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# DEVELOPMENT OF AUTOMATIC ROOM LIGHT CONTROL SYSTEM USING PIC 16F877 WITH COUNTING CAPABILTY

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## ABSTRACT

*In this paper, a detail implementation of Microcontroller based automatic room light control system capable of counting the number of persons in a room is presented. The microcontroller, 16F877A is programmed in such a way that the lighting in the room is controlled by the passage of individuals in or out of the room using TSOPI738 IR sensor which is automatic switching device that sense human presence and control the light system accordingly either by turning on/off the lighting system and then count the total number of people present in the room at any given time which is also displayed on LCD. The microcontroller tries to recognize the specific source of signal when clucked by any of the Shadow (i.e., entering of person into the room ) the microcontroller increment the counter to +1,+2,+3 then transistors T1 and T2 are triggered so that T1 drives LCD showing a number; 1,2,3 while T2 energizes the electromechanical relay to turn on the light. But if signal is dim ( i.e., exit of person from the room ), microcontroller decrement the counter to -1,-2,-3 and LCD displays numbers; 3,2,1 and light will still be on until the last person goes out when LCD will then automatically show 00.*

***Keywords****: Automatic Room Light Control System, IR Sensor, LCD, 16F877A Microcontroller.*

## 1. INTRODUCTION

In today's world, there is a continuous need for automatic appliances. With the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life such as if at all one wants to know the number of people present in a room so as not to have congestion**,** this paper proves to be helpful.

All lighting systems are operated with lighting controls, devices that switch lights on and off or devices that dim light output. The most common and basic lighting control is a simple on-off switch, which when flipped, opens and closes the circuit, feeding or cutting off the electric current necessarily to operate the lamps.

While the basic switch is economical in terms of initial cost, they can actually become quite expensive over time in terms of total ownership cost. If you look at most large city skylines at night, we see an almost majestic view of skyscrapers dotted with thousands of lights, each of them a window offering a view of an office or space that is lighted but unoccupied. Lighting system operation costs money, and yet organizations lose profits every day by paying to operate lighting systems when nobody is there to work. It's like paying workers to sit and do nothing. A solution is the adoption of automatic lighting controls that switch the lights or dim them, based on occupancy, time of day and availability of daylight. In this presentation, we will focus on occupancy sensors (TSOP1738 IR sensors). Occupancy sensors are automatic switching devices that sense human presence and control the lighting system accordingly, either by turning on/off the lighting system or, in tandem with other controls, increasing/decreasing light output. Therefore, an infrared operated bedroom light switch is a further step of solid state switching, where a bulb can be switched on or off.

## 2. DESIGN OF THE PROPOSED CIRCUIT

This shows the basic approach used to arrive at the design of the individual module of an Infrared operating bed room light switch with bi-directional counter. Here the basic rules of electronics are used to calculate circuit parameters.

### 2.1 Power Supply Unit

Most of the electronic device and circuits require DC source for their operation. The most convenient and economical source of power is AC supply, it is advantageous to convert this alternating (usually, 240v r.m.s) to DV voltage (usually smaller in value). This process of converting AC voltage to DC is accomplished with the help of step down transformer, rectifier, filter and regulator circuit. The choice of our transformer is determined by the total maximum current rating of the component of our circuit. Therefore the maximum current ratings of the components used in this work are given in table 1.0

Table 1.0 Maximum Current Rating of The Components.

| Components | Number of components | Maximum input current(mA) | Total currents (mA) |
|---|---|---|---|
| PIC16F877A | 1 | 60 | 60 |
| Transistor | 4 | 100 | 400 |

| | | | |
|---|---|---|---|
| Infrared | 2 | 20 | 40 |
| LCD | 1 | 160 | 160 |
| Others | | 20 | 20 |
| | Total | | 680 |

### 2.2 Transformer Selection

The major factors considered in the selection and design of a transformer are:

1. The mains supply (240V).
2. The maximum and minimum values of operating voltage and current.
3. The estimation of the maximum current of the system.

Form the table 3.1, the worst case maximum current approximately 1400Ma transformer design.

AC supply from the mains is rated at between 220V to 240V; 50Hz.the power rating of a transformer can be calculated following the determination of the maximum current flowing in the circuit as estimated at full load in section 3.1.

For a maximum, current estimated of 1400mA, if a 240/24V, 1500mA transformer is selected the power rating of the transformer assuming a unit power factor is given by

$$P = IV$$

This, $P = 24 * 1500 * 10^{-3}$VA

$$P = 36VA$$

It follows therefore, that the rating of the chosen transformer is as follows:

Primary voltage = 240 V

Secondary voltage = 24V

Power = 36 W at unity power factor

A full bridge rectifier, capacitor filter and a 7805 and 7812 regulators IC are used to provide the required DC voltage such as 12V for relay switch and 5V for PIC16F877A and others parts. The circuit diagram and waves form of the power supply is shown in fig 2.0

### 2.3Full Wave Rectifier

For this design a full wave rectification was adopted with four IN4001 diodes and 240/24V Transformer as follows.

