



TRƯỜNG ĐẠI HỌC
SƯ PHẠM KỸ THUẬT TP. HỒ CHÍ MINH
HCMC University of Technology and Education

AUTONOMOUS CAR

Automotive Electrical and Electronic Systems

Given By Hoang Tien & Minh Khoa & Tung Lam

OUR TEAM



Le Hoang Tien

- Leader
- Simulation
- Code



Le Ho Minh Khoa

- Content
- Microcontroller
- PowerPoint



Nguyen Ly Tung Lam

- Microcontroller
- Code

Class ID: AEES330233E_23_1_02FIE
Lecturer: Do Van Dung



MAIN CONTENT

4. Code & Simulation

How does the code work?
How is the product simulated?

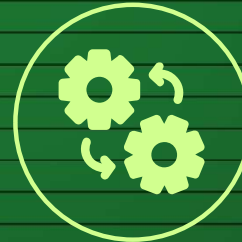
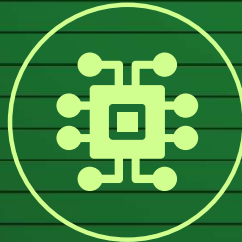


1. Initial Idea

What was the original
concept behind this project?

3. Components

What are the key parts that
make up our product?



2. Applications

What are the practical uses
that our project offers?





01

INITIAL IDEA

What is the original concept behind this project?

1. Initial Idea



1. Initial Idea



Idea



Research

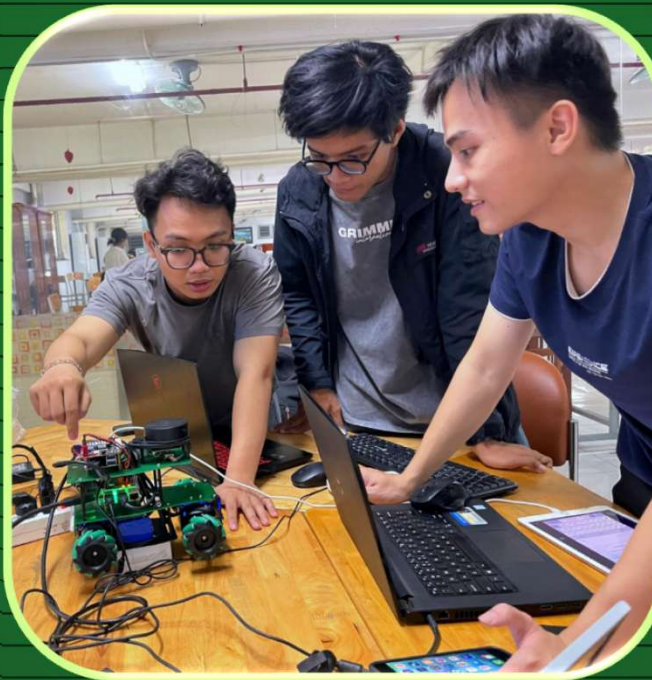
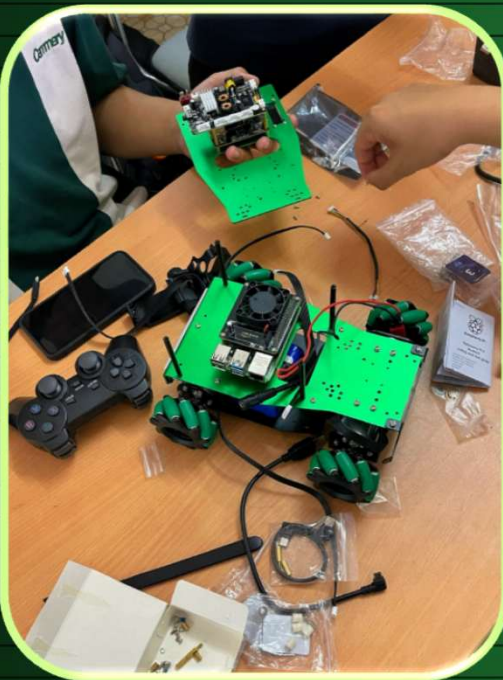


Perfect Provider



Our Autonomous Car

The Building Process





02

POTENTIAL APPLICATIONS

What are the practical uses that our project offers?



