RADIO CONTROLLED CAR DISSECTION PROJECT

ISE 511L - Fall 2016

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WHAT IS A RC CAR?

- Radio Controlled (RC) Toy Cars

All Items Shown Sold at AliExpress

INTRODUCTION

- RC or R/C – Radio Control

Amazon

Radio Control Frequency used for Wireless or Remote Control

Pros:

- No wired connection necessary
- Small number of components required
  - Controller, radio frequency transmitter, receiver, and antenna
- Signal ranging from 75’ to 10mile
  - Depending on equipment used

Cons:

- Limited duration for operation
  - Runs on batteries
  - Requires frequent charging

RC APPLICATIONS

Wireless Industrial Remote Control

- Military and Aerospace
  - Military
    - Threat Detection
      - i.e. Bomb Disposal
  - Spacecraft
    - Mars Exploration Rovers
      - i.e. Sojourner
- Conveyor Control
  - Warehouse Conveyor Belts
- Freight Loading
  - Cranes
- Remote Monitoring
  - Chemical Level Monitoring
  - Alarm Detection

Safelincs

Banner Engineering

Crane

BACKGROUND

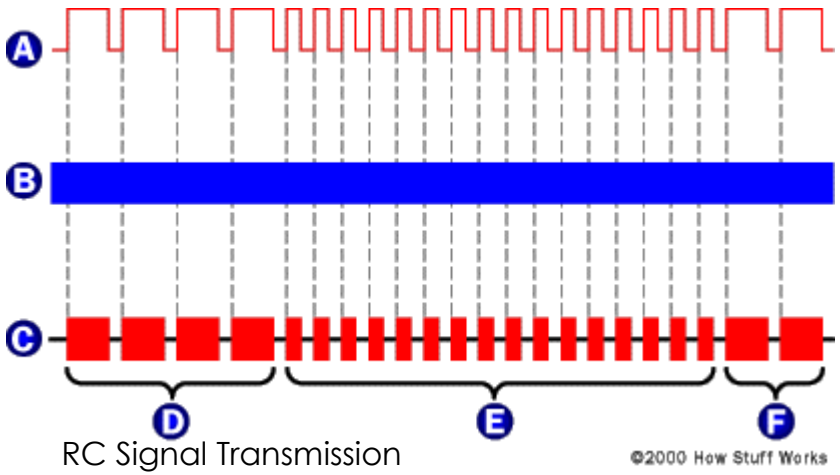
- **Early 1900's:** Radio Control was first tested
- **1940's:** RC applications were conceptualized in WWII
  - Guided missiles and bombs
- **1960's:** With the advancement of electromechanical systems especially with transistors and relays allowed for broader control
  - i.e. Multi-channel controls
- **2000's:** Modernization in early 21st century
  - Introduced pulse code modulation
  - Common 2.4Ghz spread spectrum
    - Allowed for varied frequency control

HOW RC WORKS

Basic Components:

Radio Frequency Transmitter (RF-TX), Receiver (RF-RX), Motor, Power Supply

- Transmitter, Manual Controller
  - Handheld device that includes a radio transmitter



RC Signal Transmission

- A Pulse sequence
- B 27.9MHz signal
- C Transmitted signal
- D 4 synchronization bursts each ≈ 2.1ms long with ≈ 700µs spacing
- E Burst sequence, each ≈ 700µs long with ≈ 700µs spacing
- F Sequence repeats

  - Joystick Trigger switched on IC that transmit RC signal, sequence of electrical pulses
  - Depending on number of channels (Usually 2 to 6 channels):

