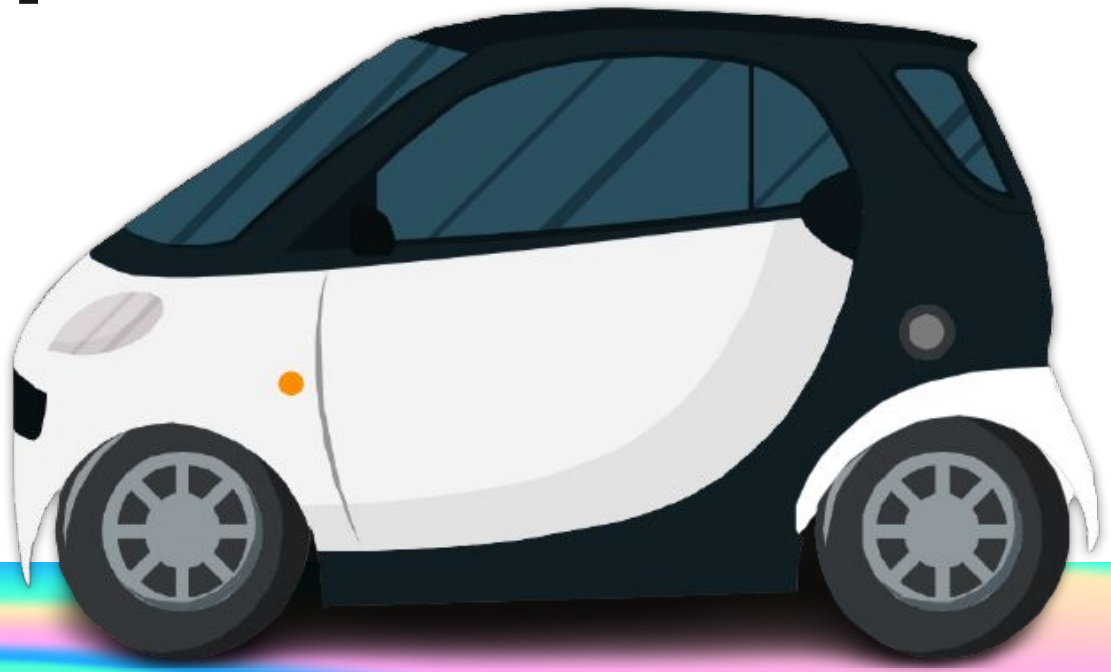
Vehicle Obstacle Detection System

Embedded System

CPE-311 & CPE-312



Member

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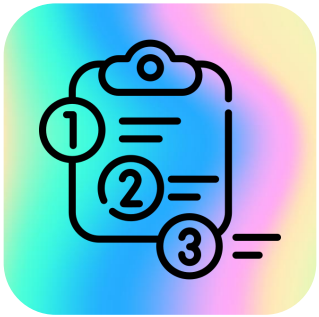
01 Overview



Requirements

Planning

Requirements

what we want to achieve

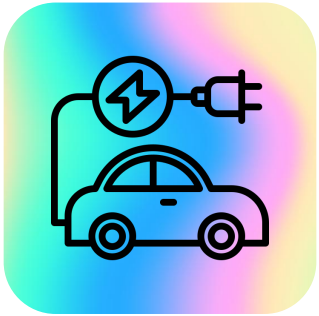
- When the car approaches an obstacle within 10 cm, **Speaker send a sound signal** before hitting the obstacle.
- Car be able to move forward and backward.

Planning

Description	January																			February			
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Requirement & Planning																								
Specification																								
Architectural design																								
Detailed Design																								
Coding																								
System Testing																								
Acceptance testing																								