Urban Planning



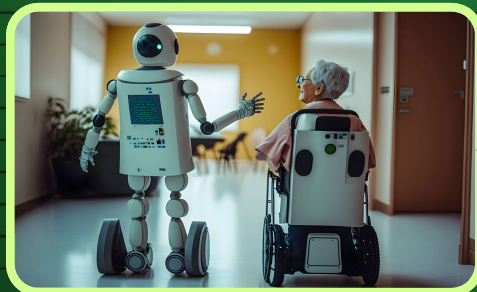
Transportation



Emergency



Delivery



Support Elderly and Disabled



Industrial

>>>>>>
03

MAIN COMPONENTS

>>>>>> What are the key parts that make up our product?

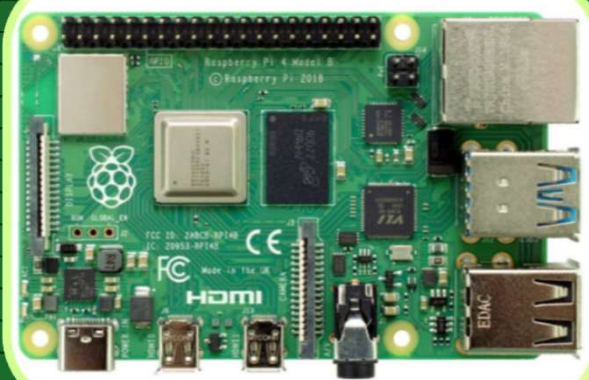
STANDARD PARTS

	Pendular suspension bracket-1		Anti-collision beam
	Motor base plate		Main controller fixed plate
	Pendulum suspension bracket-2		RGB strip fixed bracket
	Lidar fixed plate		Robot expansion board
	USB HUB expansion board		Motor*4
	OLED		Coupling*4
	LED strip		Several cables
	Data line		Screwdriver
	Handle+ AAA battery		Battery

