Project Report: Remote Control Tank

Group Members: Anthony Ma, David Uzunov, Lucas Zhou

1 Project Functionality

We built a small remote control tank that has a laser turret module on top. The chassis (Figure 1), includes the metal body, wheels, treads, and motors to power them. An arduino circuit is used to read in input from the joystick and transmit using nRF24L01 transceiver modules to a second arduino on the tank (Figure 2). The tank has two states: a drive state, and turret state which can be toggled using one of the joystick buttons. In drive mode, each joystick controls one tread while the left joystick button controls the firing of the laser. By pressing the right joystick's button, the tank toggles to turret mode, allowing you to change the direction and angle of the turret. It is controlled by 2 servo motors, one for each plane of movement (horizontal and vertical) each controlled by one joystick respectively.

Figure 1

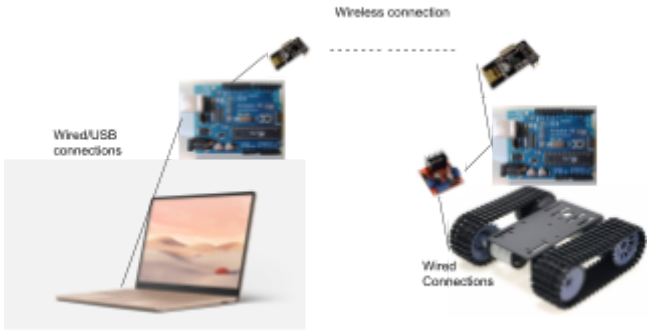


Figure 2

2 Hardware Components

- **Tank Chassis** - $20, not from the original kit, purchased from amazon
  - 2 DC Motors included in the chassis, no additional cost
- **Tank Components**
  - Arduino Uno (Not from the kit) - No additional cost - Lucas had it before the project
  - nRF24l01+ wireless transceiver - unit cost of $1.97(bought 4 costing $7.89 total, used 2); purchased from amazon
  - L298N Motor driver controller/H-bridge circuit board - purchased from UCSB ECE Shop for $4.14
  - Mini breadboard - provided in kit

    - Servo Motor(x2) - one included in the kit, one provided by Lucas
    - 5 mW laser - from ECE 5 Lab
    - Powerbank for Arduino - Anthony provided one
    - Battery pack for motors - $8.82 on amazon
    - Mini breadboard - provided in the kit
- **Controller Components**
    - Arduino Uno - from the kit provided
    - nRF24l01+ wireless transceiver - unit cost of $1.97(bought 4 costing $7.89 total, used 2); purchased from amazon
    - Mini breadboard - borrowed from a friend
    - Joystick modules(x2) - one borrowed from a friend, one included in the kit - no additional cost
    - Powerbank for Arduino - Anthony provided one
- Additional Components
    - 120 jumper cables(Male to Female) - $6.89 from amazon, supplemented the cables included in the kit

3 Design Timeline

Week 5: Ordered parts. Assembled the tank base, designed circuit and software to read inputs from the joystick.

Week 6: Implemented code for controlling the tank using joystick input. Tested on a single Arduino without wireless communication. Designed the circuit connecting the motors to the Arduino and H-bridge. Soldered wires to the motor.

Week 7: Developed wireless communication systems, connecting the two Arduinos using the nRF24L01 circuits. Started modeling and 3D printing part covers for the various components of the tank.

Week 8: Designed the turret, wrote code allowing control of the Servo motors, and continued designing 3D parts for the tank. Started working on the final report and poster, and assembled finished 3d parts while iterating those that failed.

Week 9: Finished assembling the turret and mounting it to the tank. Finished the report and poster.

4 Software Design

Transmitter:

Set Joystick and Button pins
Set Radio pins and Address
Stop listening and start writing
Create and initialize Stuct to send data

