

LED Robotics

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Project: Robot Tank Quality Assurance
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| 1.0 | Initial Release | February 16, 2021 |
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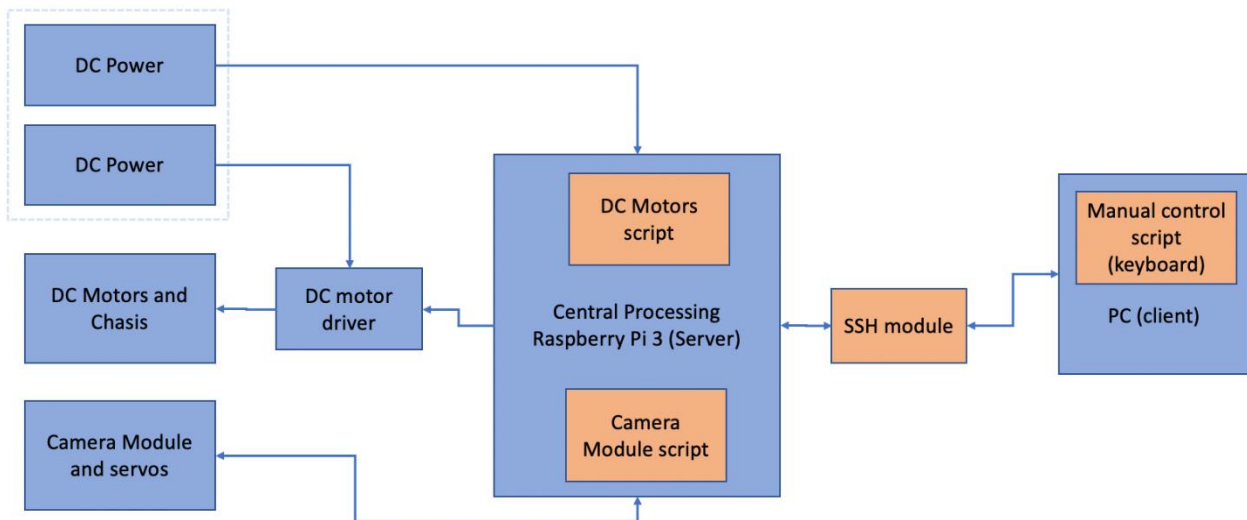
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1. INTRODUCTION

1.1. Objective

This document has the objective of Providing a detailed testing plan for all components and on-board peripherals for the Embedded Microcontroller Board.

1.2. System Block Diagram



1.3. Phase Breakdown

1. Visual Inspection

- a. Individual component inspection
- b. Solder check
- c. Jumper check

2. Power Supply and Regulator Testing

- a. Current Monitoring
- b. Voltage Verification

3. CPU Interface Testing

- a. Interface Signal Level Checks
- b. I/O Testing

4. Peripheral Circuit Testing

- a. Keyboard Manual Control (PC Client)
- b. Camera Module
- c. Status LED
- d. DC Motor

5. System Testing

- a. Performance testing

2. VISUAL INSPECTION

2.1. Individual Component Inspection

Using this as a checklist and verify each component for the following:

- Solder connection
- Proper orientation
- Correct values

| Comment | Designator | Quantity | Check |
|--------------------------|------------|----------|-------|
| 10uFCapacitor | C1, C3 | 2 | |
| 100pF Capacitor | C2, C4 | 2 | |
| 2K Resistor | R1, R2 | 2 | |
| LEDs | LED1, LED2 | 2 | |
| Raspberry Pi 3 Connector | J1 | 1 | |
| L298N Control Signals | J2 | 2 | |
| L298N Power | J3 | 2 | |
| Servo Motor 1 | J4 | 1 | |
| Servo Motor 2 | J5 | 1 | |
| USB B Micro | J6 | 1 | |

If you find any problem, please log it below.

2.2. Solder Check

Check all solder joints for short for open circuits. Please, use a multimeter to verify if there is any short circuit between the ground and power. If found any issue, please log it below.

2.3. Jumper Check

Check all the connections with jumpers. Please report it in the log below. Also report if labels do not match.

