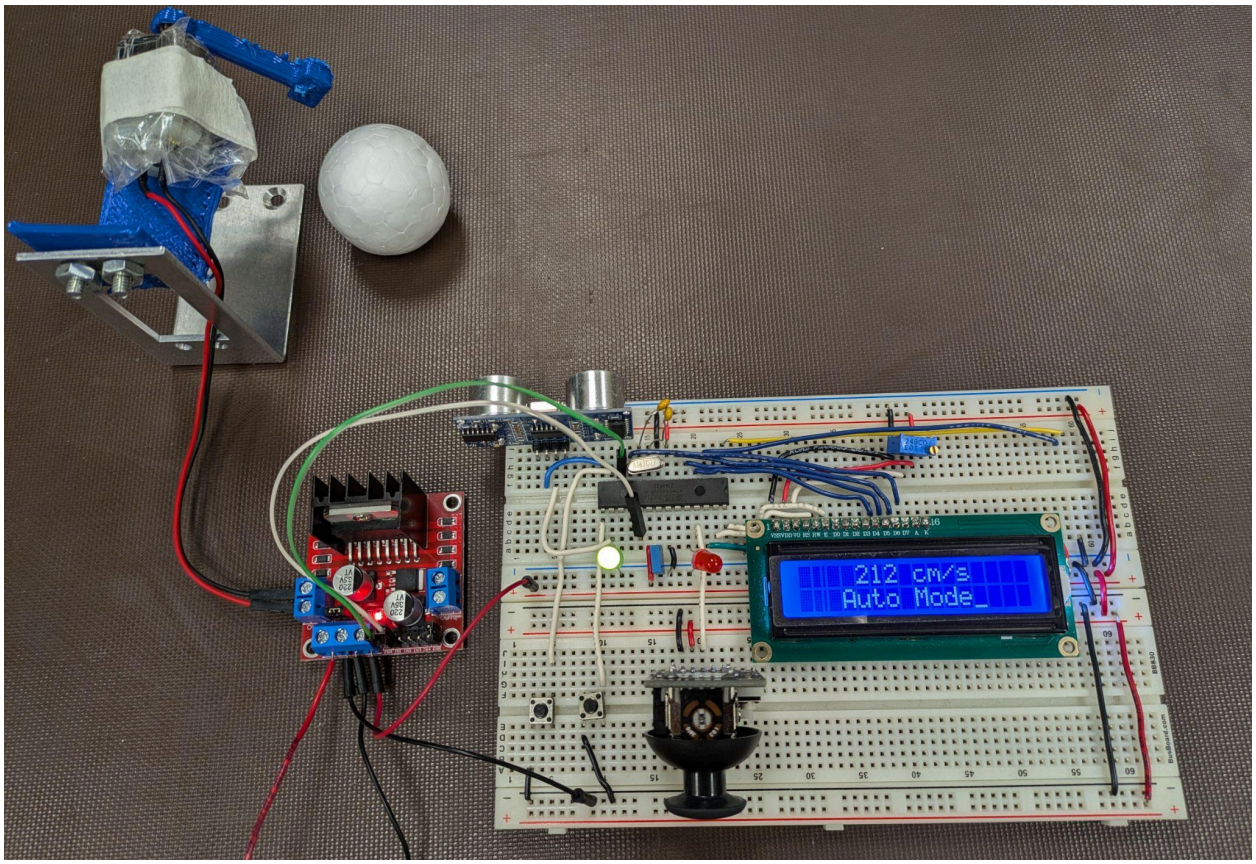
Final Project: Golf Bot

PRODUCT SPECIFICATION



Product Description:

Golf Bot is a device that simulates golf by allowing us to hit a ball to make it roll on a surface and make it into a golf hole some distance away. It has two different modes, an automatic mode and a manual mode. In the automatic mode, Golf Bot uses an ultrasonic sensor to determine how far the hole is, then using a motor controlled by a motor driver, it swings a golf arm to hit a ball to the location of the hole and lands inside. It also displays the velocity of the motor arm onto an LCD screen. Golf Bot also checks for hole stability using LED's. When the distance of the golf hole stays relatively constant, a green LED will light up. When the distance of the golf hole from the sensor changes suddenly, a red LED will light up to notify the instability. Press a button to switch modes and press a button to launch the ball when ready. When Golf Bot is in manual mode, the user uses a joystick to determine how fast they would want to hit the golf ball.

Operating Conditions:

- **Power Supply**: 7.5V DC and a current of approximately 0.2 A
- **Motor Driver:** • Operating supply voltage up to 46 V (operating at 7.5V DC)

  • Total DC current up to 4 A (operating at 0.2A)

  •Supplies 5V DC to the MCU and other related components using the internal 5V regulator

- **Motor:** Operating voltage from 3V DC to 12V DC
- **Software Environment**: MPLAB X IDE with AVR compiler
- **ATmega328P**:
  - Operating Temperature: -40℃ to +85℃
  - Maximum Operating Voltage: 5.0 - 6.0V
- **Joystick**: Operating Voltage: 5.0 V DC

Operating Instructions:

To make golf bot work we are first welcomed with a welcome screen and are asked to select automatic or manual mode. If we select the automatic mode button, the Golf Bot utilizes an ultrasonic sensor to measure the distance to the hole. Based on this measurement, it controls a motorized golf arm, via a motor driver, to accurately strike the ball, aiming to land it precisely in the hole. The current distance to the hole is displayed on an LCD screen. Once the distance remains consistent and the system is ready to launch, a green light activates, signaling readiness for the shot. You can also press a button to switch modes and press a button to launch the ball when ready. When Golf Bot is in manual mode, the user uses a joystick to determine how far they would want the golf ball to travel.

Safety Precautions:

- Make sure you keep fingers away from the motor arm in order to avoid injuries
- Do not forget to unplug the power supply after usage

Quantitative Information:

- **Distance Display**:
  - ±2.2 cm (due to delay and the linear interpolation calculation we used in our code)
- **Sensor Characteristics**:
  - **Speed of Sound**: Assumed to be 0.0343 cm/μs for distance calculations.
  - ±2.0 cm (Uncertainty during input capture)
- **Uncertainty in Measurement**:
  - Uncertainty in the laboratory DC power supply: ±1.35%
  - Minor variations may occur due to temperature fluctuations affecting the speed of sound.

Power Consumption:

Component	Quantity	Power Consumption
Motor	1	min speed: 0.23A *7.5 V = 1.725 W normal speed: 0.24A*6.5V=1.560 W max speed: 0.24A*5.9V= 1.416W
ATMega328P	1	0.2 mA * 5 V = 1 mW
Joystick	1	10 mA * 5 V = 50 mW
HC-SR04 Sensor	1	15 mA * 5 V = 75 mW
LED	2	30 mA * 5 V = 150 * 2 = 300 mW
Total		**1.986 W**

NB: The power consumption calculation is for the Auto mode. The motor values were directly taken from the Laboratory DC power supply for accuracy and comparison and the rest were compared with the values from the datasheets.

Hence, our goal specifications were indeed achieved after making our project. We were successful in getting all the required power consumption values after integrating and putting all the code together. The power consumption values listed abided the uncertainties as well.