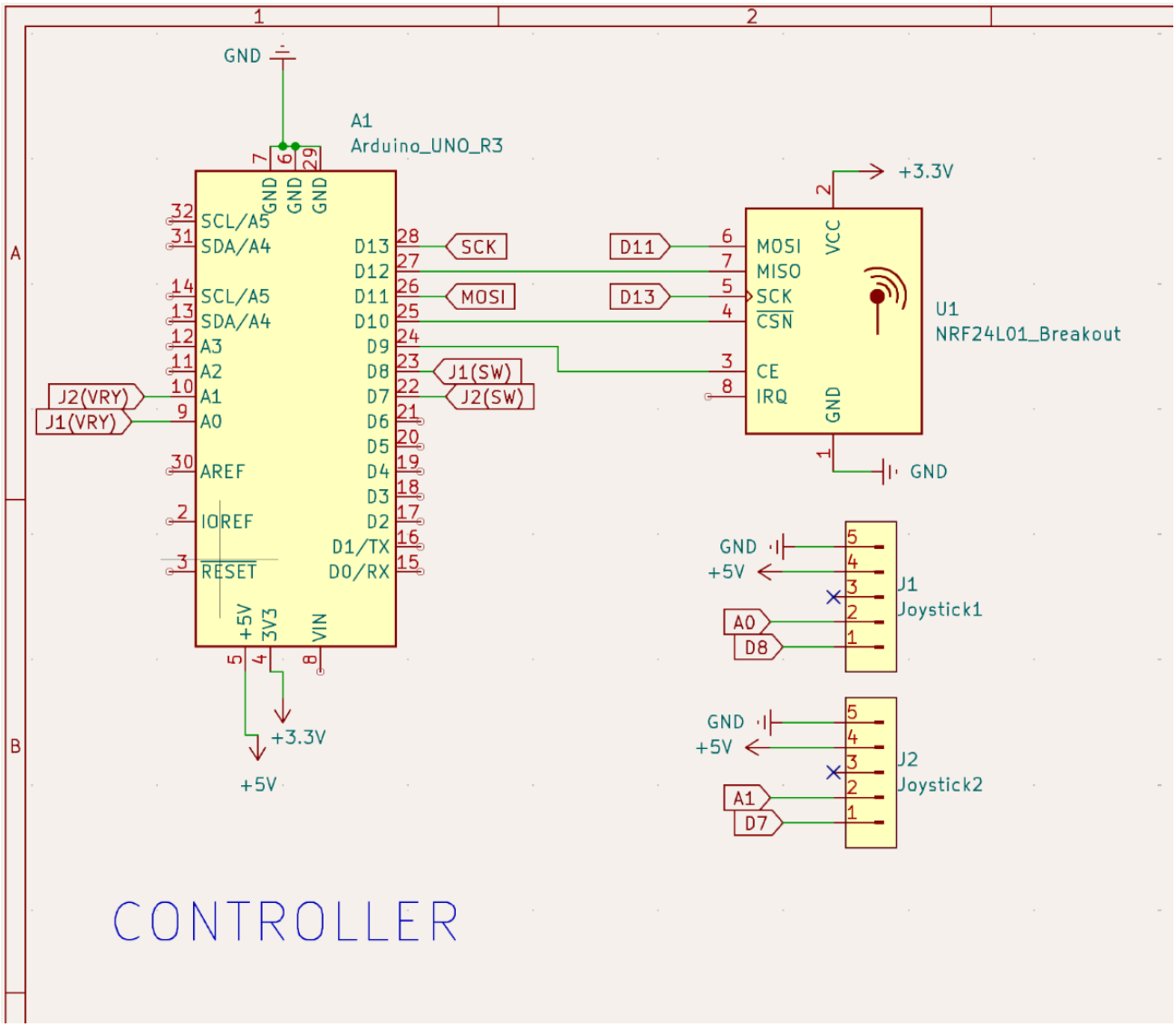
```
Setup{
  Open writing pipe of radio
  Set channel and power level
  Set debounce time for buttons
}

Loop{
  Read in Y positions of each joystick
  Check button states
  Write data into stuct
  Transmit struct to tank
  Reset all data
  delay(10);
}
```