02 Specification

System information



Function

Behavior

System information

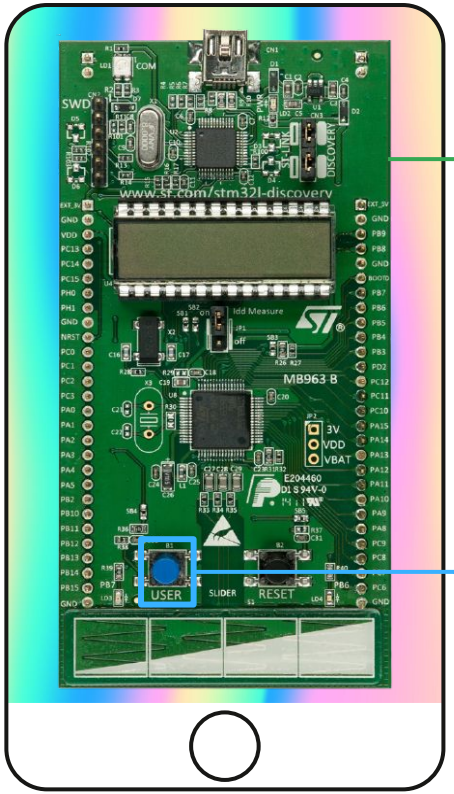
Software:
Keil µVision 5

Create, develop and monitor project

Language: C

Develop program

System information



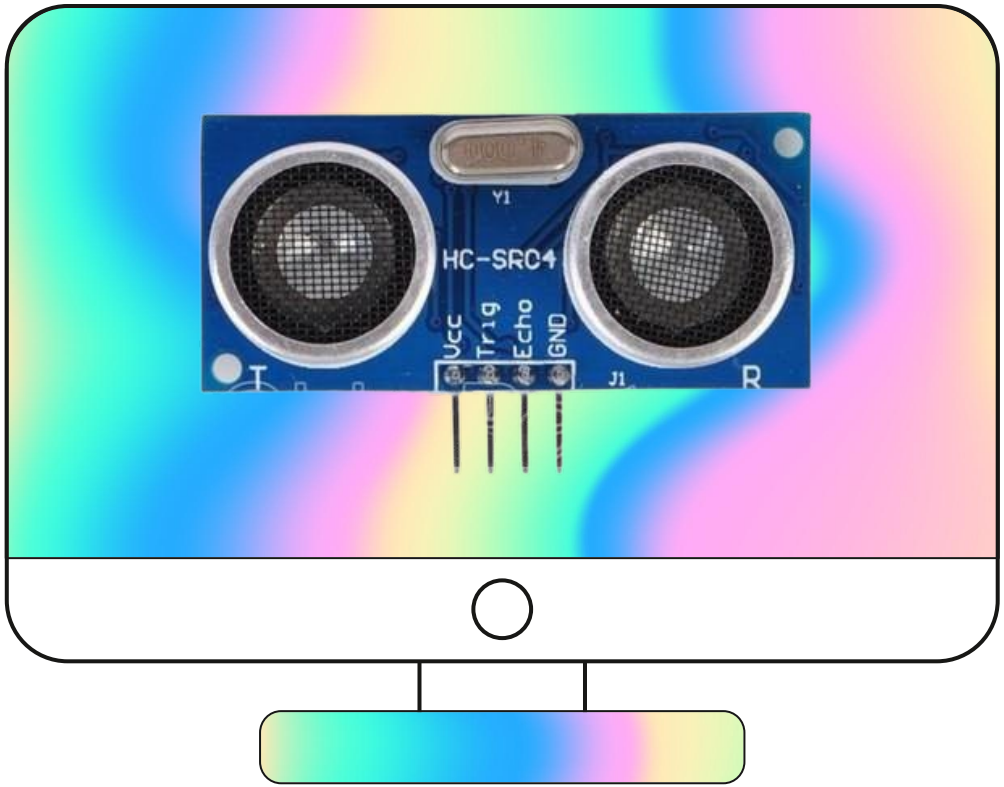
MCU : STM32L152RB

Process the entire program

USER Button

Press to moves motor clockwise (move forward)