3. POWER SUPPLIES AND REGULATORS

3.1. Current Monitoring

For this test, the current of the whole system should be checked. For this, the robot tank can be tested using 2 regulated power supply to replace the power modules. The following steps should be applied:

- Connect the raspberry Pi and the DC Motor driver to separate regulated power supplies.
- Both should have their current limited to 1.8 A.
- Set up both to 5V.
- Start running the robot tank software.
- Move the robot tank in all directions.
- Move the servos for the camera in all directions
- Monitor the current being drawn.

Report if there is any issue to move the robot tank. Also, report the current every time.

3.2. Voltage Verification

Measure the output voltage level of each power supply. Connect the power supply into the raspberry and verify the following voltage level:

| Device | PIN | Description | Expected Voltage | Tolerance | Measured Voltage |
|--------------|-----|---------------------------|------------------|------------|------------------|
| L298N | GND | DC Motor and Logic Ground | 0.0V | 0 - 0.5V | |
| L298N | +5V | L298N Logic | 5.0V | 4.5 – 5.5V | |
| Raspberry | 4 | 5V Power output | 5.0V | 4.9 – 5.2V | |
| Raspberry | 6 | Ground | 0V | 0 - 0.5V | |
| PCB Servor 1 | 1 | 5V Power | 5.0V | 4.9 – 5.2V | |
| PCB Servor 2 | 1 | 5V Power | 5.0V | 4.9 – 5.2V | |
| PCB Servor 1 | 2 | Ground | 0V | 0 - 0.5V | |
| PCB Servor 2 | 2 | Ground | 0V | 0 - 0.5V | |

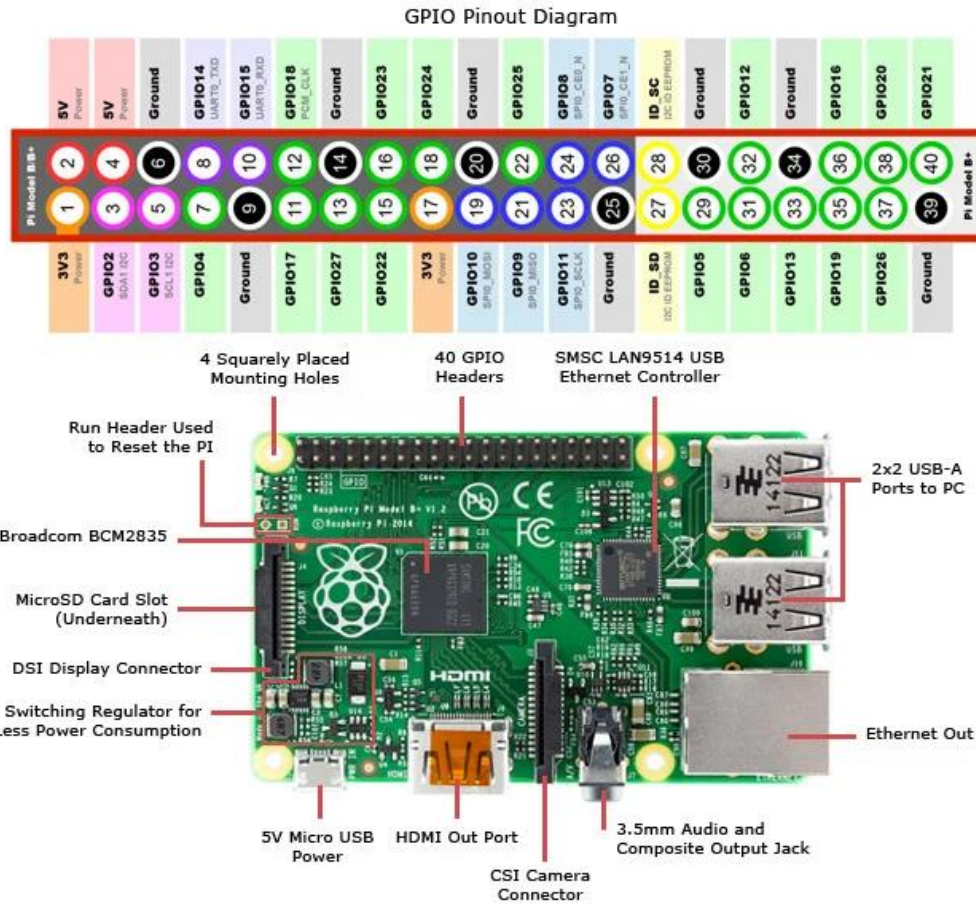
Connect the power supply into the PCB and verify the following voltage level:

| Device | PIN | Description | Expected Voltage | Tolerance | Measured Voltage |
|----------|-----|-----------------------|------------------|------------|------------------|
| Mini USB | 5 | Ground | 0V | 0 - 0.5V | Dt: 0v |
| Mini USB | 1 | 5V Power output | 5.0V | 4.9 – 5.2V | DT: 5.04 |
| L298N | +12 | DC Motor power supply | 5.0V | 4.9 – 5.2V | DT: 5.04 |