1. Forward
2. Reverse
3. Left
4. Right

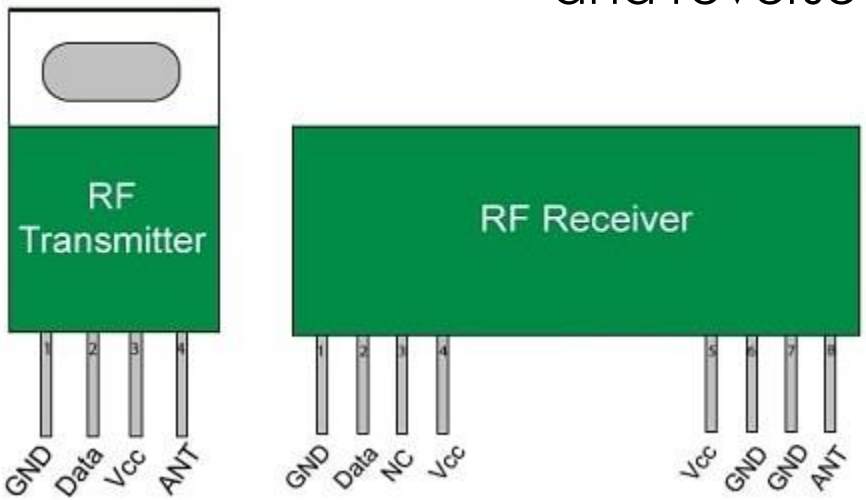
DIY Hacking

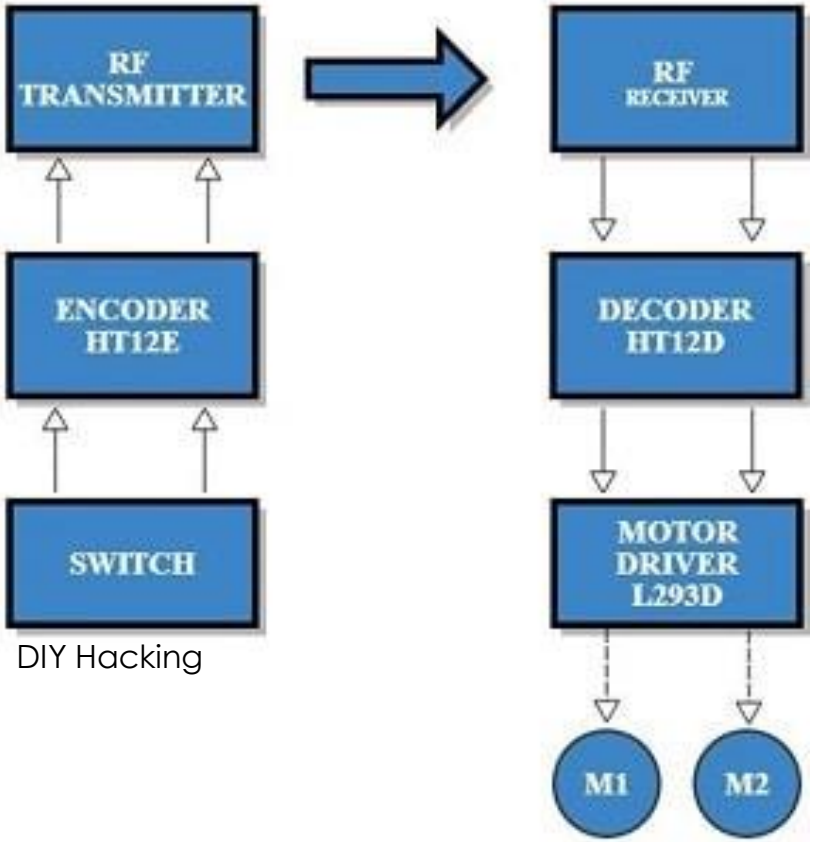
HOW RC WORKS

Basic Components:

Radio Frequency Transmitter (RF-TX), Receiver (RF-RX), Motor, Power Supply

- Receiver
  - IC Chip on RC Board is alerted and pulses are translated to the electric motors within the RC Car
  - One Motor controls the front wheels (left & right); Second Motor controls forward and reverse





DIY Hacking

PRODUCT SPECIFICATIONS

- **Mini Cooper Full Function Radio Control**

My Amazon Order

- 1:24 Scale
  - Dimensions: 6.5” x 3.5” x 2.5”
- 24.045MHz Radio Frequency Controller
  - Dual Joystick Controller
- Functions:
  - Forward, Reverse Left, Right
  - Headlight, Taillight
- Car Powered by 3 AA Batteries
  - 2 AA Batteries for the Controller

DRIVING CONTROL DEMONSTRATION

LEFT JOYSTICK:

- Forward
- Reverse

RIGHT JOYSTICK:

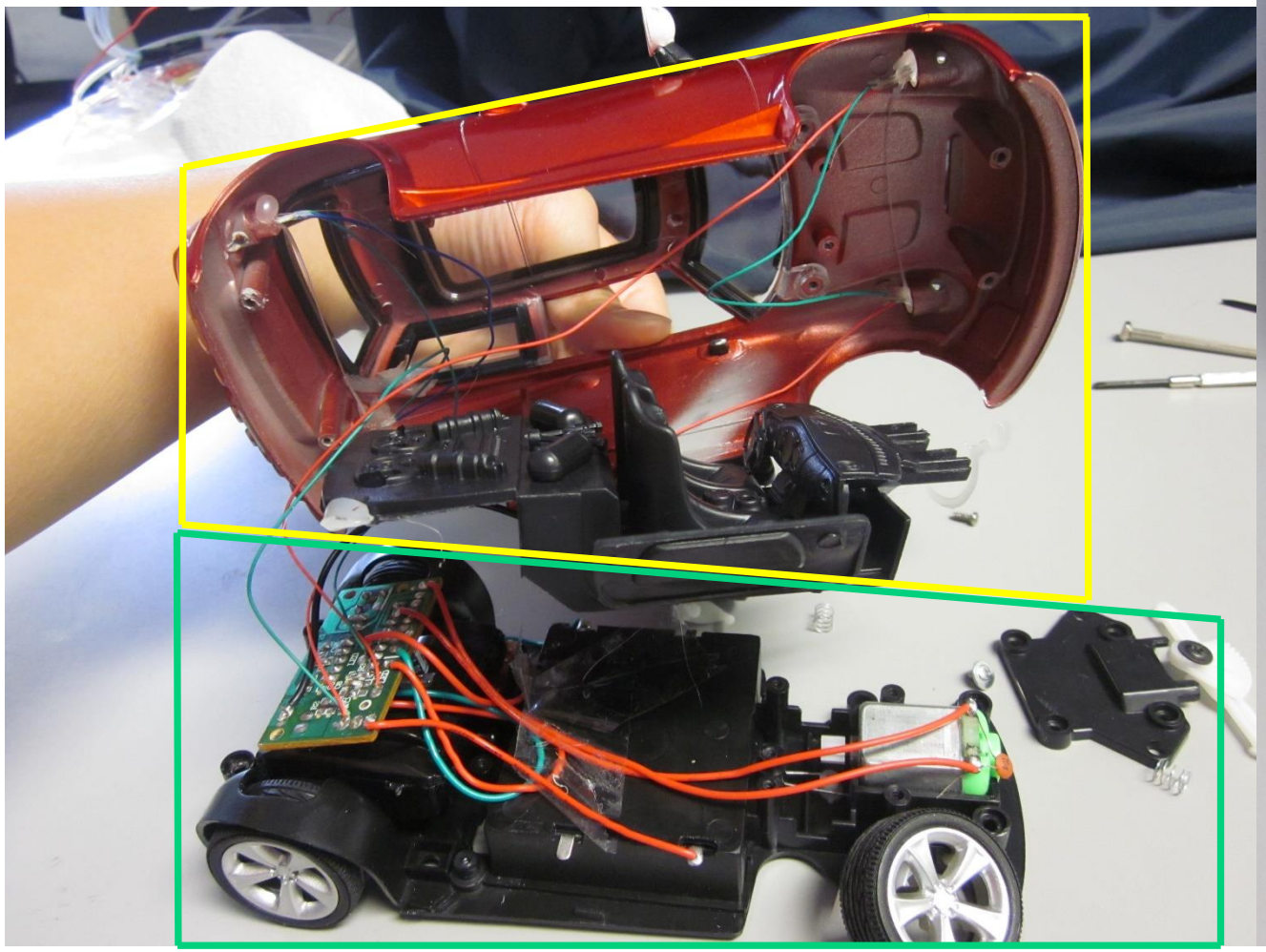
- Left steering
- Right steering

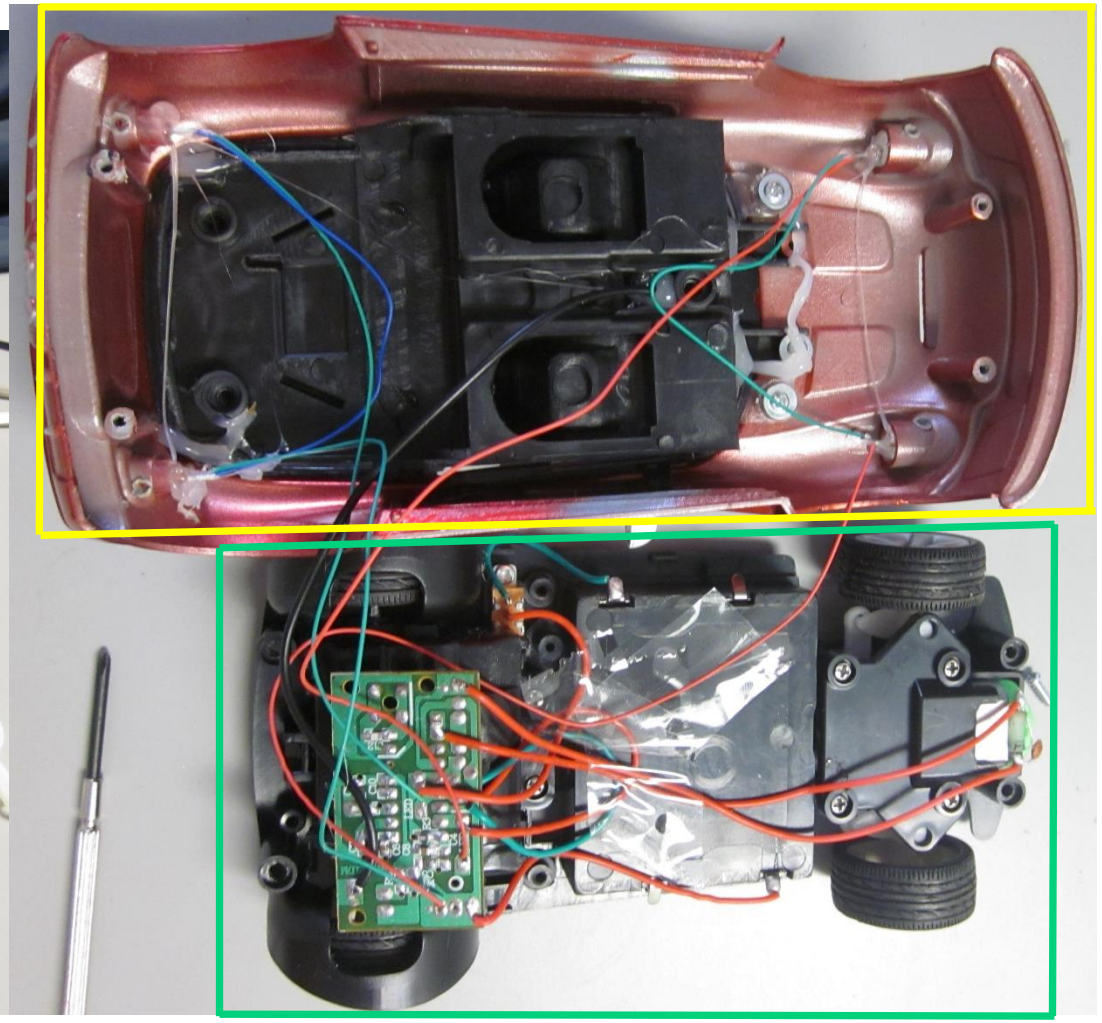
TEST DRIVE

- Reaches speeds up to 2mph
- Constant Speed when switch it on
  - Initial Acceleration is from jumpstarting motor from 0 to max speed
  - Deceleration when motor stops and car rolls to a stop
- Front LEDs for Forward Drive
- Red Backlights for Reverse
- Manual Control is very jerky