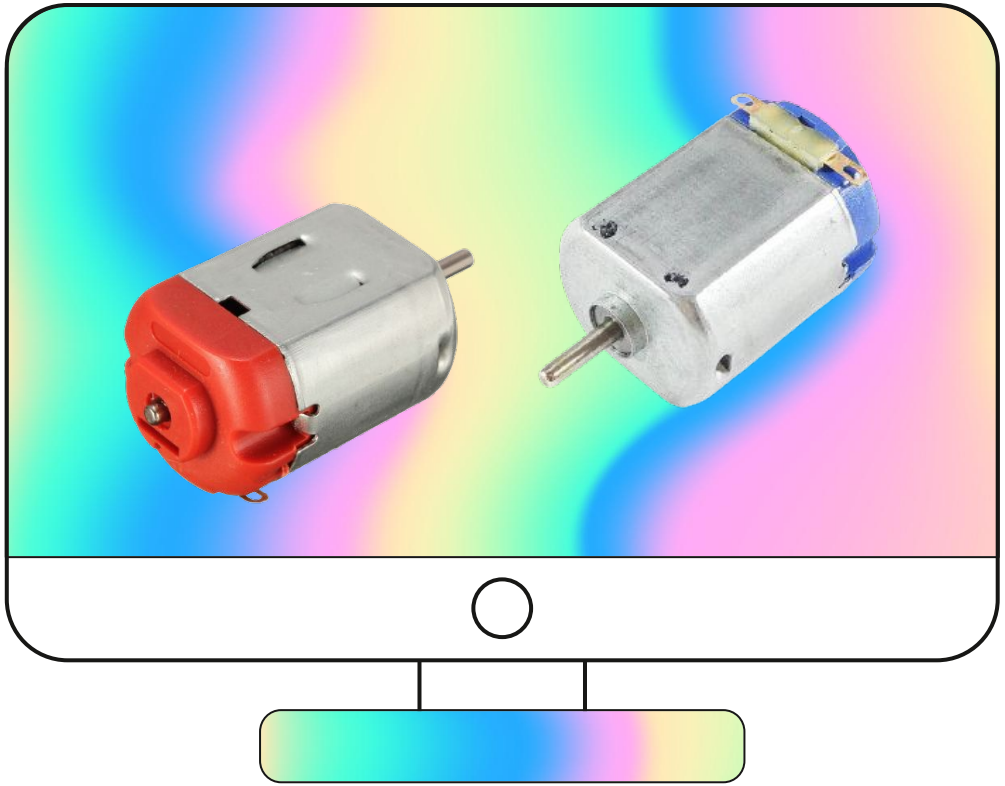
System information



Ultrasonic sensor : HC-SR04 module

Measures the distance to an obstacle using ultrasonic sound waves

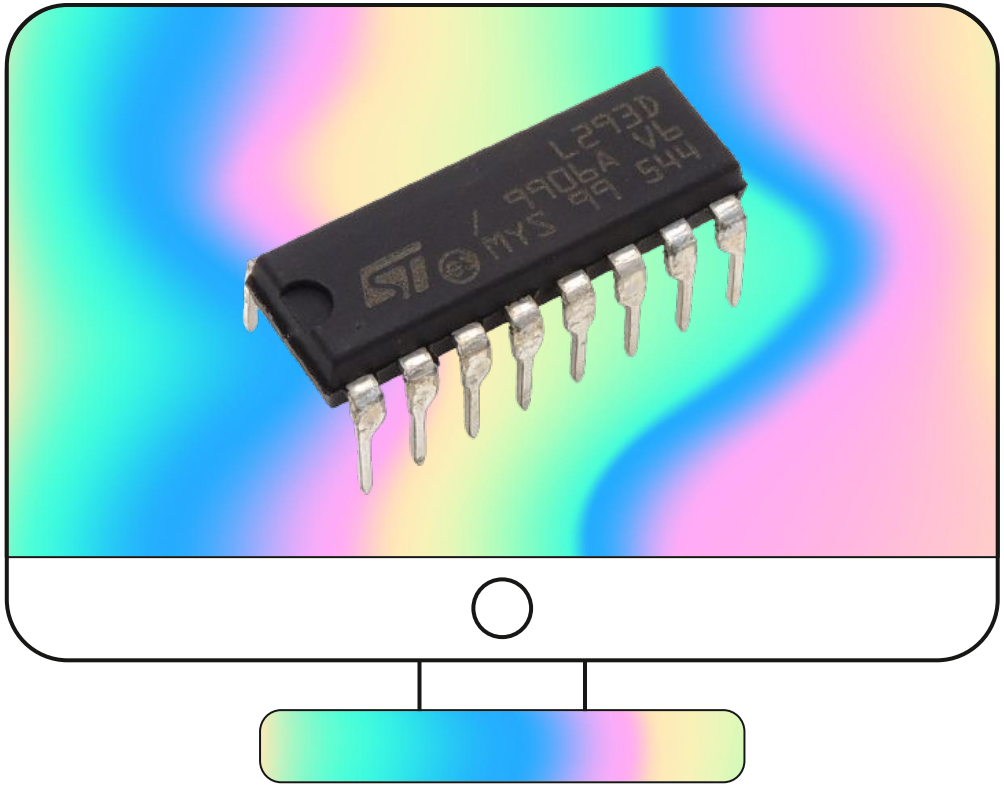
System information



2 DC motors

Control movement speed and direction (forward, backward)