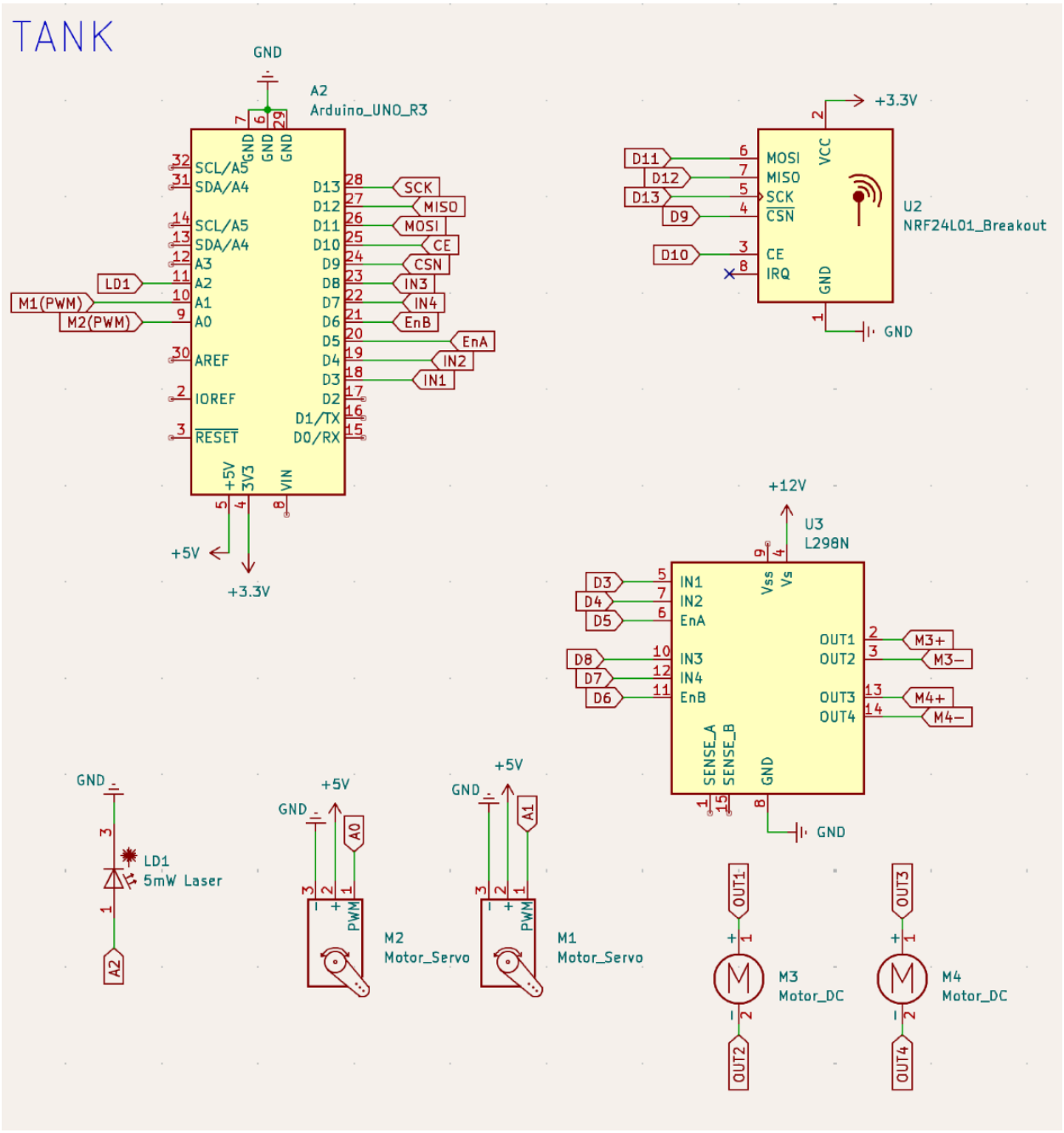
Create Stuct for recieve Joystick data
Set Radio pins and Address
Set Tank DC Motor pins
Set Turret Servo Motor pins
Set Turret initial position
Set Laser pin