DISSECTION

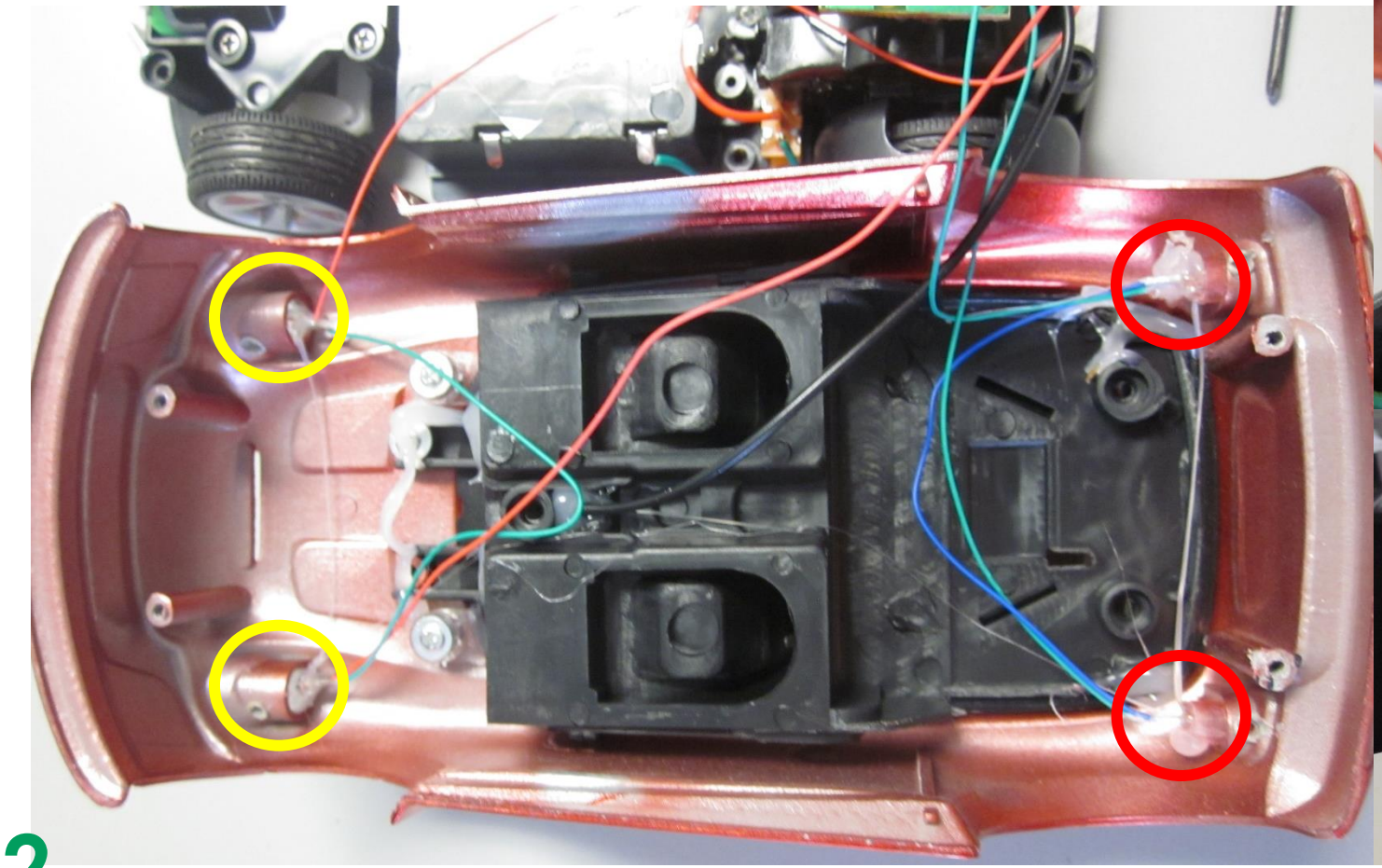
COMPONENT BREAKDOWN: BODY/INTERIOR + MOTORIZED CHASSIS

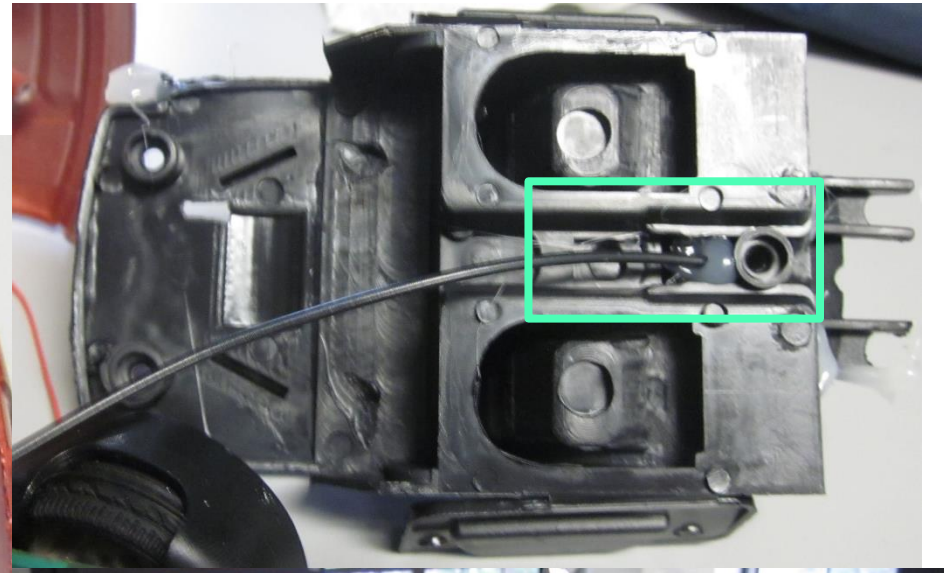


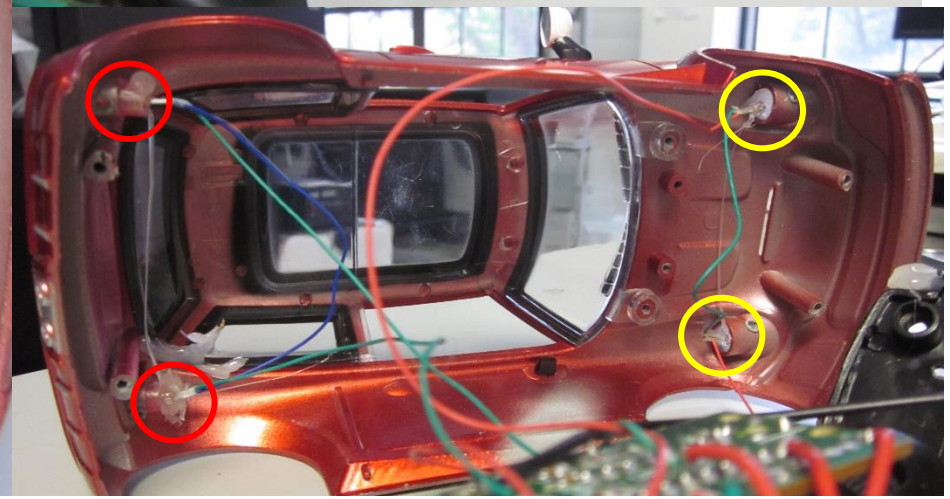


DISSECTION - BODY & INTERIOR

- Electromechanical controlled

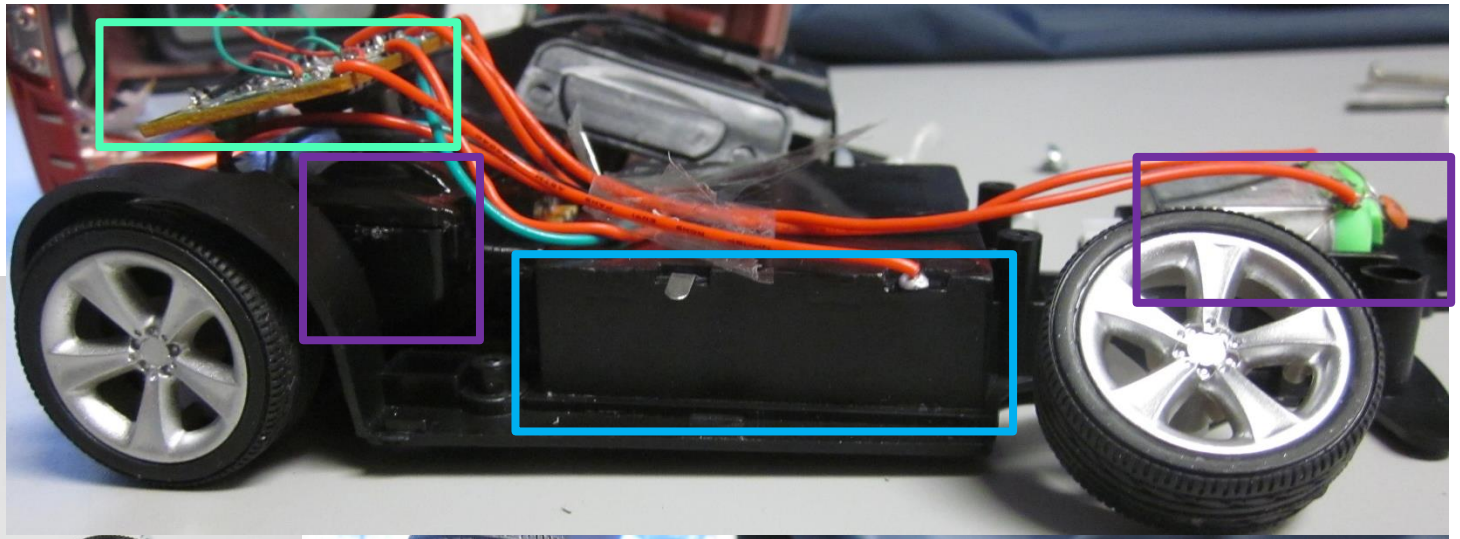


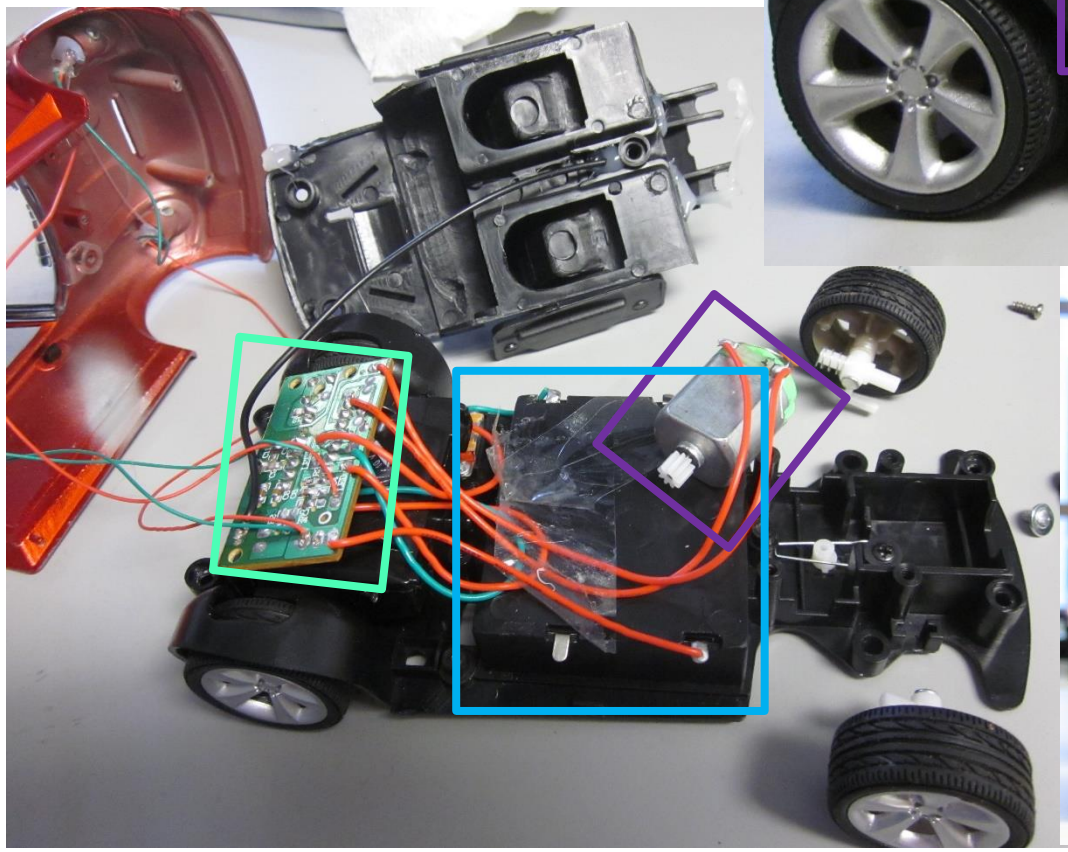