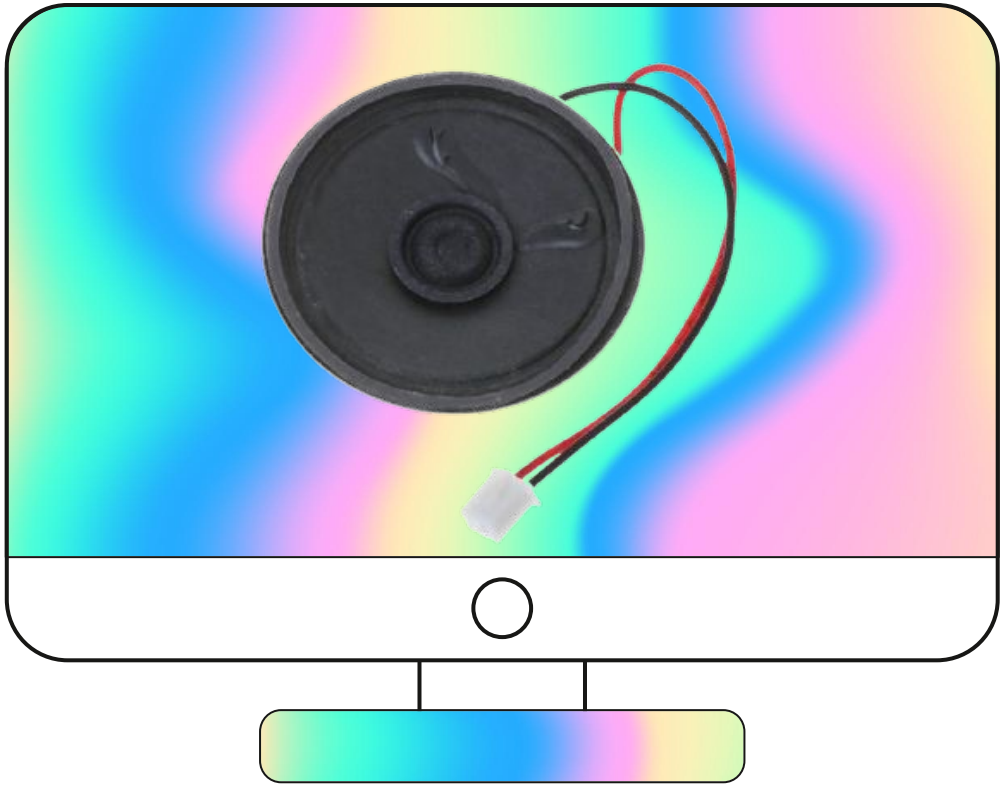
System information



IC : L293D module

Motor Driver IC which allows the DC motor to drive on any direction

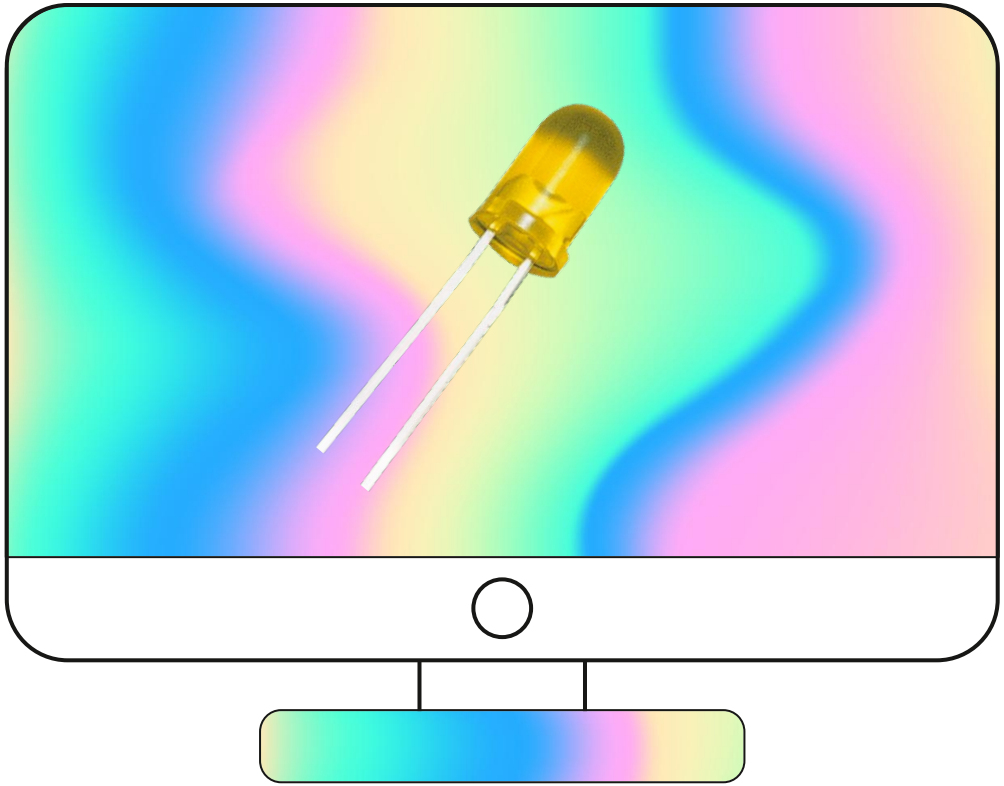
System information



Speaker

Sound an alarm when an obstacle is within the specified range

System information

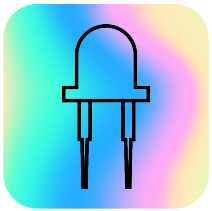


LED

The light flashes when an obstacle is within the specified range

Function

Control movement
(Motor)



Flashing light
(LED action)

Calculate distance
(Ultrasonic sensor)

Alert
(Speaker)

Behavior

Movement Path

1. Button controls a motor
2. Motor direction with wheels
3. Slow down to stop move when speaker is activated.

Display Path

1. Receive action from movement path to activate LED

Behavior

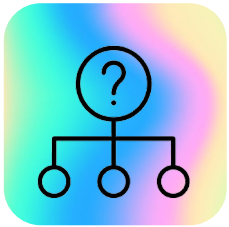
Ultrasonic Path

1. Calculate distance from car to obstacle
2. When a car almost hit obstacle (within 10 cm.), motor stopped
3. sent signal to speaker

