University of Regina

ENEL 387 Project Final Report

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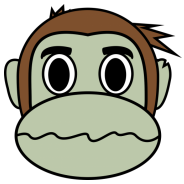
Robot ID: Zombie Harambe



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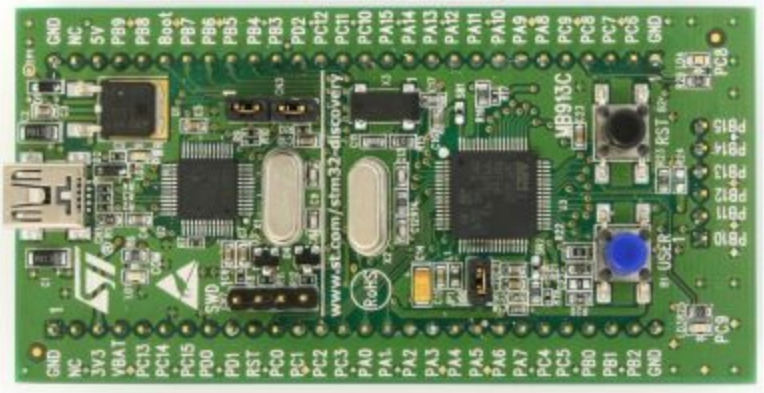
Part Specification

STM32VLDiscovery Carrier Board

Supply Voltage: 9VDC

Function: Used with STM32F100 Discovery to connect with external peripherals

STM32F100 Discovery



Supply Voltage: 5V

Frequency: 24Mhz

Pins Used: PA9, PA10, PA11, PA12, PC5, PB7, PA8, PB13, PB14, PA3, PA4, PB6, PB7, Pin60.

