TDPS Group 33 Lab Notebook

Experiment Name: Line-Tracking Algorithm

Target:

For each frame, output should be correspond to the moving direction

Approaches:

① image binarization
② filtering operations (Gauss Filtering, openCV Implementation)
③ ~~⊗~~ generating blank strips
④ image multiplication and merging
⑤ curve fitting ~~and~~ to median

~~In~~ Train of Thought:

We want to generate the ~~following~~ matrices with following characteristics:

△ The strips on each matrix are equal in length and width
△ The number of pixels ~~occ~~ occupied by each strip is equal

The strips can not be ray-shaped, we place it in parallel.

Through Python program, the impletation is very successful.

Implementation:

After the sum of true multiplication, ~~using~~ I use binomial fitting and ultimately calculate the symmetry axis is the data I should provide for the main-control program.

I use Python to implement the program above in Raspberry Pi 3B+ that can be set as Linux operation system that can run Python. Then I got the following result:

-4	-3	-2	-1	0	1	2	3	4
78384	842015	818315	818[illegible]	845835	[illegible]	[illegible]	[illegible]	741340
1354735	1632145	1613130	1656225	1675330	1656225	1646280	1588360	1440485

Name: Changgang Zheng
Date: Mar. 24. 2019
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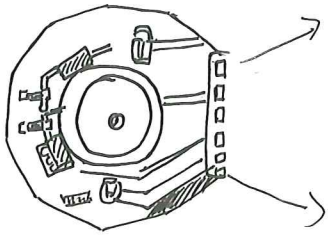
TDPS Group 33 Lab Notebook

Experiment Name: Basic running of motors

Objective: Running motors

Procedure:

My team member Changgang Zheng has purchased 4 GM25-370 Reduction gear DC motors for 4 Maccallum wheels.



① At the ~~begg~~ beginning, I connected the power supply of "+","-" polars of the motor to 2 pins of Arduino. But the motor cannot rotate.

Mistakes: The rated voltage of the motor is almost 12V, the Arduino cannot supply voltage that large.

② Then, I connected "+","-" polars to the power supply in lab.
Different speed can be achieved using voltages of different magnitude.
Different rotational direction can also be achieved by switching "+" and "-" polars

We ~~can~~ definitely cannot control the speed and direction in this way.

After checking the datasheet, A module "L298N" is needed.

Name: Yuxuan Li
Date: Mar. 16th 2019
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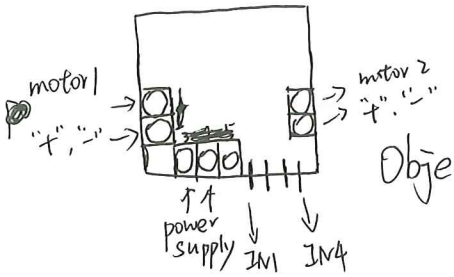
TDPS Group 33 Lab Notebook

Experiment Name: Improved runnings for motors

L298N



Objective: Running motors with different speed and direction (Improved)

Procedure: After purchasing "L-298N" module

① The poner supply of 2 motors needs to be connected to left and right sides of "L298N"

② The power supply of encoder on the motor needs to be connected to 2 ~~digital~~ analog outputs of Arduino

③ The A and B phase pins of 2 encoders need to be connected to IN1, IN2, IN3, IN4 on "L298N"

④ A stable power supply for motors needs to connected to "L298N" power supply pins. "Jumper" pin is necessary for voltage larger than 12V.

⑤ The PWM output of Arduino could be linked to L298N for speed control

What awaits is to assemble the motors with 4 wheels.

Name: Yuxuan Li
Date: Mar. 19th 2019
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TDPS Group 33 Lab Notebook

Experiment Name: Query information about wireless communication & HC-12

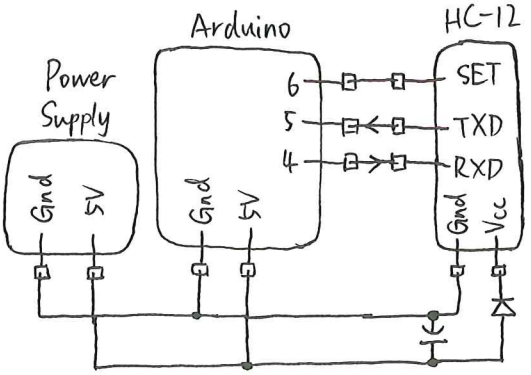
Goal: Complete "Patio 2 - Task 3" to realize communication function, which requires the robot to transmit a message to a laptop using a Wavesens HC-12 wireless transceiver.

Procedure: 1. Query the definition and applications of wireless communication.

in Wikipedia: "Wireless communication, or sometimes simply wireless, is the transfer of information or power between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio waves. With radio waves distances can be short, such as a few meters for Bluetooth or as far as millions of kilometers for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking."