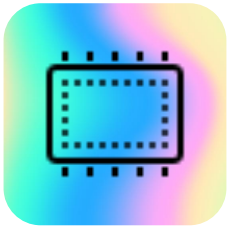
Speaker

1. Alert while near object
2. Stop sound when car move forward

03 Architectural design



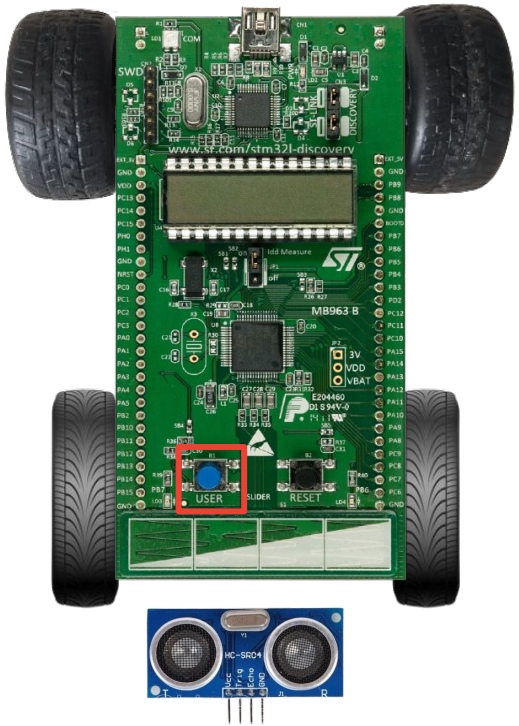
Block diagram



Hardware detail selection

STM32L152RB
Pin allocation

Block diagram

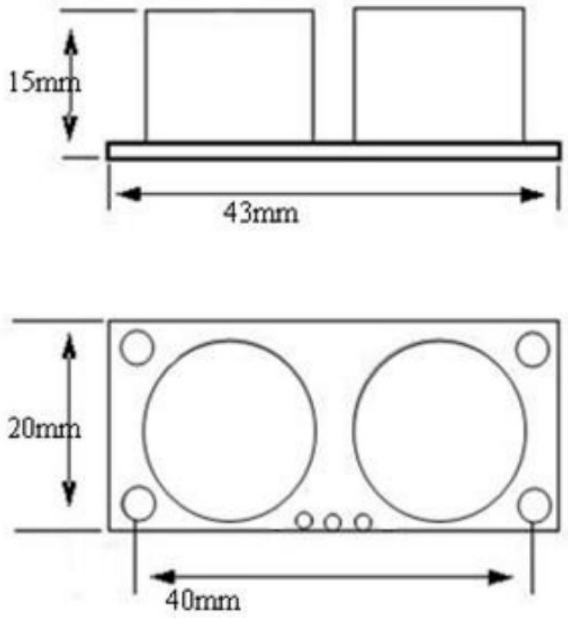


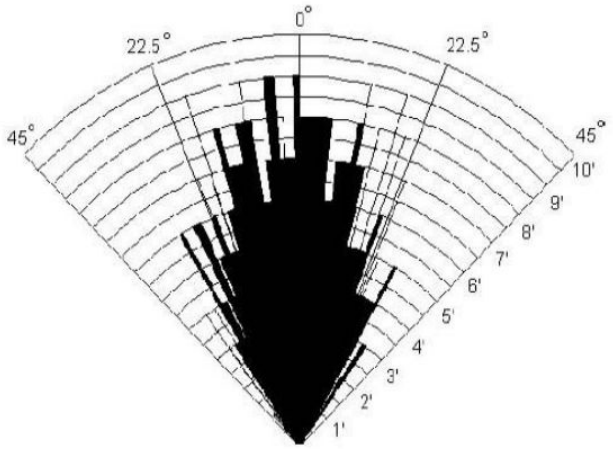
10 < d < 10 = 15

counterclockwise

Hardware detail selection

Ultrasonic ranging module : HC-SR04 Datasheet





Practical test of performance,

Best in 30 degree angle

Hardware detail selection

Ultrasonic ranging module : HC-SR04 Datasheet

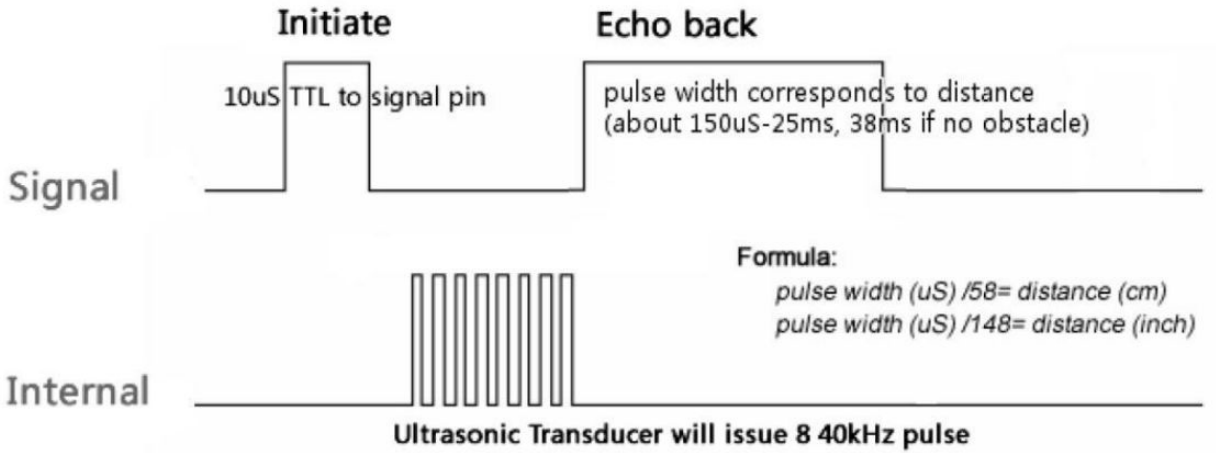
Electric Parameter

Working Voltage	DC 5 V
Working Current	15mA
Working Frequency	40Hz
Max Range	4m
Min Range	2cm
MeasuringAngle	15 degree
Trigger Input Signal	10uS TTL pulse
Echo Output Signal	Input TTL lever signal and the range in proportion
Dimension	45*20*15mm

Hardware detail selection

Ultrasonic ranging module : HC-SR04 Datasheet

Sequence chart



Hardware detail selection

L293D
L293DD

PUSH-PULL FOUR CHANNEL DRIVER WITH DIODES

- 600mA OUTPUT CURRENT CAPABILITY PER CHANNEL
- 1.2A PEAK OUTPUT CURRENT (non repetitive) PER CHANNEL
- ENABLE FACILITY
- OVERTEMPERATURE PROTECTION
- LOGICAL "0" INPUT VOLTAGE UP TO 1.5 V (HIGH NOISE IMMUNITY)
- INTERNAL CLAMP DIODES