HC-SR04 Ultra01+ Ultrasonic Range Finder

Supply Voltage: 5V DC

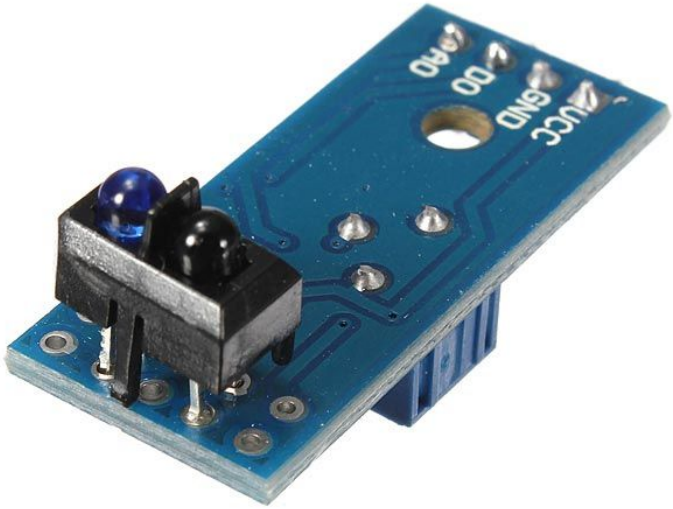
Quiescent Current: 2mA

Effectual angle: 15 degree

Ranging Distance: 2cm - 500 cm

Resolution: 0.3 cm

SENS-TCRT5000



Operating Voltage: 3.3VDC to 5VDC

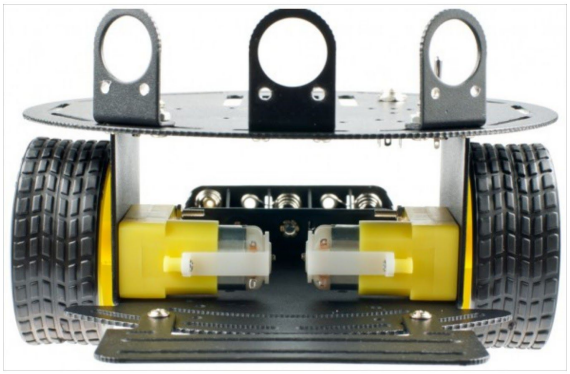
IC: LM393

Sensor: TCRT5000

Operating range: 1mm to 25mm

Dimensions: 31mm x 14mm / 1.22 in x 0.55 in

2WD Mobile Platform



WD Arduino mobile robot development platform

Low-cost Arduino microcontroller mobile platform

Two differential drive

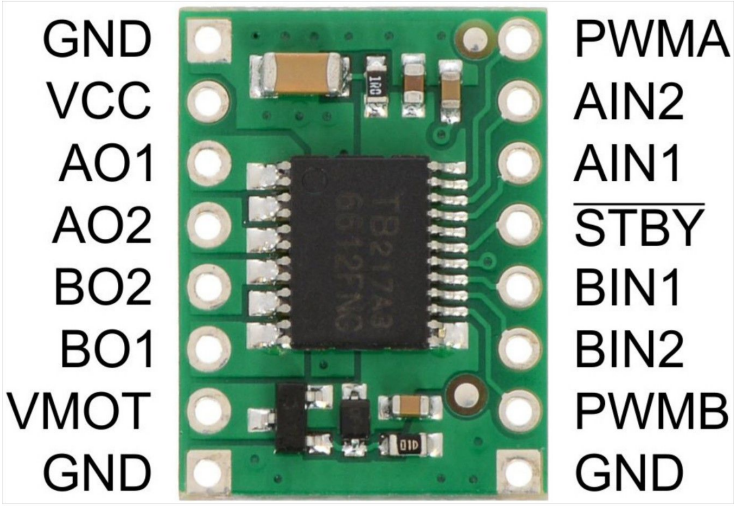
Caster ball included

Complete chassis with mounting hardware

Dimensions: 170mm diameter base

Weight: 400g

Pololu Dual DC Motor Driver



Motor driver: TB6612FNG
Motor channels: 2
Minimum operating voltage: 4.5 V
Maximum operating voltage: 13.5 V
Continuous output current per channel: 1 A
Peak output current per channel: 3 A
Continuous paralleled output current: 2 A
Maximum PWM frequency: 100 kHz
Minimum logic voltage: 2.7 V
Maximum logic voltage: 5.5 V
Reverse voltage protection: Yes

DFRobot 6V,180rpm Micro DC Geared Motor with Back Shaft

Gear Ratio 1:120

No-load speed(3V): 100RPM

No-load speed(6V): 200RPM

No-load current(3V): 60mA

No-load current(6V): 71mA

Stall current(3V): 260mA

Stall current(6V): 470mA

Torgue (3V): 1.2Kgcm

Torque (6V): 1.92Kgcm

Size: 55mm x 48.3mm x 23mm

Weight: 45g

Battery Holder 6XAA

Comes with a DC2.1 Power jack which can plug to Arduino directly

Max Operating Temperature: 80°C (176F)

Cell Quantity: 6

Battery Type: AA

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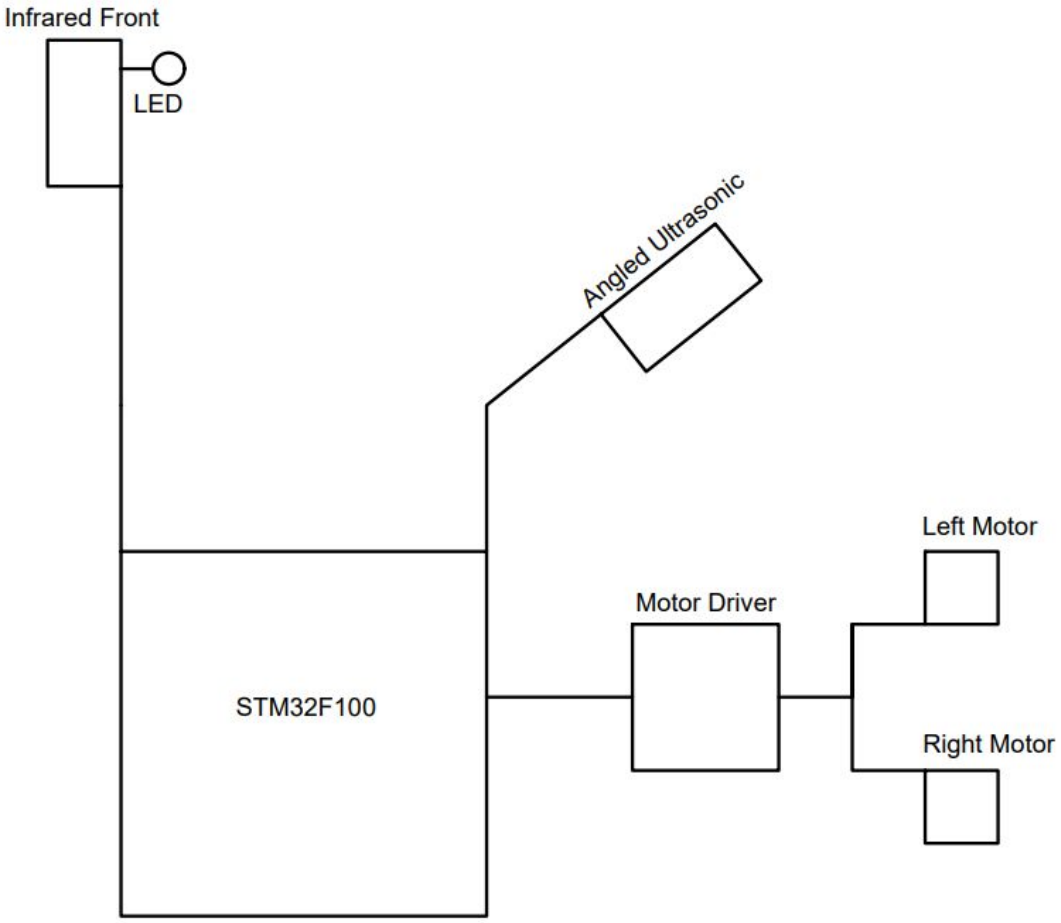
Block Diagram:

The basic system and parts are indicated below in our block diagram.



Functionality:

The robot will travel by two wheels and a caster ball . It will be capable of moving forward, turning left or right. Using an ultrasonic sensor, the robot will determine a direction to turn depending on the distance. Finally using an infrared sensor, the robot will be able to detect lines and output to a LED on the infrared sensor’s exterior.

User Control and Indicators:

The user will turn the robot on and it will navigate on its own. It has four LEDs that will light up depending on the robot's direction of movement. LED 2 and 4 light when the robot is moving forward. LED 2 and 3 light up when the robot is moving left and LED 1 and 4 light up when the robot is turning right. Our IR sensor has a green light near the VCC pin that says when the IR is on and the green light nearest the A0 pin will turn on when the sensor detects an object in front of it.

Schematics/Datasheets:

***See attached Folder named “Schematics” for Schematics**
***See attached Folder named “Datasheets” for Datasheets**

Testing Procedures:

A breadboard is used as a placeholder for some of the parts and for the circuitry of the robot. Starting with the motor driver and motors, the driver was connected on a breadboard with 5V and a ground given to the breadboard by the microcontroller. The motors were then connected to the motor driver which supports the control of dual motors. As one of the AIN & BIN pins is given a digital 1 (3.3V - 5V) or a 0 (grounded), the motors start rotating the wheels. Each motor was given the same speed by using the potentiometer on the discovery board to set the speed. Now that the wheels were spinning with a controlled direction and speed, the pins of the motor driver were connected to their designated pins on the STM32F100 Discovery via the carrier board. For the ultrasonic sensor, a 10us pulse was given to the TRIG pin. By connecting the ECHO pin to an oscilloscope a square wave is shown, when an object is near the sensor. The sensor was then connected to its specified pins on the carrier board. To test the IR sensor, a 5V and ground connection was given along with a digital and analog connection. A black background with white lines was used to test the sensor and the external LED. When the sensor was placed across the black background, the LED would remain turned off. The moment it came across a white line, the LED would turn on to indicate a line. To complete the testing the IR sensor was hooked up to the STM32F100 Discovery via the carrier board.

*See Source and Header files for code

Course Navigation:

Robot is capable of navigating a rectangular course. All navigation is Ultrasonic sensor based with no pre programmed or dead-reckoning navigation. Robot uses an IR sensor to detect lined patterns.

See video for demo/details:

Zombie Harambe Robot Course Navigation

*Note: Due to certain circumstances of not owning a printer and IR sensor pins coming pre-soldered, a large enough line pattern was not printed for course navigation hence the IR sensor needs to be read from up close.

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Updates:

talk about what parts/schematics/designs changed, and why

Part Specification:

- Added ‘STM32VLDiscovery Carrier Board’ since it powers and houses ‘STM32F100 Discovery’.
- Removed ‘ToF Range Finder Sensor Breakout Board’ due to I2C library requirement and restriction.
- Added ‘SENS-TCRT5000’ to replace the previous IR sensor and buzzer.
- Removed ‘Electronic Brick Buzzer’ due to problems with circuitry.
- Replaced ‘4XAA Battery Holder’ with ‘6XAA Battery Holder’ due to limited Voltage with 4XAA.

Block Diagram:

- Replaced Audible Device with LED
- A single Ultrasonic sensor used instead of 3.

Functionality/User Control and Indicators:

- Robot will not be moving backwards, unless code is implemented.
- Uses LED as an indication of lines instead of a buzzer

Schematic:

- Replaced old IR sensor schematic with new IR sensor schematic
- Updated STM32F100 schematic
- Updated HC-SR04 Ultrasonic sensor schematic
- New Chassis Schematic

Icon is issued by a free photos source. No live or deceased gorilla(s) were used to build, test, and/or harmed for this product

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