

ARDUINO CONTROLLER PROGRAMMING & ITS APPLICATIONS

Day-Four

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Outline

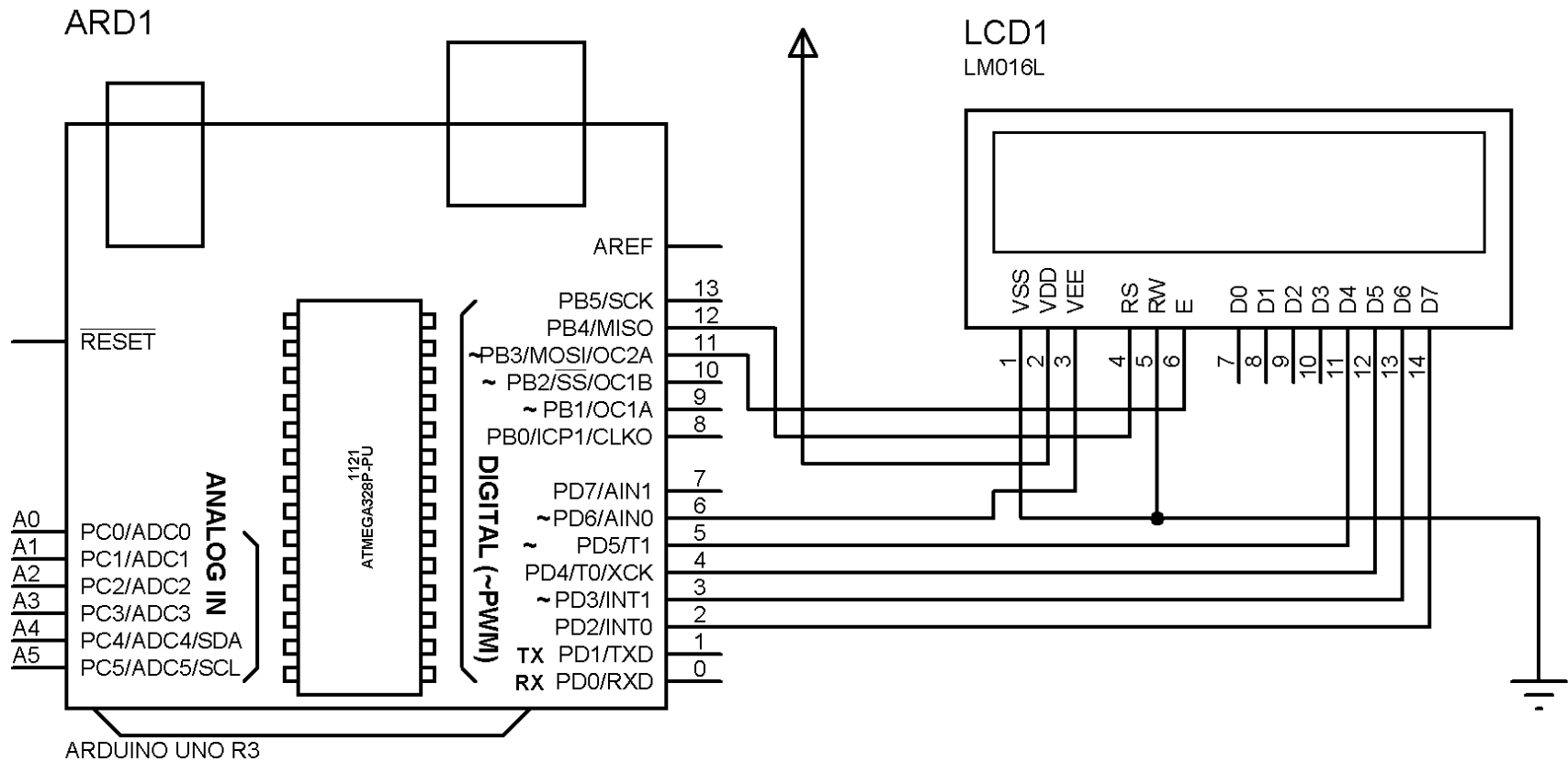
Day	Activity
1	i. Introduction to Arduino development board and Arduino IDE ii. C/C++ language overview iii. Basic input / output with Arduino iv. Overview of Proteus simulation software for Arduino simulation
2	i. Interfacing and glowing LEDs with different pattern ii. Interfacing push button and piezo buzzer iii. Interfacing a temperature sensor with Arduino
3	i. Familiarization with Serial Monitor for input and for output ii. Interfacing LDR sensor with Arduino iii. Interfacing PIR motion sensor with Arduino
4	i. Interfacing Arduino with LCD (16x2), relay and Servo motor ii. Interface Arduino with Sonic Sensor for obstacle detection
5	i. Interfacing shift register and 7-segment display with Arduino ii. Interfacing HC-05 Bluetooth module with Arduino iii. Driving GSM modem with Arduino
Prerequisites: <ul style="list-style-type: none"> - Knowledge of C++ - Knowledge of basic electronic components 	