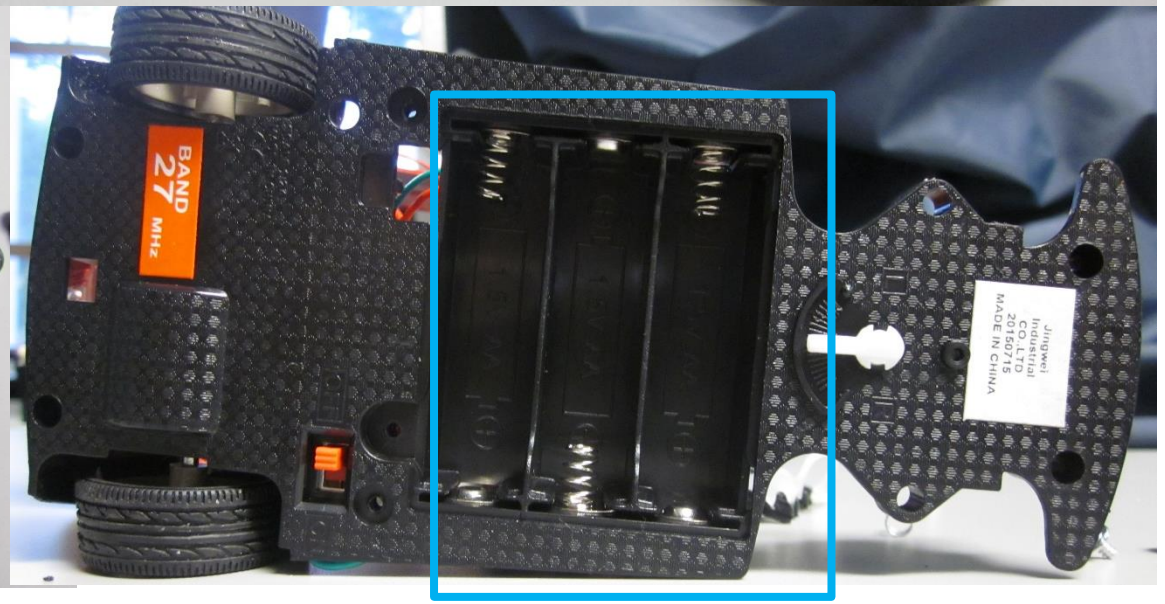


DISSECTION - CHASSIS

- POWER SUPPLY
- MOTORS (2)
- RX IC CHIP

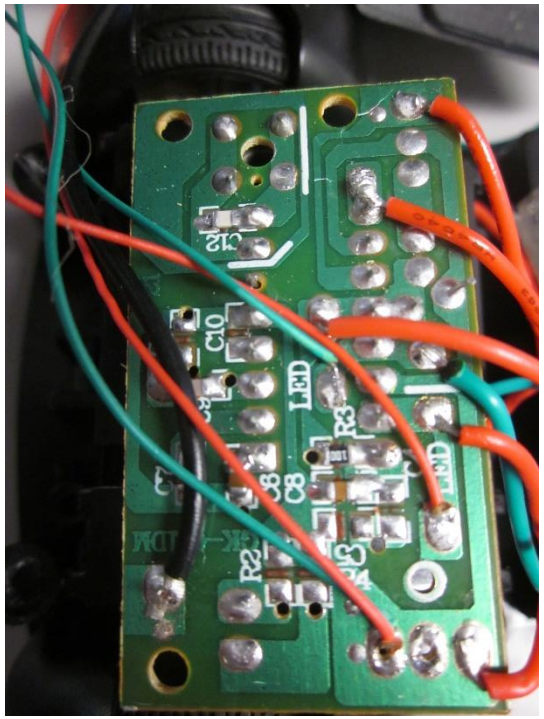




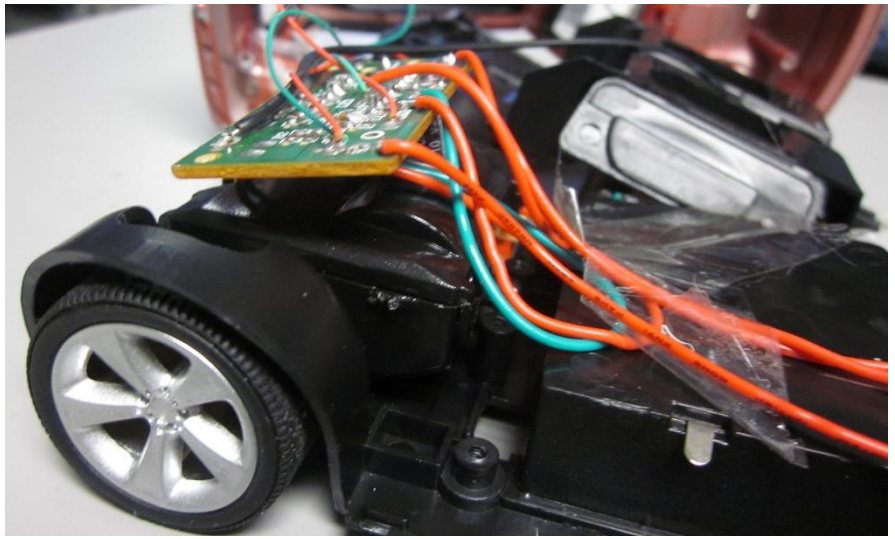


DISSECTION - CHASSIS

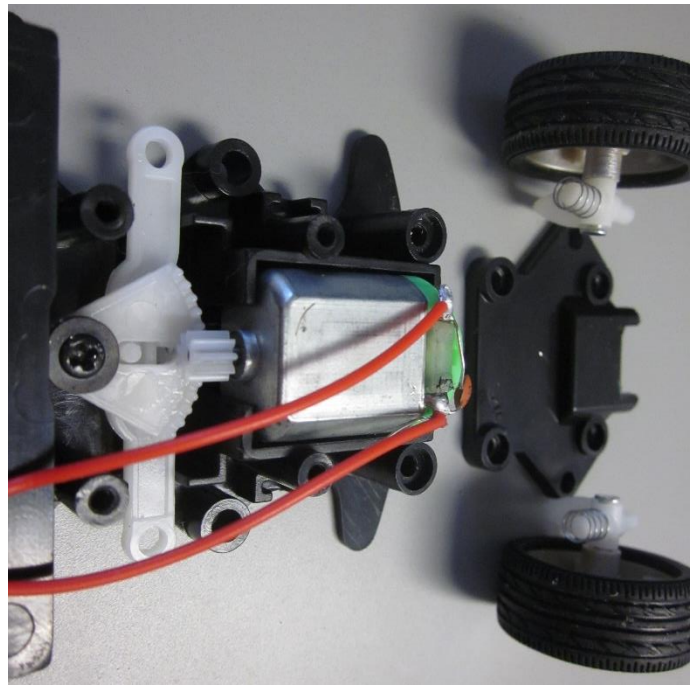
RX IC Chip feeds to Front and Back motors + LED's