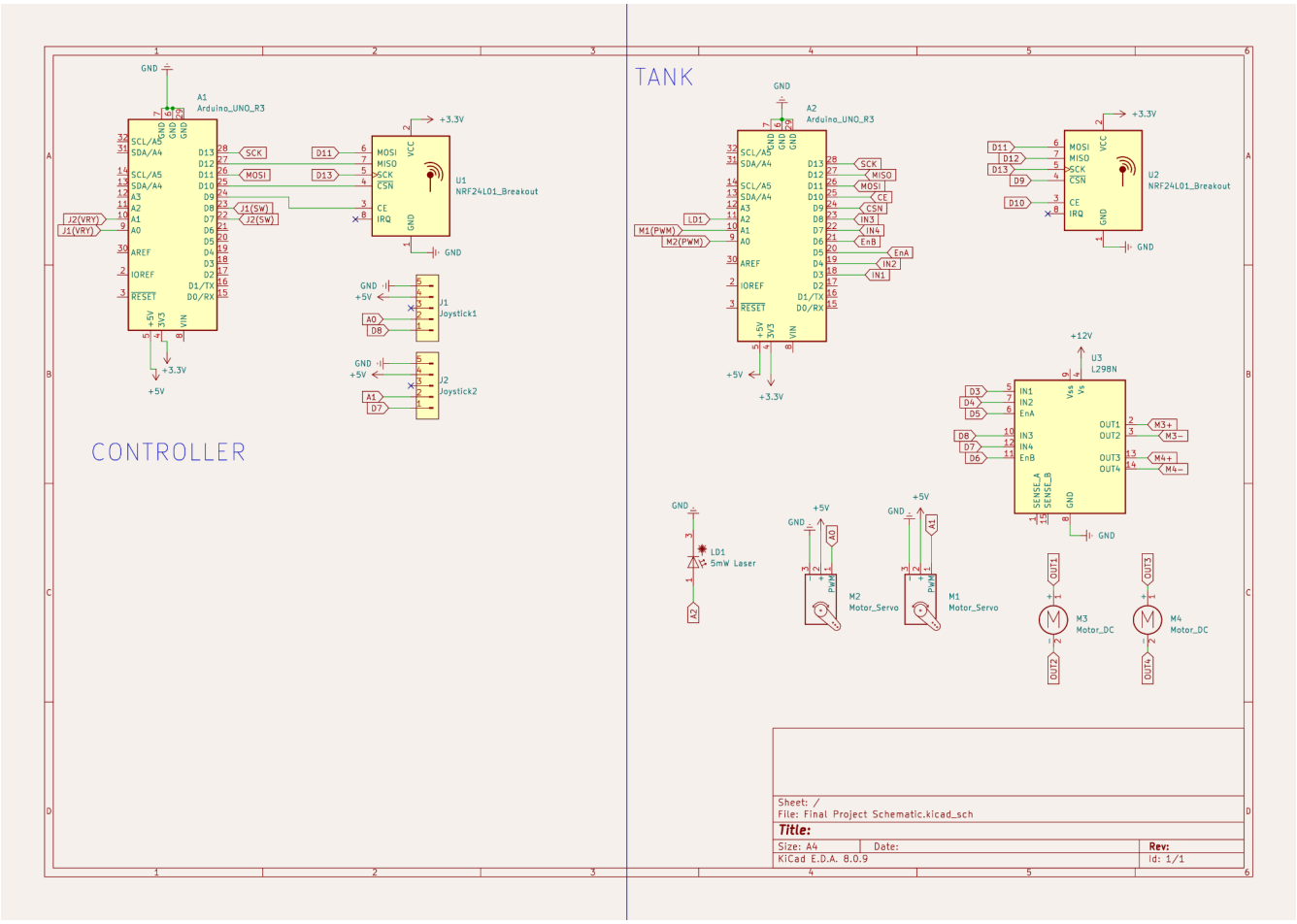
```
Setup{
  Open writing pipe of radio
  Set channel and power level
  Start listening
  Set motor pins to Output
  Initialize servo pins
```

```
  Move servo to starting position
  Set Laser pin to Output
}

Loop{
  Check for radio signal
    If available - read in data from radio
  If (Right button is pressed)
    Switch between turret and tank mode
  If (Left button is pressed)
    Shoot laser

  If (in tank mode)
    if (Joystick pushed forward)
      Move corresponding track forward
    Else if (Joystick pushed back)
      Move corresponding track back

  else if (in turret mode)
    if (Right joystick pushed forward)
      Move turret left
    else (right joystick back)
      Move turret right
    if (Left joystick pushed forward)
      Move turret up
    else (Left joystick back)
      Move turret down
  delay(10);
}
```

