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Design and hardware implementation of generation of PWM based on microcontroller

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Abstract-Aiming at the demand of PWM pulse generation in the field of power electronics, measurement and control so on. In this paper hardware circuit of pulse generation of PWM based on PIC microcontroller is designed and tested by varying on-off cycle, we can change the pulse width.

Keywords- PWM generation, microcontroller, PIC 16F84.

I. INTRODUCTION

PWM is very important part in electronics circuit, control, measurment. There are two methods of PWM generation first one is by analog circuit and other is by digital circuit. Analog circuit is not used now a days due to less reliability and more complicated compare to digital circuit. In digital circuit change and modification is easy and more flexible. In this paper I used microcontroller to change duty cycle.it is tested and verified in laboratory. There are different applications like adjust brightness of screen using PWM,drive buzzer

with different loudness ,control speed of motor, control direction of servo, generate analog signal, in telecommunication to encode message etc. Future scope is also available in such areas.

II. PWM TECHNIQUE

PWM uses rectangular pulse wave whose pulse width is modulated resulting in variation of average value of the waveform. On-off behavior changes the average voltage of the

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signal. Output signal alternates between on and off within a specified period. Advantage of PWM is that average value proportional to duty cycle.

Pulse width modulation is digital signal which is most commonly used in control circuit .This signal is set high (5 V) and low (0 V) in predefined time. Time during which signal stays high is called "on time" and time during which signal stays low is called "off time." There are important two parameters in PWM.

1) Duty cycle 2) frequency of PWM

1) Duty cycle: The percentage of time in which the PWM signal remains high (on time) is called duty cycle.

If signal is always on it is in 100% duty cycle and if it is always off it is 0% duty cycle. Here on period called the pulse width.

$$\text{Duty cycle} = \frac{T_{ON}}{T_{ON} + T_{OFF}}$$

Ton =D x T
T = Total time
D = Duty cycle
Ton = on time
Toff = off time
T= Ton+ Toff

Advantages of PWM:

It has high power handling capacity, cheap in cost, high efficiency, noise interference is less and low power consumption and more accurate.

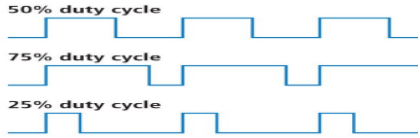

Fig 1 PWM for different duty cycle

2) Frequency of PWM: Frequency of PWM signal determines how far a PWM completes one period. One period complete on and off of PWM signal as shown in above figure. Here we set the frequency 50 Hz and 20 msec period.

III. CIRCUIT DIAGRAM

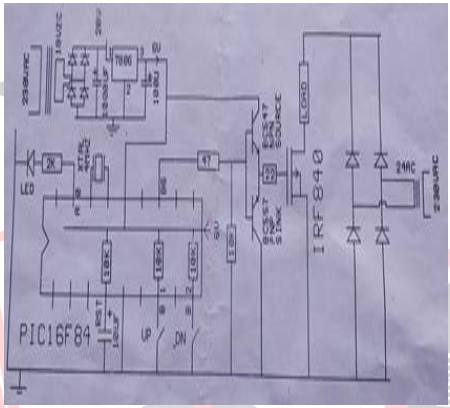

Fig 2 Hardware circuit of PWM pulses generation

Here 230 V Ac supply given to the transformer, 230/18 V step down

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transformer is used to step down the voltage.AC supply given to the diode rectifier to convert ac to dc. Capacitor is used for filtering purpose and 7806 voltage regulator is used to regulate the voltage from 18 V to 6V.That 6V applied in to the microcontroller and push pull amplifier. Here 4MHz crystal is used to control frequency. Here PIC 16F84 is used to generate pulses, up and down switches are used to vary on and off time.4 MHz crystal is used to regulate the frequency. For push pull amplifier PNP and NPN transistor BC547 and BC557 used. During any given half cycle input signal one transistor is pushed into deep conduction while other being pulled out. Which drive IRF840 MOSFET. Lamp load is connected in series with MOSFET. Then I have used diode rectifier for rectification and step up transformer which convert 24 V into 230V AC.

FLOW CHART

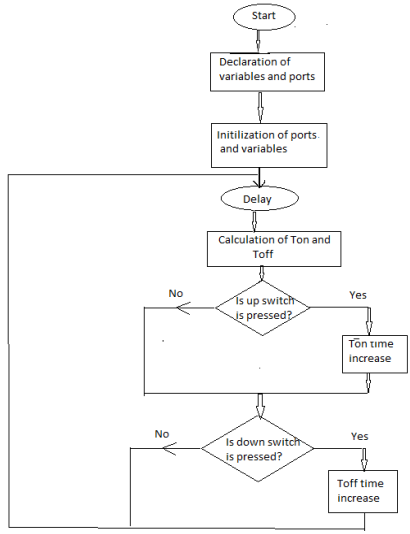
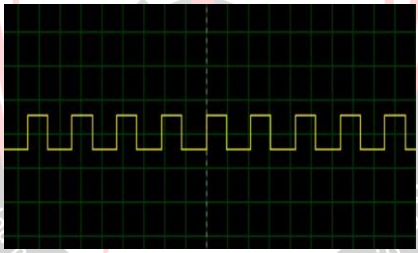


Fig 3 Flow chart of PWM generation

RESULT: Proposed pwm generation PCB is builted and tested in laboratory.This works proporly as per theoritical expectations.Due to push pull amplifier distortion is reduced.Here i put the results of different duty cycles.PWM generally widely used in industrial applications.



a) 40% duty cycle

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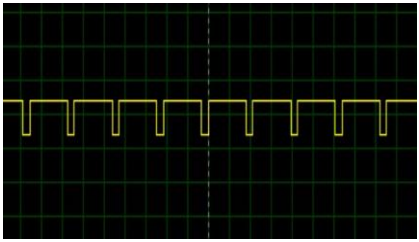
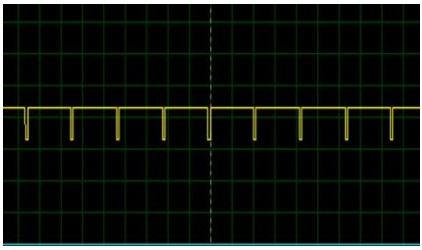


b) 80% duty cycle



c) 90% duty cycle

CONCLUSION

Microcontroller PIC 16F874 Can generate pulses and by using up and down switches we can change on and off cycles of pulse.Its working accurately with minimum hardware at low cost.Due to push pull amplifier harmonic distortion can be reduced.Its more accurate method.

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