2. Find a website which provides information about "Understanding and Implementing the HC-12 Wireless Transceiver Module" as well as its datasheet, how to connect to Arduino and some related program code.

"The HC-12 is a half-duplex wireless serial communication module with 100 channels in the 433.4 - 473.0 MHz range that is capable of transmitting up to 1km."



Name: Shiying Li

Date: Mar. 13. 2019

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TDPS Group 33 Lab Notebook

Experiment Name: HC12 module for communication task

Task: be familiar with HC12 and use it for communication module

Object:
- collect information about HC12 details and working theories
- purchase HC12 componet for our project
- learn HC12 and apply it to Arduino

(i) information about HC12

433 Mhz 1000M HC-12 ~~Replace Bluetooth Antenna~~

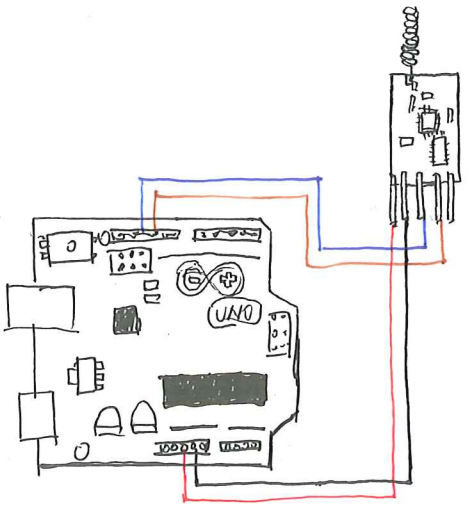
power supply voltage	3.3 V
Default communication distance	about 600 m
Default idle current	16 mA
Module size	27.8 mm * 14.4 mm * 4 mm

As the above HC12 info indicates, the required voltage and communication distance are essentially meet our project need. So, the next step is to purchase it.

(ii) The purchase of HC12 433 kHz ~~was~~ made online (TaoBao)

(iii) Arduino and HC-12

The circuit schematics of connecting the HC-module to the Arduino is as follows



HC-12 pinout

Name: Zhensheng Xie

Date: Mar. 5, 2019

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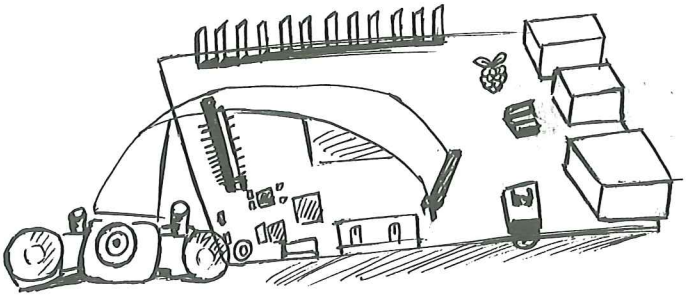
TDPS Group 33 Lab Notebook

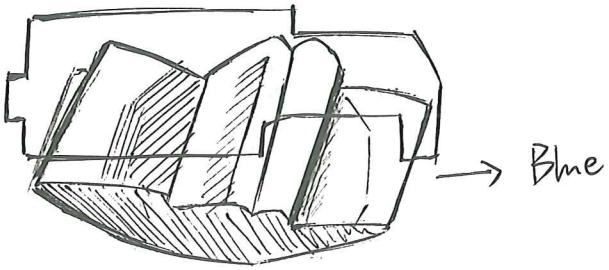
Experiment Name: Color Detection Algorithm

Objective: Design the color detection algorithm to satisfy the requirements of helping the robot match the determined color efficiently.

Procedure:

- looking up related work and algorithm online to have an overall concept.
- Trying to use hsv (Hue, Saturation, Value) to distinguish the image as red, green or blue.
- Utilize the "camera_continuous" function of raspberry's camera to capture images continuously.
- Processing the image through mask, bitwise, blur and gray.





Name: Kexin Fan

Date: Mar. 10. 2019

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TDPS Group 33 Lab Notebook

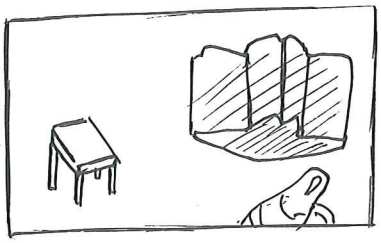
Experiment Name: Coordinates Determination

Objective: Determine the coordinates of the detected object in the image. This could help the robot determine the direction of color square.

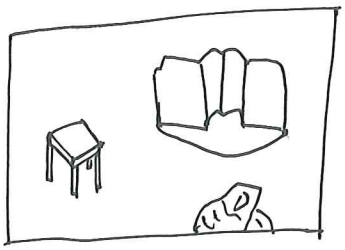
Procedure:

- Looking up related work and algorithm online.
- Downloads "aircv" database in python.
- Writing the related algorithm by matching the detected object on the original image and then obtaining the coordinates on the original image.

