

Pulse Width Modulation

Spoken Tutorial Project

<https://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



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- PWM i.e. Pulse Width Modulation



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- PWM Duty Cycle



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- PWM Frequency



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- PWM i.e. Pulse Width Modulation
- PWM Duty Cycle
- PWM Frequency
- L293D Motor Driver IC



Pre-Requisites

To follow this tutorial, you should have basic knowledge of:



Pre-Requisites

To follow this tutorial, you should have basic knowledge of:

- **Electronics and**



Pre-Requisites

To follow this tutorial, you should have basic knowledge of:

- Electronics and
- C or C++ programming language



System Requirements

To record this tutorial, I am using



System Requirements

To record this tutorial, I am using

- **Arduino UNO board**



System Requirements

To record this tutorial, I am using

- Arduino UNO board
- Ubuntu Linux 16.04 OS



System Requirements

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- Arduino UNO board
- Ubuntu Linux 16.04 OS
- Arduino IDE



External Components Required



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- **Breadboard**



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- **10K Ohm Potentiometer**



External Components Required

- **Breadboard**
- **10K Ohm Potentiometer**
- **LED**



External Components Required

- **Breadboard**
- **10K Ohm Potentiometer**
- **LED**
- **220 Ohm Resistor**



External Components Required

- **Breadboard**
- **10K Ohm Potentiometer**
- **LED**
- **220 Ohm Resistor**
- **Jumper Wires**

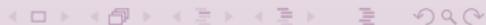


External Components Required

- **Breadboard**
- **10K Ohm Potentiometer**
- **LED**
- **220 Ohm Resistor**
- **Jumper Wires**
- **Push Button**



DC Motor



L293D Motor Driver IC



Pulse Width Modulation



Pulse Width Modulation

- PWM signal is a square wave signal which has a high frequency i.e. (1KHz)



Pulse Width Modulation

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- PWM is a technique by which the width of the pulse is varied



Pulse Width Modulation

- PWM signal is a square wave signal which has a high frequency i.e. (1KHz)
- PWM is a technique by which the width of the pulse is varied
- It is done while keeping the frequency of wave constant



Pulse Width Modulation



Pulse Width Modulation

- PWM signal consists of two main properties that define its behaviour



Pulse Width Modulation

- PWM signal consists of two main properties that define its behaviour
- They are duty cycle and frequency



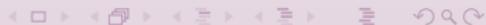
Duty Cycle



Duty Cycle Formula



PWM Frequency



PWM Frequency

- Frequency determines how fast the PWM completes a cycle



PWM Frequency

- Frequency determines how fast the PWM completes a cycle
- How fast it switches from HIGH to LOW states



Example - Duty Cycle

- We will perform one simple experiment by varying duty cycle



Example - Duty Cycle

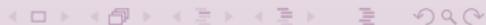
- We will perform one simple experiment by varying duty cycle
- This will control brightness of LED



Arduino PWM Pins



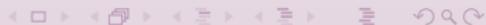
LED Connection



L293D - Pinout



DC Motor Connection



DC Motor Live Setup



Summary

- **Pulse Width modulation**
- **PWM Duty Cycle**
- **PWM Frequency**
- **How to control speed and direction of DC motor**



Assignment

- **Connect a Buzzer instead of LED in the above circuit connection**
- **Upload same program and check the output**
- **You would hear a noise with different frequencies**



About the Spoken Tutorial Project

- Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- It summarises the Spoken Tutorial project
- If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- Do you have questions in **THIS Spoken Tutorial?**
- Please visit <http://forums.spoken-tutorial.org>
- Choose the minute and second where you have the question
- Explain your question briefly
- Someone from our team will answer them



Acknowledgements

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