS " SECURED "

D13: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT13

SJMP D13

EXIT13: NOP

RET

SET\_LOAD4\_OFF: MOV DPTR,#UPCOM

C14: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT14

SJMP C14

SEND\_DAT14: MOV DPTR,#MYDATA14 ;DISPLAYS " INTRUDER "

D14: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT14

SJMP D14

EXIT14: NOP

RET

SETTING\_DONE: MOV DPTR,#UPCOM

C15: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT15

SJMP C15

SEND\_DAT15: MOV DPTR,#MYDATA15 ;DISPLAYS " INTRUDER "

D15: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT15

SJMP D15

EXIT15: NOP

RET

THE\_TIME\_IS: MOV DPTR,#UPCOM

C16: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT16

SJMP C16

SEND\_DAT16: MOV DPTR,#MYDATA16 ;DISPLAYS " INTRUDER "

D16: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT16

SJMP D16

EXIT16: NOP

RET

RESET\_CLOCK: MOV DPTR,#UPCOM

C17: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT17

SJMP C17

SEND\_DAT17: MOV DPTR,#MYDATA17 ;DISPLAYS " INTRUDER "

D17: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT17

SJMP D17

EXIT17: NOP

RET

SYSTEM\_RESET: MOV DPTR,#UPCOM

C18: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT18

SJMP C18

SEND\_DAT18: MOV DPTR,#MYDATA18 ;DISPLAYS "INTRUDER"

D18: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT18

SJMP D18

EXIT18: NOP

RET

YES\_NO: MOV DPTR,#DOWNCOM

C19: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT19

SJMP C19

SEND\_DAT19: MOV DPTR,#MYDATA19 ;DISPLAYS " INTRUDER "

D19: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT19

SJMP D19

EXIT19: NOP

RET

INVALID\_COMMAND: MOV DPTR,#UPCOM

C20: CLR A

MOVC A,@A+DPTR

LCALL COMNWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ SEND\_DAT20

SJMP C20

SEND\_DAT20: MOV DPTR,#MYDATA20 ;DISPLAYS " INTRUDER "

D20: CLR A

MOVC A,@A+DPTR

LCALL DATAWRT2

LCALL SHORT\_DELAY

INC DPTR

JZ EXIT20

SJMP D20

EXIT20: NOP

RET

;ldc commands and lcd data

COMNWRT2: ;SEND COMMAND TO LCD

MOV LCD\_PORT,A ;COPY REG A TO P1

CLR RS\_BIT ;RS=0 FOR COMMAND

CLR RW\_BIT ;R/W= FOR WRITE

SETB EN\_BIT ;E=1 FOR HIGH PULSE

LCALL SHORT\_DELAY ;GIVE LCD SOMETIME

CLR EN\_BIT ;E=0 FOR H-TO-L PULSE

RET

DATAWRT2: ;WRITE DATA TO LCD

MOV LCD\_PORT,A ;COPY REG A TO PORT 1

SETB RS\_BIT ;RS=1 FOR DATA

CLR RW\_BIT ;R/W=0 FOR WRITE

SETB EN\_BIT ;E=1 FOR HIGH PULSE

LCALL SHORT\_DELAY ;GIVE LCD SOME TIME

CLR EN\_BIT ;E=0 FOR H-TO-L PULSE

RET

;delay subroutines

LONG\_DELAY: MOV 35H,#20

BACK3: MOV 36H,#255

BACK2: MOV 37H,#255

BACK1: DJNZ 37H,BACK1

DJNZ 36H,BACK2

DJNZ 35H,BACK3

RET

ONE\_SEC: MOV 35H,#10

SEC3X: MOV 36H,#255

SEC2X: MOV 37H,#255

SEC1X: DJNZ 37H,SEC1X

DJNZ 36H,SEC2X

DJNZ 35H,SEC3X

RET

HALF\_SEC: MOV 35H,#4

SEC30: MOV 36H,#255

SEC20: MOV 37H,#255

SEC10: DJNZ 37H,SEC10

DJNZ 36H,SEC20

DJNZ 35H,SEC30

RET

SHORT\_DELAY: MOV 38H,#255

AGAIN3: DJNZ 38H,AGAIN3

RET

DELAY: MOV 35H,#2

SEC30X: MOV 36H,#255

SEC20X: MOV 37H,#255

SEC10X: DJNZ 37H,SEC10X

DJNZ 36H,SEC20X

DJNZ 35H,SEC30X

RET

MYDATA1: DB " DESIGN AND ",0

MYDATA2: DB "CONSTRUCTION OF ",0

MYDATA3: DB "ELECTRICAL LOADS",0

MYDATA4: DB "PLANNING SYSTEM ",0

MYDATA5: DB " TIME IS ",0

MYDATA6: DB " 00:00:00 ",0

MYDATA7: DB " SET LOAD 1 ON ",0

MYDATA8: DB " SET LOAD 1 OFF ",0

MYDATA9: DB " SET LOAD 2 ON ",0

MYDATA10: DB " SET LOAD 2 OFF ",0

MYDATA11: DB " SET LOAD 3 ON ",0

MYDATA12: DB " SET LOAD 3 OFF ",0

MYDATA13: DB " SET LOAD 4 ON ",0

MYDATA14: DB " SET LOAD 4 OFF ",0

MYDATA15: DB " SETTING DONE ",0

MYDATA16: DB " THE TIME IS ",0

MYDATA17: DB "RESET THE CLOCK ",0

MYDATA18: DB " SYSTEM RESET? ",0

MYDATA19: DB " YES NO ",0

MYDATA20: DB "INVALID COMMAND ",0

UPCOM: DB 38H,06,0EH,80H,01,0 ;COMMANDS AND NULL

DOWNCOM: DB 38H,06,0EH,0C0H,0

DISCOM: DB 38H,06,0CH,0C4H,0

END

COMPLETE CIRCUIT DIAGRAM



MODE OF OPERATION

The mode of operation of the industrial based electrical energy scheduler works on the principle that a power source should not be over loaded. This system provides a smart way to systematically load the source so that it will not be a burden on it. It involves timing the duration of the turn on and turn off of the load, via a wireless means.

The loads are domestic based so the switches are made up of static relays (BT136) which is controlled by the 8052 microcontroller, via an Opto-triac MOC3021.

The push buttons are used to set the time on and time off duration of the loads. The LCD screen prompts the user to input the times of the various loads as well as an opportunity to set the durations.

The complete system operates on a 5 VDC power supply obtained from a 220vac power source. This power source is from the public mains and the power will be stepped down using a step down transformer that will step down the voltage from a high one to a low one then enable rectifier bridge diodes to convert the voltage to a pulsating voltage. A filter capacitor will be used to filter off the ripples before the voltage will be fed through a voltage regulator integrated circuit, 7805. This will finally ensure that the required 5 volts dc power required to operate the system, is available.