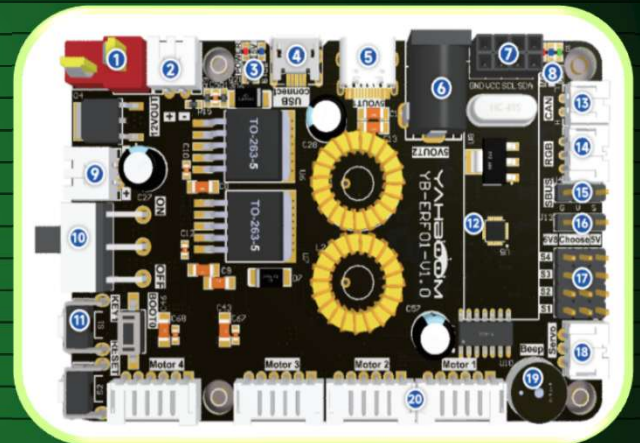
IMPORTANT PARTS



X3 LiDAR



RASPBERRY PI 4B



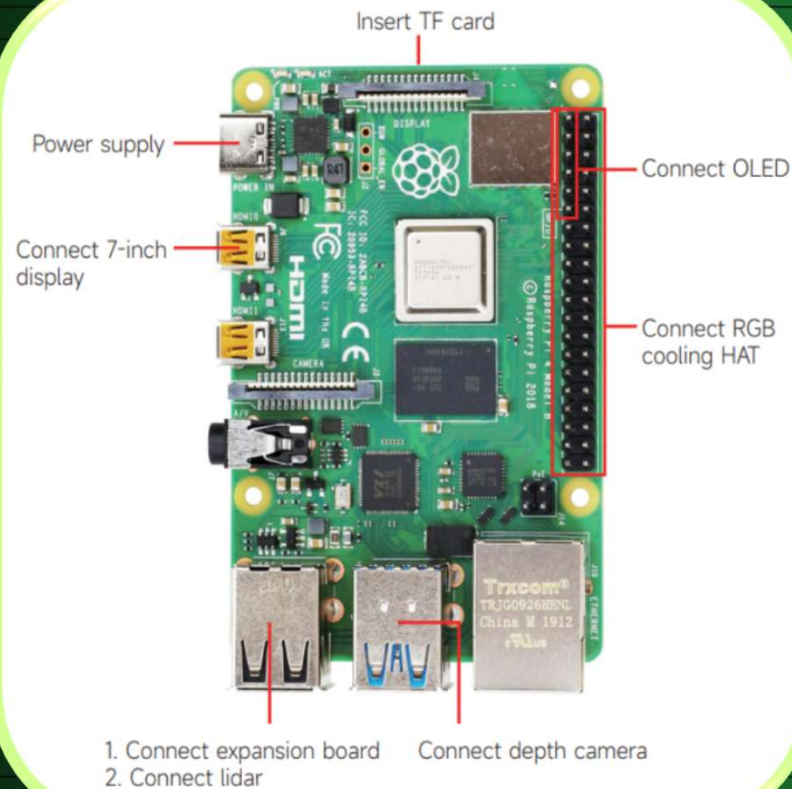
Expansion Board

X3 LiDAR



Property	Parameter
Measuring frequency	<i>3000Hz</i>
Scanning frequency	<i>10Hz</i>
Measurement Range	<i>0.12-8m</i>
Scan Angle	<i>360°</i>
Absolute error	<i>2cm</i>
Relative Error	<i>1%</i>
Pitch Angle	<i>1.75°</i>
Angle Resolution	<i>0.6°-1.2°</i>