LCD 16x2 Screen

- LCD screen is usually used to display messages
- LCD library is available with Arduino IDE i.e. [LiquidCrystal.h](#)
- LCD can be controlled in:
 - 4-Bit mode: Control words are sent with two nibbles, slow but saves 4 GPIO pins
 - 8-bit mode: Control words are sent as byte, fast but requires 4 more GPIO pins
- Pin configuration
 - VSS – GND
 - VDD – +5v
 - VEE – Contrast Pin (with Pin 6 PWM or with POT)
 - RS – Register Select, with Pin 12
 - R/W – Read/Write, with GND
 - E – Read/Write Enable Signal, with pin 11
 - D0 to D3 – Lower data Bits (Leave unconnected)
 - D4 to D7 – Higher data bits, with pin 5,4,3,2 respectively
 - LED+ & LED- – Power connection, VCC and GND respectively
- LiquidCrystal object is required for initialization
 - i.e. `LiquidCrystal object_name(RS, E, D4, D5, D6, D7);`
 - `object_name.begin(cols, rows)` – to initialize LCD

Example 1: LCD 16x2

Circuit



Example 1: LCD 16x2

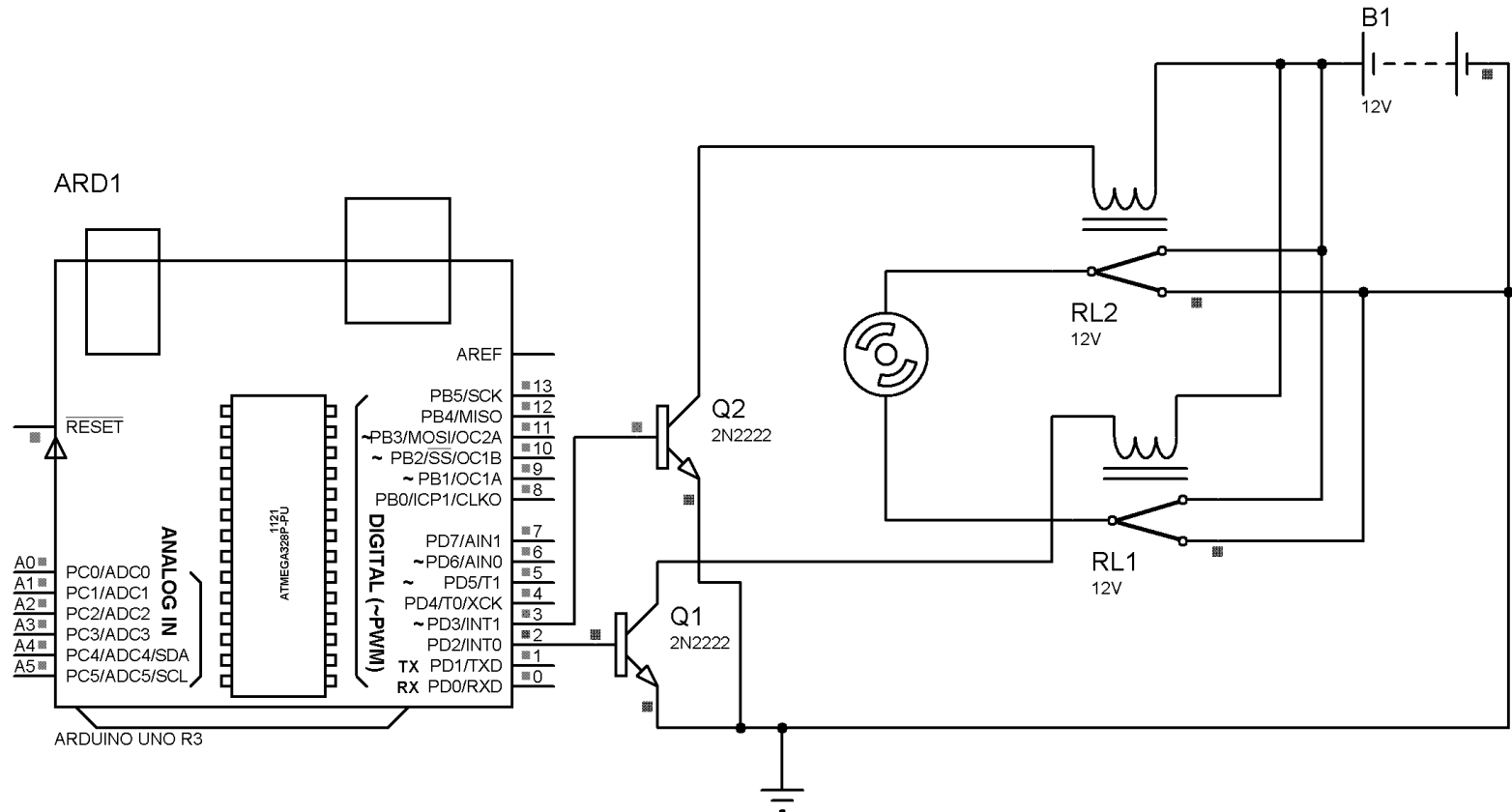
Code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
int Contrast=100;
void setup()
{
  //Write the contrast value on pin 6
  analogWrite(6,Contrast);
  lcd.begin(16, 2);
  lcd.print("Arduino Programming");
  delay(1000);
}
void loop()
{
  // lcd.clear();
  lcd.setCursor(0,1);
  lcd.print(Contrast, BIN);
  delay(1000);
  lcd.setCursor(0,1);
  lcd.print(Contrast, HEX);
  while(1);
}
```

Example 2: DC motor control with relay

- Relay is an electronic/electrical component used as switch
- 2 DC relays can be used to control polarity of a DC motor

Circuit



Example 2: DC motor control with relays

Code

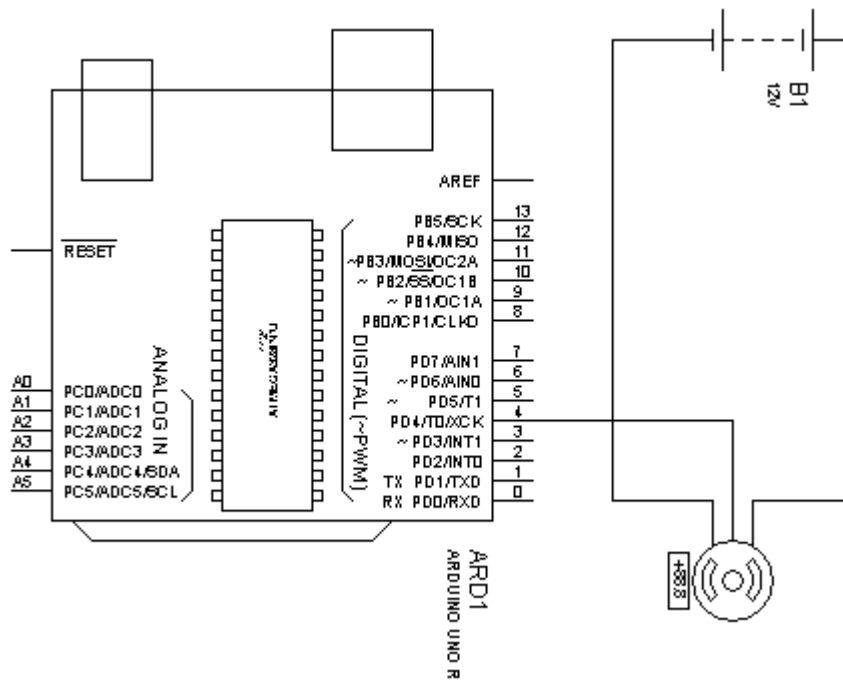
```
#define PR1 2
#define PR2 3
void setup()
{
  pinMode(PR1,OUTPUT);
  pinMode(PR2,OUTPUT);
}
void motorccw(int seconds)
{
  digitalWrite(PR1,HIGH);
  digitalWrite(PR2,LOW);
  delay(seconds*1000);
  digitalWrite(PR1,LOW);
  digitalWrite(PR2,LOW);
}
```