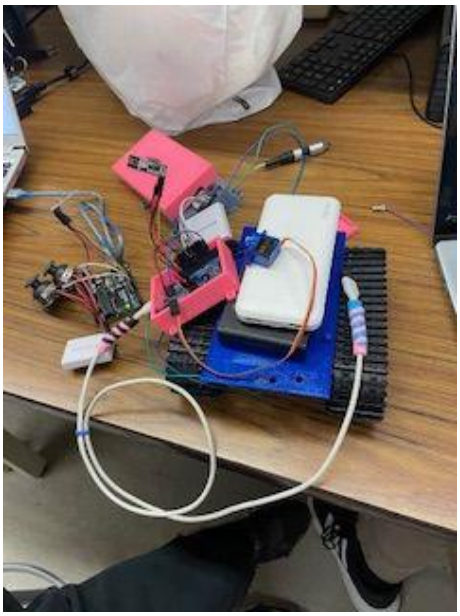
5 Circuit Schematics

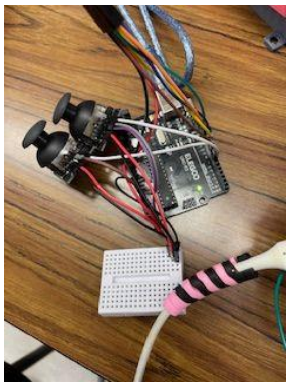


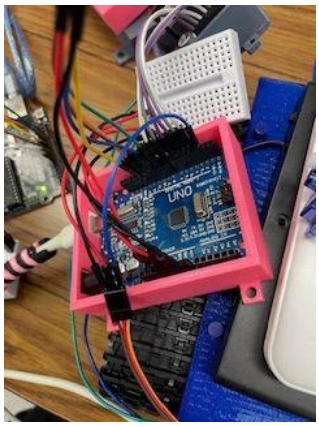

TANK
GND
A2
Arduino_UNO_R3
SCL/A5
SDA/A4
SCL/A5
SDA/A4
A3
A2
A1
A0
AREF
IOREF
RESET
D13
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1/TX
D0/RX
+5V
3V3
VIN
SCK
MISO
MOSI
CE
CSN
IN3
IN4
EnB
EnA
IN2
IN1
LD1
M1(PWM)
M2(PWM)
+5V
+3.3V
+3.3V
D11
D12
D13
D9
D10
MOSI
MISO
SCK
CSN
CE
IRQ
VCC
GND
U2
NRF24L01_Breakout
GND
+12V
U3
L298N
D3
D4
D5
D8
D7
D6
IN1
IN2
EnA
IN3
IN4
EnB
Vss
Vs
OUT1
OUT2
OUT3
OUT4
M3+
M3–
M4+
M4–
SENSE_A
SENSE_B
GND
GND
GND
LD1
5mW Laser
A2
+5V
GND
A0
PWM
M2
Motor_Servo
+5V
GND
A1
PWM
M1
Motor_Servo
OUT1
OUT2
M3
Motor_DC
OUT3
OUT4
M4
Motor_DC

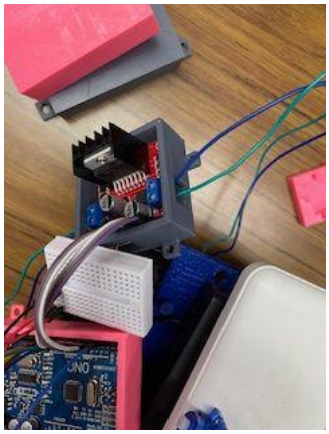
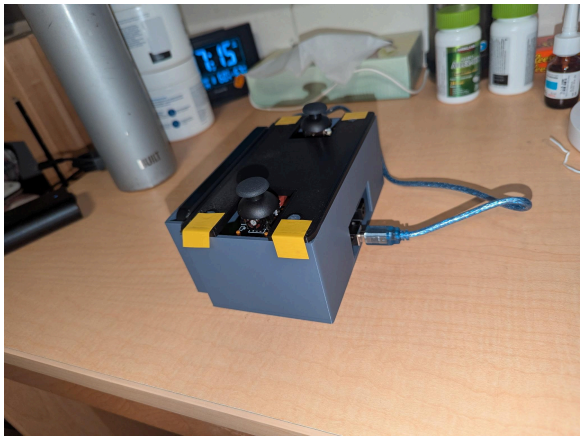


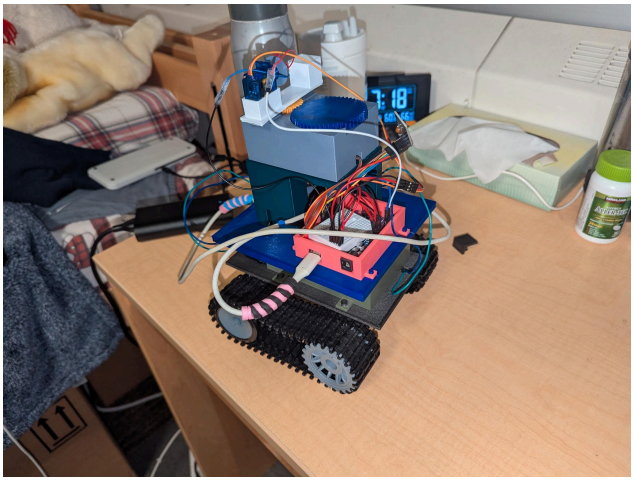
6 Circuit Prototype









7 Testing

Initially, after assembling the tank, we tested the right and left tracks to see if they could move forward or backward just with an Arduino and circuit. Once that was successful, we added a joystick that moved both tracks. We also tested the button to see if it would power on the motor whenever it was pressed. As for our code, we ran the serial monitor and debugged the input/output until our code ran properly. For the turret, we made sure the servo motor turned in the horizontal and vertical planes through testing and revising code, adding to our initial program.