The average output voltage from the full wave rectifier is evaluated by integrating the sinusoidal input over the whole period of the signal is given as follows:

$$C_1 = 1500 \times \frac{10^{-3}}{4 \times 50(33.94 - 24)} = 754.52\ \mu F$$

For practical purpose a standard value of 1000 $\mu F$ was chosen in this design.

The complete circuit of power supply is shown in figure 2.0

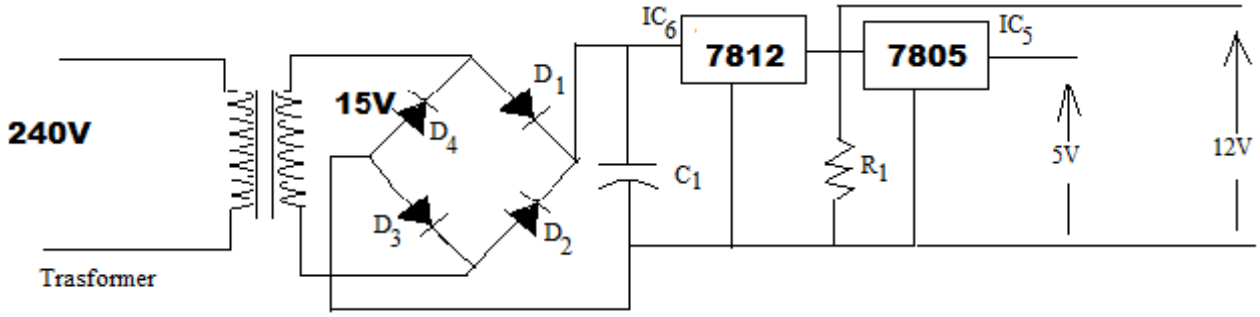


Figure 2.0 Power Supply Circuit.

### 2.4 Infrared Sensing Unit

This unit as shown in fig. 3.0 is used to sense the human passage across a door for both inlet and outlet, by using infrared sensor, which employed laser diode and photodiode

$$R_{LD} = \frac{V_{DD} - V_{LD}}{I_{LD}}$$

The values obtained from datasheet for both laser diode and photodiode.

$V_{DD} = 5V$

$V_{LD} = 1.5V$

$I_{LD} = 20mA$

$$R_{LD} = \frac{5 - 1.5}{20 \times 10^{-3}}$$

$RLD = 175\Omega$

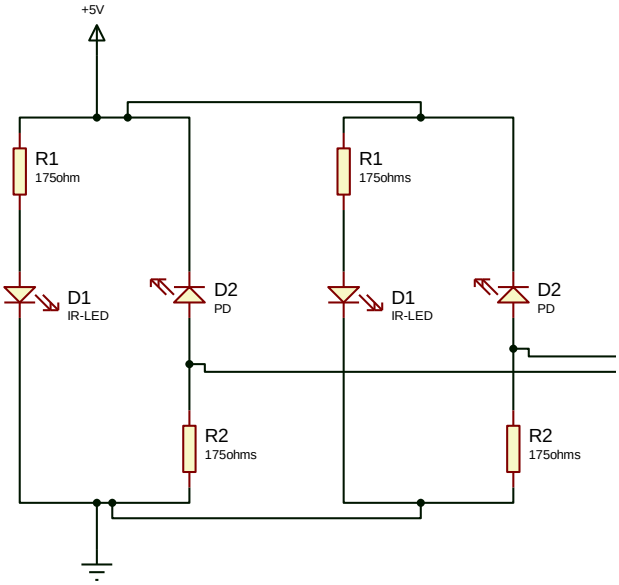


Fig 3.0 Infrared sensor unit

## 2.5Microcontroller

The control unit is mainly the PIC16F877A microcontrollers IC there are necessary interface circuit in order to operate properly.

## 2.6 The Crystal Oscillator

In applications where great time precision is not necessary, Crystal oscillator offers additional savings during purchase. The standard crystal oscillator gives an accurate frequency and in this 4MHz crystal was used,