```
void motorcw(int seconds)
{
  digitalWrite(PR1,LOW);
  digitalWrite(PR2,HIGH);
  delay(seconds*1000);
  digitalWrite(PR1,LOW);
  digitalWrite(PR2,LOW);
}
void loop()
{
  motorcw(5);
  delay(2000);
  motorccw(5);
  delay(2000);
}
```

Example 3: Servo Motor with Arduino

- Servo, another type of motor which can be controlled w.r.t angular position
- Arduino provides library for Servo Motor
- The Servo factors to consider:
 - Torque: More torque, more weight can be lifted
 - Speed: Can be controlled using program and/or current applied
 - Rotational Angle: Depending upon model, 360 degree/value can complete one rotation

Circuit



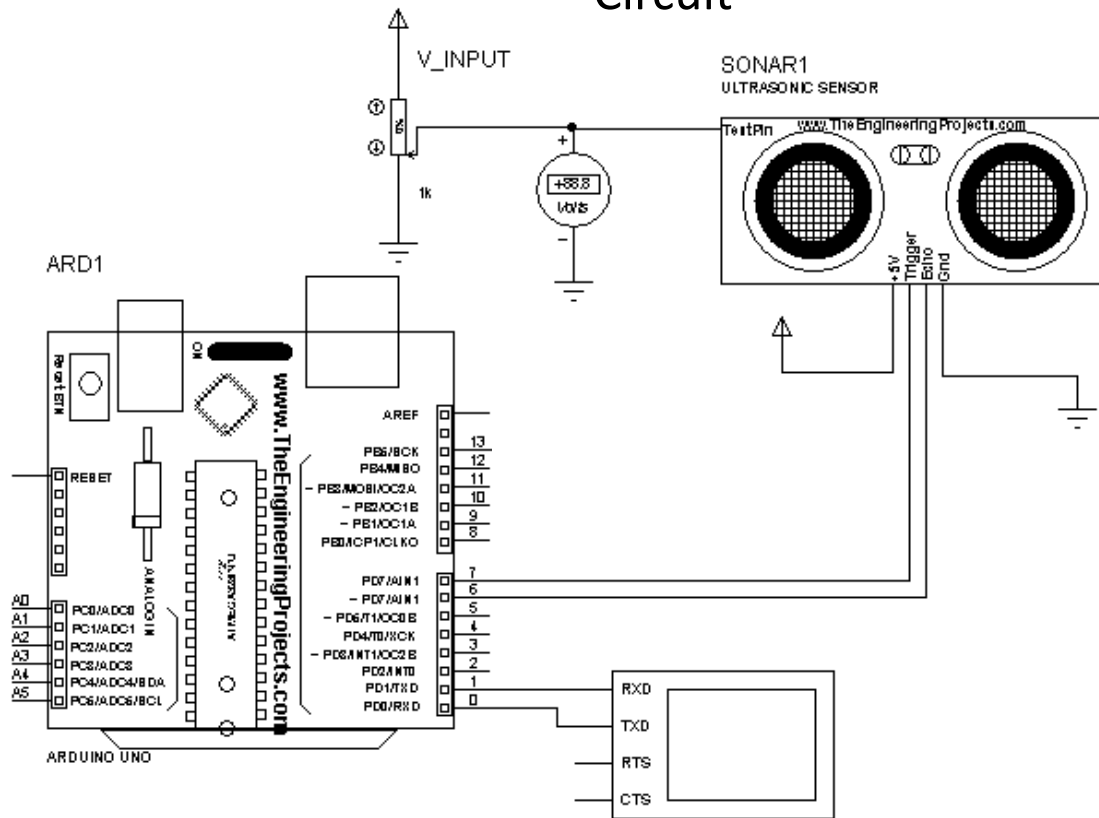
Code

```
#include <Servo.h>
Servo myservo;
void setup()
{
  myservo.attach(4);
}
void loop()
{
  myservo.write(180);
  delay(1000);
  myservo.write(90);
  delay(1000);
  myservo.write(0);
  delay(1000);
}
```


Example 4: Ultrasonic Sensor for obstacle detection

- Sonic sensor is used to send sonic sound waves and received the reflected waves
- On basis of which, we can use it for obstacle detection and even for measuring distance

Circuit



Example 4: Ultrasonic Sensor for obstacle detection

Code

```
const int pingPin = 7; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 6; // Echo Pin of Ultrasonic Sensor
void setup()
{
  Serial.begin(9600); // Starting Serial Terminal
  pinMode(pingPin, OUTPUT);
  pinMode(echoPin, INPUT);
}
void loop()
{
  long duration, inches;
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(pingPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  inches = duration/74/2;
  Serial.print(inches);
  Serial.print("in, ");
  Serial.println();
  delay(100);
}
```

Questions