4. CPU Interface Testing

4.1. Interface Signal Level Checks

Check that interfaces are operating at the specified signal levels



Or we could use the schematic from Ki-Cad?

(image from

<https://www.jameco.com/Jameco/workshop/circuitnotes/raspberry-pi-circuit-note.html>)

4.2. I/O Testing

To load the test software onto the board, you should run the command `IOTest`. This program will help test if any pin is damaged, and for that reason, the raspberry should be disconnected from the circuit.

This software will guide you in different procedures to evaluate the component's proper operation, and it is divided into the following phases:

1. Put all output in low
2. Put all output in high.

If any issue with the peripheral was noticed, please log it below.

Raspberry

| Pin # | PIN Name | Signal Description | Expected Voltage (High) | Measured Voltage (High) | Expected Voltage (Low) | Measured Voltage (Low) |
|-------|----------|--------------------|-------------------------|-------------------------|------------------------|------------------------|
| 11 | IN2 | Motor 1 direction | 3.0 – 3.6V | | 0 - 0.4V | |
| 13 | IN1 | Motor 1 direction | 3.0 – 3.6V | | 0 - 0.4V | |
| 15 | EN1 | ENABLE A | 3.0 – 3.6V | | 0 - 0.4V | |
| 16 | IN3 | Motor 2 direction | 3.0 – 3.6V | | 0 - 0.4V | |
| 18 | IN4 | Motor 2 direction | 3.0 – 3.6V | | 0 - 0.4V | |
| 22 | ENB | ENABLE B | 3.0 – 3.6V | | 0 - 0.4V | |
| 10 | S1 PWM | Servo 1 PWM | 3.0 – 3.6V | | 0 - 0.4V | |
| 12 | S2 PWM | Servo 2 PWM | 3.0 – 3.6V | | 0 - 0.4V | |

5. PERIPHERAL CIRCUITS TESTING

To execute this test is required the use of the test software. Please download if before initializing that procedure. Each peripheral is individually tested.

5.1. Keyboard Manual Control (PC client)

The direction of the robot tank should be verified in relation to the GPIO outputs and the desired direction. To test this peripheral the robot tank scripts should be run. Please report the observed functions, the involved pins and the signals.

| Keyboard Keys | Expected Behaviour | Observed Function | Pins involved | Signals |
|---------------|--------------------|-------------------|---------------|---------|
| I | Upper Servo Left | | | |
| O | Upper Servo Middle | | | |
| P | Upper Servo Right | | | |
| J | Lower Servo Left | | | |
| K | Lower Servo Middle | | | |
| L | Lower Servo Right | | | |
| C | Capture Image | | | |
| B | Reset the working? | | | |
| V | Preview Image | | | |
| W | Move Forward | | | |

| | | | | |
|---|--------------|--|--|--|
| S | Move Reverse | | | |
| A | Move Left | | | |
| D | Move Right | | | |

Check commands priority. Press all the move keys at the same time and report below.

5.2. Camera Module

Check if the streaming video system works. Run the camera software and report unexpected behavior below.

5.3. Status LED

Check that the 2 LEDs work as expected:

- D1 : Raspberry Pi ON
- D2 : DC Motor driver ON

5.4. DC Motor

Before the test, please:

- Check each pin for expected signal level.
- Check all voltage supply vias.

Each DC motor will continuously rotate the caterpillars for 2 seconds forward, stop 1 second, and rotate 2 seconds backward.

If any issue with the peripheral was noticed, please log it below.



6. SYSTEM TESTING

6.1. Performance Testing

- Run the robot tank scripts.
- Ramp Test
- Stall Test

If any issue is noticed, please log it below.