SO(12+4+4)

Powerdip (12+2+2)

ORDERING NUMBERS:

L293DD

L293D

DESCRIPTION

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoides, DC and stepping motors) and switching power transistors.

To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 5 kHz.

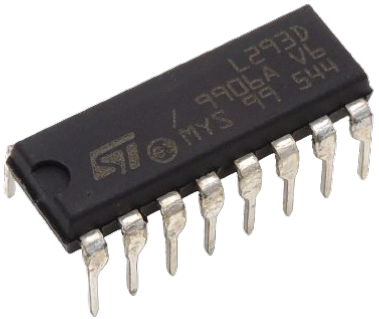
The L293D is assembled in a 16 lead plastic packaage which has 4 center pins connected together and used for heatsinking

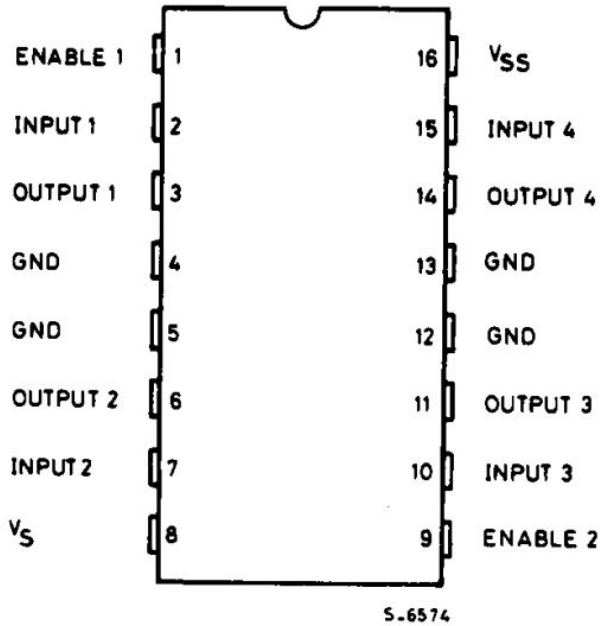
The L293DD is assembled in a 20 lead surface mount which has 8 center pins connected together and used for heatsinking.

Hardware detail selection

L293D
L293DD

PUSH-PULL FOUR CHANNEL DRIVER WITH DIODES





Powerdip(12+2+2)

Hardware component lists

Component list	Qty.	มีแล้ว	แหล่งที่ซื้อ	ราคา/ชิ้น	ราคารวม
STM32L152RB board	1	/			
Ultrasonic sensor	1	/			
DC Motor	2	/			
Speaker	1	/			
LED	1	/			
Wires	-	/			
Gear	8	/			
Toy car wheels	4	/			
					0

PIN Allocation

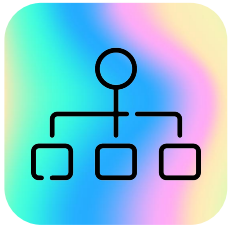
PIN\PORT	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A																
B																
C																
D																
H																

Available pins
Special pins
No pin out

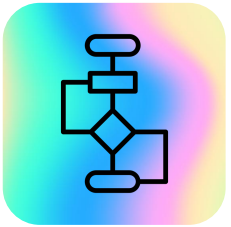
Input 1	Input 2	Output1	Output 2	output 3
User button	UltraSonic	Motor	LED	Speaker