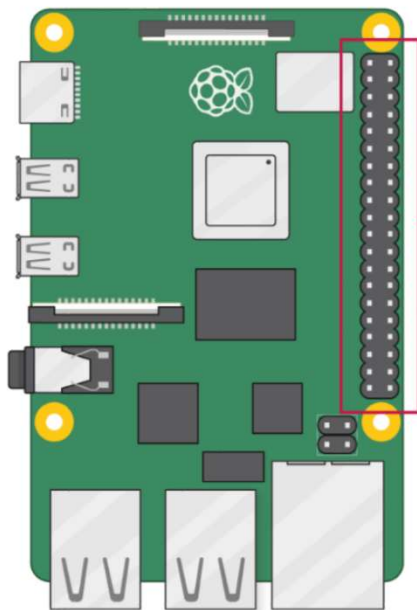
RASPBERRY PI 4B



Performance parameters

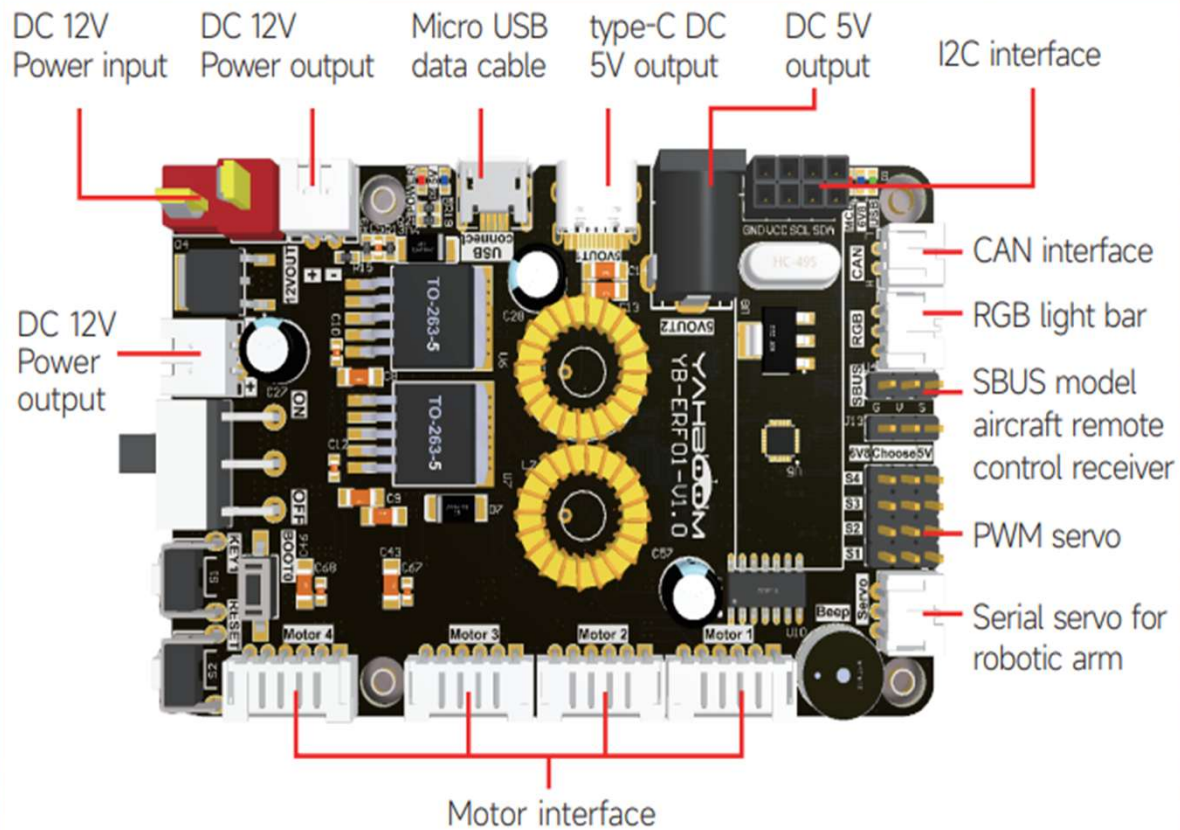
- Broadcom BCM2711, (CPU)
- Quad core Cortex-A72 64-bit SoC 1.8GHz
- 2.4 GHz and 5.0 GHz IEEE 802.11 AC wireless
- Bluetooth 5.0
- 2 USB 3.0 ports; 2 USB 2.0 ports.
- Raspberry Pi standard 40 pin GPIO header
- 2 × micro-HDMI® ports (up to 4kp60 supported)
- 2-lane MIPI DSI display & camera ports
- 4-pole stereo audio and composite video port
- H.265 (4kp60 decode)
- H264 (1080p60 decode, 1080p30 encode)
- Micro-SD card slot
- 5V DC via USB-C connector (minimum 3A*)
- 5V DC via GPIO header (minimum 3A*)
- Power over Ethernet enabled
- Operating temp: 0 – 50 degree C

RASPBERRY PI 4B



3V3 power	1	2	5V power
GPIO 2 (SDA)	3	4	5V power
GPIO 3 (SCL)	5	6	Ground
GPIO 4 (GPCLK0)	7	8	GPIO 14 (TXD)
Ground	9	10	GPIO 15 (RXD)
GPIO 17	11	12	GPIO 18 (PCM_CLK)
GPIO 27	13	14	Ground
GPIO 22	15	16	GPIO 23
3V3 power	17	18	GPIO 24
GPIO 10 (MOSI)	19	20	Ground
GPIO 9 (MISO)	21	22	GPIO 25
GPIO 11 (SCLK)	23	24	GPIO 8 (CE0)
Ground	25	26	GPIO 7 (CE1)
GPIO 0 (ID_SD)	27	28	GPIO 1 (ID_SC)
GPIO 5	29	30	Ground
GPIO 6	31	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	34	Ground
GPIO 19 (PCM_FS)	35	36	GPIO 16
GPIO 26	37	38	GPIO 20 (PCM_DIN)
Ground	39	40	GPIO 21 (PCM_DOUT)

