Assignment 7

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Title:

Write an Application using Raspberry Pi board to control the operation Stepper Motor

Aim/Objectives:

- To understand the concept of Stepper Motor
- To interface Stepper Motor with Raspberry Pi model
- To program the Raspberry Pi model to rotate the Stepper motor in clockwise direction
- To program the Raspberry Pi model to rotate the Stepper motor in anti-clockwise direction

Software:

- Raspbian OS
- IDLE IDE

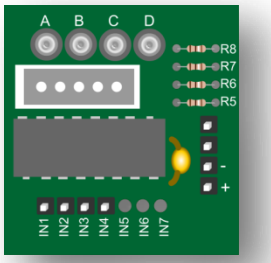
Hardware Modules:

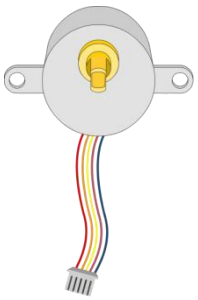
- Raspberry Pi Board module
- Stepper motor module
- Monitor

Theory:

- Stepper motor is an electromechanical device which converts electrical energy into mechanical movements.
- Stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps.
- Due to unique design of stepper motor, it can be controlled to a high degree of accuracy without any feedback mechanisms.
- The shaft of a stepper, mounted with a series of magnets, is controlled by a series of electromagnetic coils.
- The coils are charged positively and negatively in a specific sequence, precisely moving the shaft forward or backward in small "steps".
- Typical types of stepper motors can rotate $2^0, 2.5^0, 5^0, 7.5^0 and\ 15^0$ per input electrical pulse.
- The inner magnet of stepper motor is effectively divided into many separate sections, which look like teeth on a gear wheel.
- The electromagnets and the output shaft of stepper motor are arranged in such a way that when we give train of 8 pulses, the output shaft completes its one rotation.
- The speed of the motor shafts rotation is directly related to the frequency of the input pulses.
- The length of rotation is directly related to the number of input pulses applied.

- A stepper motor can be a good choice whenever controlled movement is required. They can be used to advantage in applications where you need to control rotation angle, speed, position and synchronism.
- Some of these include Robotics, printers, plotters, high-end office equipment, hard disk drives, medical equipment, fax machines, automotive and many more.





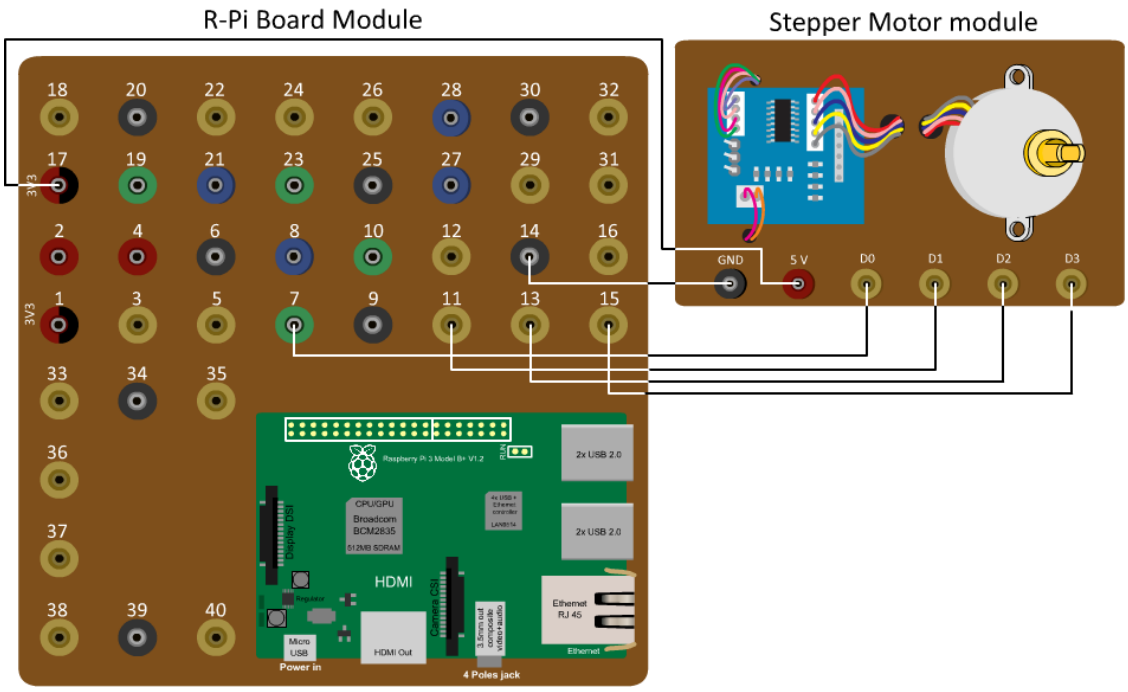
1. Blue wire: Coil 4
2. Pink wire: Coil 3
3. Yellow wire: Coil 2
4. Orange wire: Coil 1
5. Red wire: 5v

- To drive Stepper motor it requires high current (more than 150m amp).
- So we connect the driver circuitry between Raspberry-Pi board and the stepper to boost the current that passes through the stepper motor.
- And as per the change in current, the speed of stepper motor changes.

Safety precautions:

- Raspberry-Pi provides 3.3V and 5V VCC pins Raspberry-Pi operates on 3.3V.
- Various sensors and actuators operate on different voltages.
- Read datasheet of a given sensor or an actuator and then use appropriate VCC pin to connect a sensor or an actuator.
- Ensure that signal voltage coming to the Raspberry-Pi from any sensor or actuator does not exceed 3.3V.
- If signal/data coming to Raspberry-Pi is greater than 3.3V then use voltage level shifter module to decrease the incoming voltage.
- The Raspberry-Pi is a costly device, hence you should show the circuit connections to your instructor before starting your experiment.

Interface diagram:



Steps for assembling circuit:

- Connect the VCC pin of Stepper motor to 3.3 V (pin) of Raspberry Pi module
- Connect the GND pin of Stepper motor to GND pin of Raspberry Pi module
- Connect the D0, D1, D2, D3 pins of Stepper motor to pins 7, 11, 13, 15 of Raspberry Pi module

Procedure:

- Write the program as per the algorithm given below.
- Save program.
- Run code using Run module.

Algorithm:

- Import GPIO and Time library
- Set mode i.e. GPIO.BOARD
- Set all Warnings as False
- Define control pins
- Set GPIO pins 7, 11, 13, 15 as Output
- Follow the Half step sequence
- Run the sequence one by one using “For loop”

Observation:

- Check the rotation of the Stepper motor – Clockwise or Anticlockwise.