Back wheel motor is encased in a thermal compartment

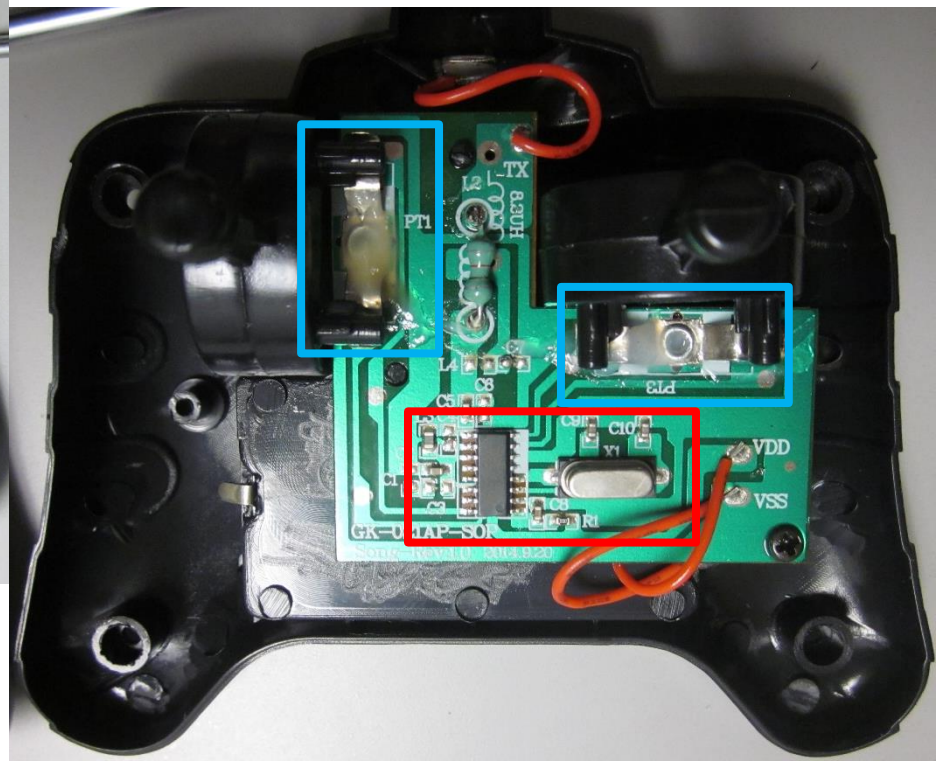


Front wheel DC Motor, Dampened wheels, Steering rudder



DISSECTION – RADIO CONTROLLER

- TX IC feeds to Antenna
- Two Switch Channels
- Encoder IC



CONCLUSION

- Radio Control has a diverse range of applications ranging from recreational usage to military applications
- Wireless capability very useful for remote control
  - paired with various radio frequency bands especially with the 2.4Ghz spread spectrum
- Fairly simple control and usage paired with straightforward components and equipment
- Low-cost with easily replaceable parts
  - i.e. power supply, motors, and transmitters

FUTURE APPLICATIONS

GOAL: RC Car travels to target destination
- With no prior mapping/path planning configuration
- Without hitting objects

- Retrofitting RX Chip with Arduino Microcontroller

- HC-SR04 Ultrasonic Distance Sensor
  - Obstacle Avoidance

- Target/Signal Emitter
  - To define target/goal location

QUESTIONS ?