EXPANSION BOARD



04

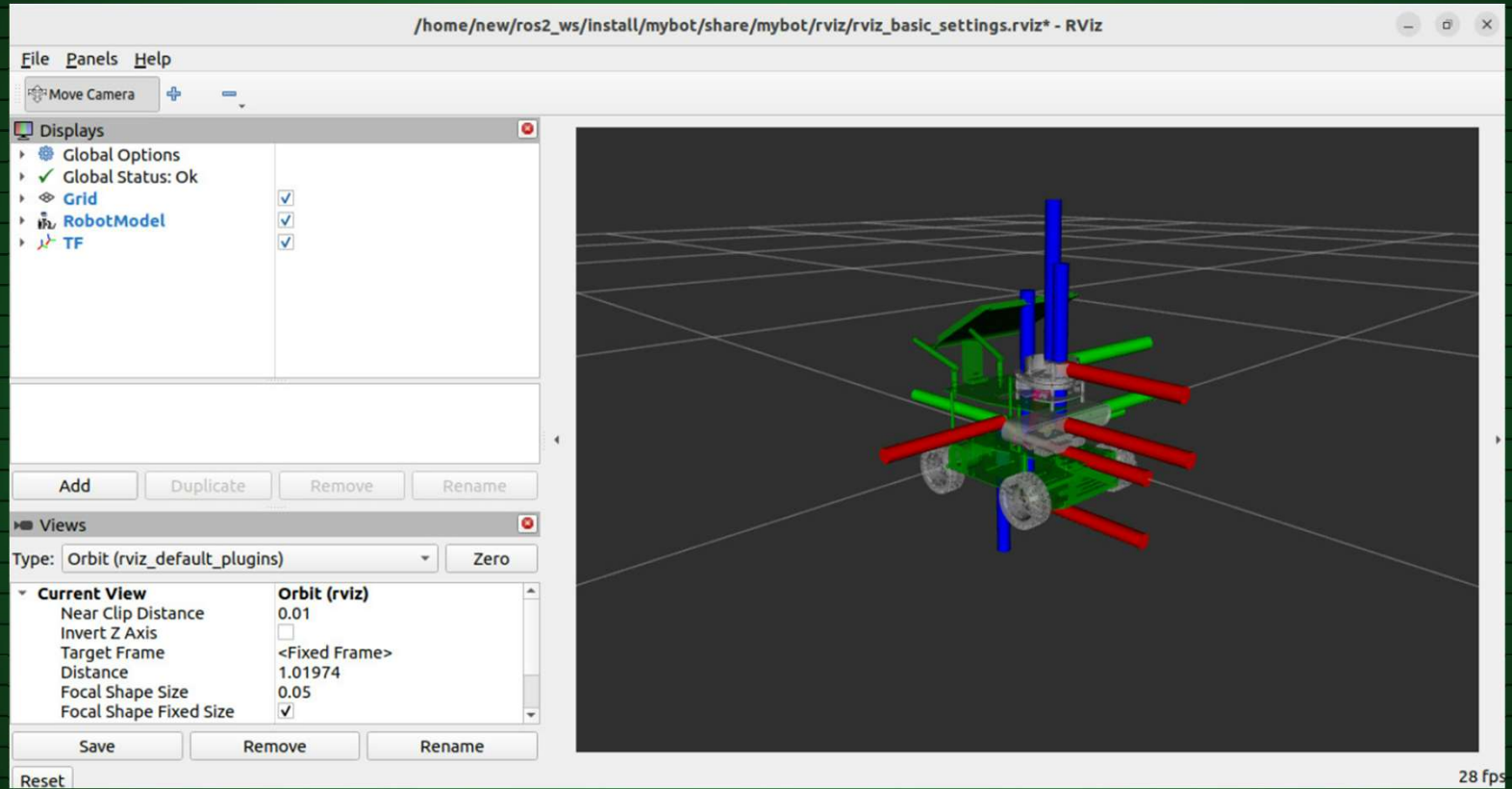
CODE & SIMULATION

How does the code work? How is the product simulated?