Results:



Detected Object



Original Image

'shape': (640, 480), 'confidence': 0.5532550215721137, 'result': (320, 240), 'rectangle': ((0, 0), (0, 480), (640, 0), (640, 480))}

Name: Kexin Fan

Date: March 27, 2019

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TDPS Group 33 Lab Notebook

Experiment Name: Operate Voice Module

Goal: Design a piezoelectric buzzer or loudspeaker to play tones and make it speak out.

Process: I use the Arduino ~~tuno~~ tone Library. It is just a Arduino library that produces square waves at a specified freqwey on any arduino pin. The duration can be specified selectively, the pin can be connected to piezoelectric buzzer or loudspeaker to play tone.

Firstly, I open the Arduino IDE software on the computer. Use Arduino language to encode and control the circuit. Open a new sketch file by clicking new.

Secondly, to create a pitches.h file, I click the button direcly below the serial monitor icon, and then select "New Tab".

Then, I search some codes that represent some easy tones initially. And save the code shown as pitches.h.

Finally, we can hear notes saved in the pitches.h file.

Name: Huimin Wang
Date: Mar. 16. 2019
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TDPS Group 33 Lab Notebook

Experiment Name: Matrix Generation for Line Tracking

Objective:

Generate the matrices ~~that~~ with following characteristics:

- △ The strips on each on each matrix are equal in length and width
- △ The number of pixels occupied by each strip is equal
- △ The angle between two strips is equal

Besides, there are several strips on each picture.

Train of Thought:

The reason why I use strip matrixes is that I want to use strips to ~~calculate~~ multiply the original image and sum it, which is a calculating method that can save ~~many~~ computing resources. ~~Nine~~ 9 values can be obtained after the final point multiplication. I use ~~binomial~~ binomial fitting and finally calculate the symmetry axis, which is the data I should provide for main-control program.

Implement:

I use Python to try to implement the program with Raspberry Pi 3B+ that can be set as a Linux operation system, which can run Python.

Results:

I found it very difficult in realizing the construction. In a rectangular lattice, it is impossible to generate bands that satisfy the conditions mentioned above. I think the objective of the experiment is too harsh. Thus, I will try to ~~achieve~~ achieve the objective in another method.

Name: Changgang Zheng

Date: Mar.10.2019

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TDPS Group 33 Lab Notebook

Experiment Name: Operate Steering Engine(s) (In Mbed)

Objective:

Drive the steering engines we ~~used~~ use (LD-150MG) to rotate specific angles as I ~~expected~~ expect

Procedure:

First of all, I referred to the data sheet and found out the requirements of how steering engines work. That is, transmitting Pulse-Width Modulation Signals with specific period and duty cycle to the steer engine.

Then, based on some fundamental programs, I tested the steering engines. However, it didn't work. I had to make adjustment ~~and~~ in programs as well as in the I connected the electronic circuit (connecting the cathodes of steering engines and batteries both to ~~gron~~ ground is necessary). Finally, I succefully enabled steering engines rotate specific angles ~~an~~ as I expected.

~~Plan~~ Future Plan:

until now, all of my programs are run in mbed LPC1768, but the ~~Ardu~~ aim of our team is to run all the programs in an Arduino development board. Therefore, the next step of my job is to learn how to program in Arduino and use it to drive steering ~~gin~~ engines.

Name: Yue Zeng
Date: Mar. 16. 2019
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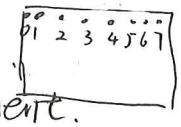
TDPS Group 33 Lab Notebook

Experiment Name: Motion Tracking Device

Goal: Using a Motion tracking device to help with the movement of the car. Mpu-6050.

lab 1: To learn about the component.



In this experiment, the component mainly helps to measure the acceleration of x, y, z axises.

Register (Hex)	Register (Decimal)	bit 7	bit 6	bit 5	bit 4	bit 3
1C	28	XA-ST	YA-ST	ZA-ST	AFS_SEL[1:0]	

So in this lab, I mainly learn about Pin 3 ~ 7.

when XA-ST sets to 1, the X-Axis accelerometer perform self test.

Similarly as YA-ST, ZA-ST.

AFS_SEL is a 2 bit unsigned value, it is used to select the range.

lab 2. To learn about I²C Master control

Register Hex	Register Decimal	bit 7	bit 6	bit 5	bit 4	bit 3 ~ bit 0
24	36	MULT_MST_EN	WAIT_FOR_ES	SLV_3_FIFO_EN	I2C_MST_P_NSR	I2C_MST_CLK[3:0]

The register configures the auxiliary I²C bus for single & multiple control. When bit 7 set to 1, the current will increase by 30μA and means the component is available. bit 6 controls Data Ready interrupt. bit 5 controls data load and bit 4 configures the I²C master transition from one slave read to another. which means the next slave read.

Name: Congyang Lei

Date: Mar. 14. 2019

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