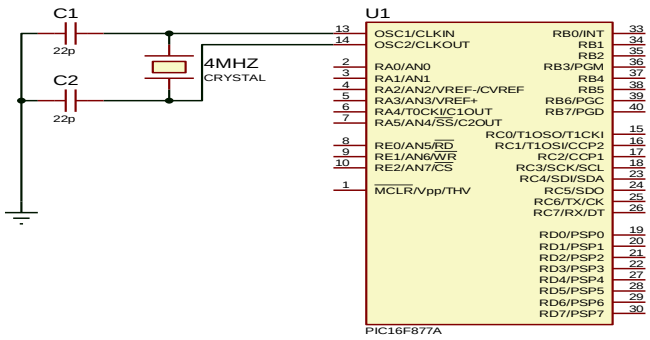


Fig 4.0 crystal oscillator connection

The above diagram shows how XT oscillator is connected with PIC16F877A. With value of capacitor22pF, oscillator can become stable. A clock of the oscillator must be divided by 4. Oscillator clock divided by 4 can also be obtained on OSC2/CLKOUT pin, and can be used for testing or synchronizing other logical circuits. $The\ frequency = \frac{1}{4} \times 4 \times 10^6 = 1MHz$

## 2.7The Master Clear

The master clear (MCLR) is used for putting the microcontroller into a 'known' condition. This practically means that microcontroller can behave rather inaccurately under certain undesirable conditions. In order to continue its proper functioning it has to be reset, meaning all registers would be placed in a starting position. Reset is not only used when microcontroller doesn't behave the way we want it to, but can also be used when trying out a device as an interrupt in program execution. The connection in fig 5.0 below.

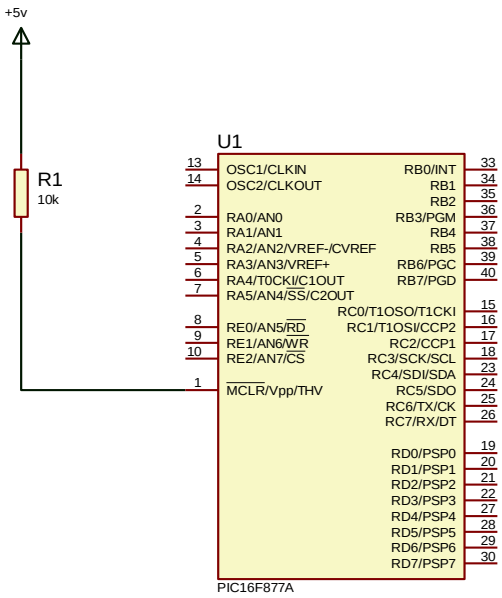


Fig 5.0 resetting the PIC16F877A via MCLR

## CIRCUIT OPERATION OF AN INFRARED OPERATED BEDROOM LIGHT SWITCH.

With bi-directional counter, the operation of the circuit is simple and easy to understand. Initially the power supply is switch on position, when a person enters into the room the light emitting diode receive an infrared signal that has been sent back to an IR sensor which drive that in turn activate the microcontroller 16F877A (the brain of the whole system). 16F877A is loaded with a program capable of controlling the LCD for display and the relay for turn on the bulb.

A microcontroller tries to recognize the specific source of signal when clucked by any of the shadow (i.e., entering of person into the room ) the microcontroller increment the counter to +1,+2,+3 then transistors T1 and T2 are triggered so that T1 drives LCD showing a number; 1,2,3 while T2 energizes the electromechanical relay to turn on the light.

But if signal is dim (i.e., exit of person from the room), microcontroller decrement the counter to -1,-2,-3 and LCD displays numbers; 3, 2, 1 and light will still be on until the last person goes out when LCD will then automatically show 00.

## 3. TESTING AND RESULT

The test of the system is made with three person, when the first person enter into the room automatically the light goes on and LCD display 1, light remain on when the second and third person enter such that LCD shows 2 then 3. When the three person leaving the room one after the other, the LCD display 2, 1, and 00 respectively. When the last person leaves the room, the light turn off and LCD display 00.

## 4. CONCLUSIONS

This circuit has been successfully completed and tested. The device was used to turn on a bulb automatically when somebody enters the bedroom. In addition, the presence of the visitor was detected and counted incrementally. The counter decremented in value anytime a visitor left the room. This device is useful and it finds application in diverse areas of life. Top among such are:

- For counting purposes and automatic room light control.
- Usage in domestic appliances; switching automatically any appliance using ac supply.
- It could be using in school, lecture hall, exam hall to avoid congestion and exam mall practice.
- With some modification, it could be used as security mechanism in home, industry and any private places or offices to control the entering and exit of estrange person.

## REFERENCES

[1] "The Atmel Mega 16 Datasheet", doc2466.pdf, Atmel Corporation,San Jose CA, USA, 2003

[2] Eric Waddington, MarekMichalkiewicz, Reiner Pommel, Theodore A. Roth, Jorge Wunch,"The avr-libc Manual", http://savannah.nongnu.org/projects/avr-libc/ 2004

[3] Alan Simpson, "PRACTICAL ROBOTICS, A First Course in Microcontroller Programming and Usage", University of Plymouth, Nov. 2002

[4] Alan Simpson, "Programming the Miabot", University of Plymouth, Sept. 2004

[5] Engr. A. Kabir "Electronic Engineering II", Unpublished Lecture notes, ABUDEE, Zaria, 2010.