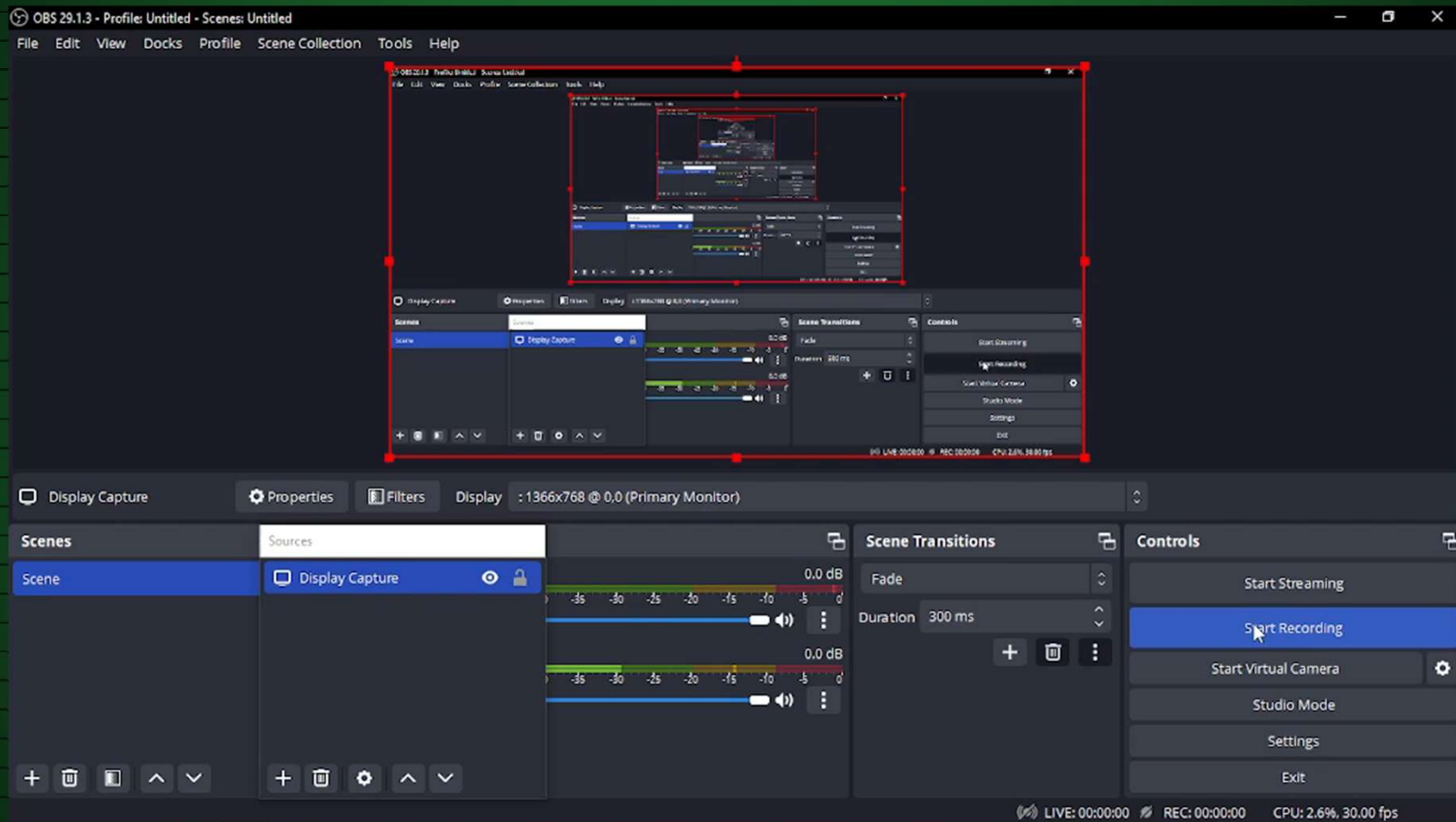
THE CODE

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```


THE SIMULATION



THE SIMULATION



ACRONYMS

LiDAR: Light Detection and Ranging

CPU: Central Processing Unit

GPIO: General Purpose Input/Output

HDMI: High-Definition Multimedia Interface

MIPI: Mobile Industry Processor Interface

DSI: Data Systems International

SD: Secure Digital

DC: Direct Current

SDA: Serial Data

SCL: Serial Clock

SCLK: Serial Clock

GPCLK0: General Purpose Clock 0

MOSI: Master Out Slave In

MISO: Master In Slave Out

PWM: Pulse Width Modulation

TXD: Transmit Data

RXD: Receive Data

TF: TransFlash

CE0: Chip Enable 0

CE1: Chip Enable 1

IDSC: Identification Serial Clock

PCM_DIN: Pulse Code Modulation Data In

PCM-DOUT: Pulse Code Modulation Data In

PCM_FS: Pulse Code Modulation Frame Synchronization

PCM_CLK: Pulse Code Modulation Clock

IEEE: Institute of Electrical and Electronics Engineers

RGB: Red, Green and Blue

OLED: Organic Light Emitting Diode

USB: Universal Serial Bus

ID_SD: Identification Serial Data

CAN: Controller Area Network

SBUS: Serial Bus

ROS: Robot Operating System



THANKS FOR WATCHING!

AUTONOMOUS CAR

Automotive Electrical and Electronic Systems