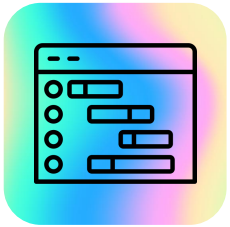

04 Detailed design



Top-down design

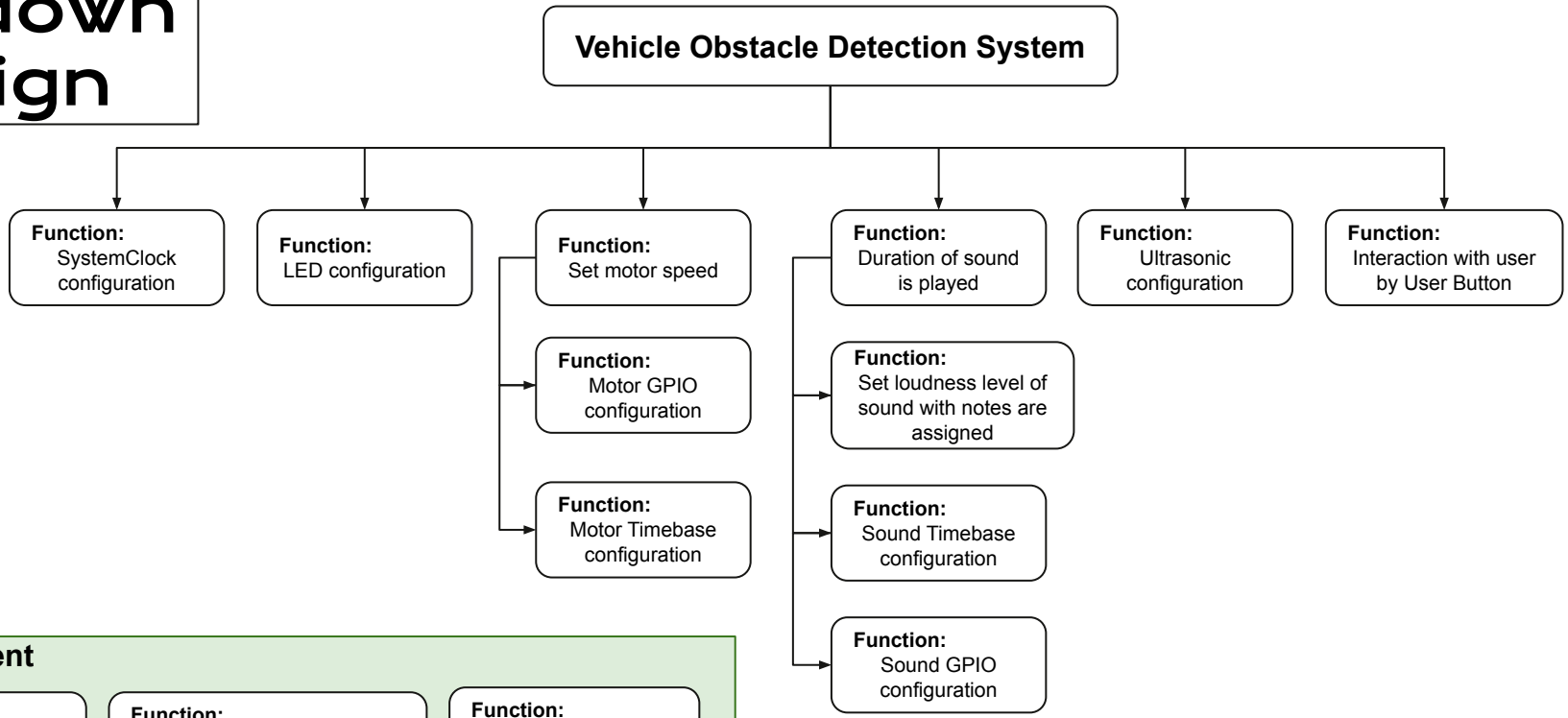


Flowchart



Gantt chart

Top-down design



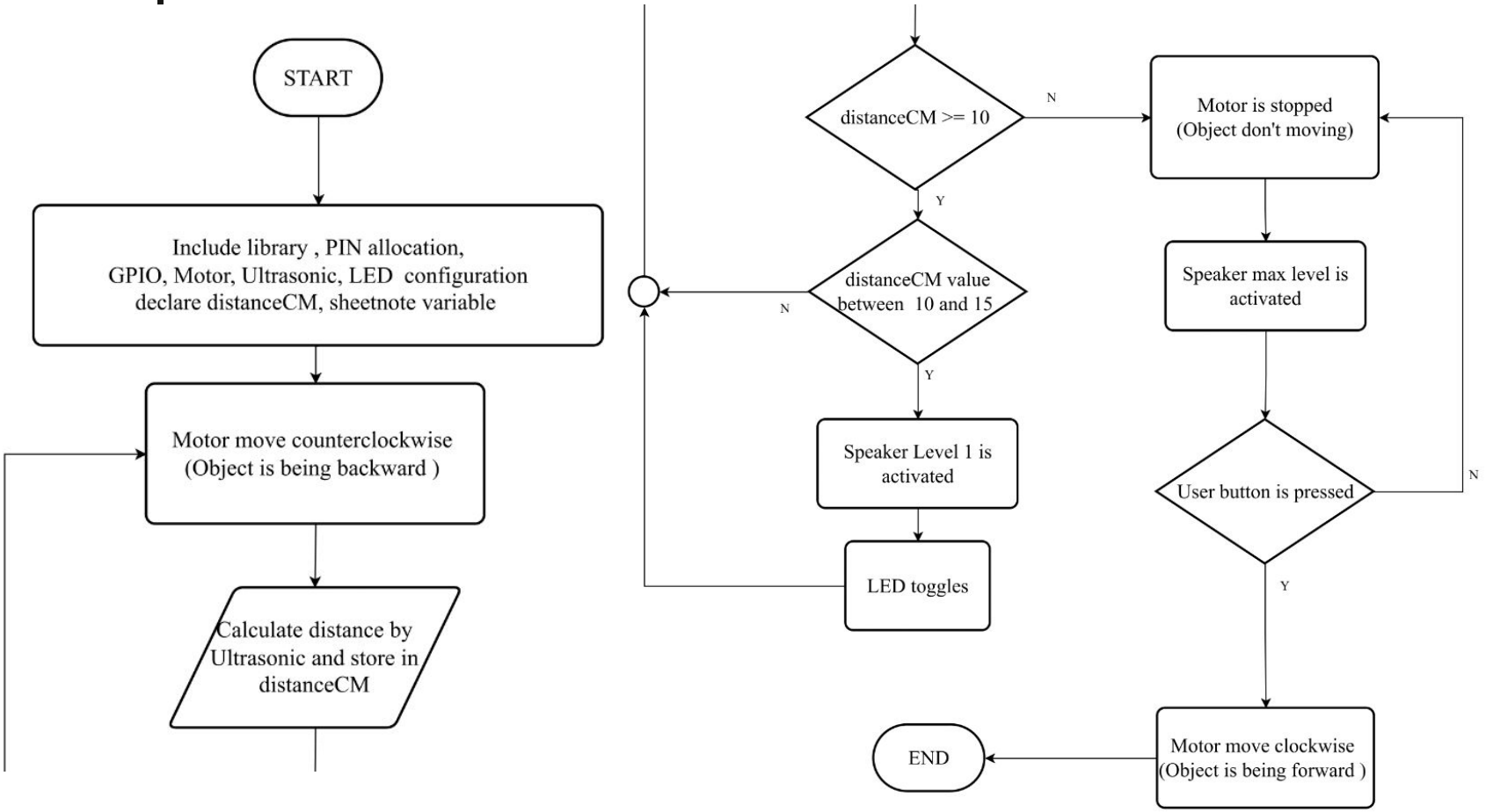
Motor Movement

- **Function:** Motor move clockwise (Object is being forward)
- **Function:** Motor move counterclockwise (Object is being backward)
- **Function:** Motor is stopped (Object don't moving)

Hardware

- LED
- Motor
- Speaker
- Ultrasonic
- User Button

Flowchart


START
Include library , PIN allocation,
GPIO, Motor, Ultrasonic, LED configuration
declare distanceCM, sheetnote variable
Motor move counterclockwise
(Object is being backward)
Calculate distance by
Ultrasonic and store in
distanceCM
distanceCM >= 10
N
Y
distanceCM value
between 10 and 15
N
Y
Speaker Level 1 is
activated
LED toggles
Motor is stopped
(Object don't moving)
Speaker max level is
activated
User button is pressed
N
Y
Motor move clockwise
(Object is being forward)
END

Gantt Chart

Description	Responsible person	January																				February			
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Project planning	EVERYONE	Plan																							
		Done																							
Project Design	Thanyaluck, Kittipat & Phattaranan		Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan													
			Done	Done	Done	Done	Done	Done	Done	Done															
Coding & Debugging	Rakphong & Panuwit										Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan	Plan		
											Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Delay	
Presentation	EVERYONE																							Plan	Plan
																								Done	Done

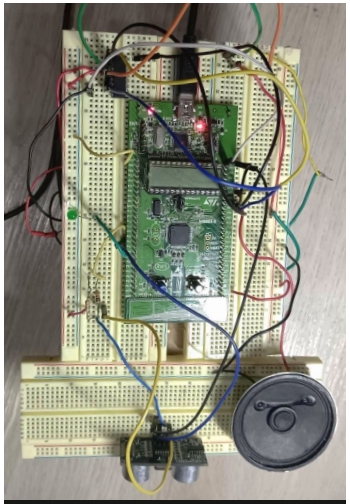
Plan Done Delay

05 Project Demo

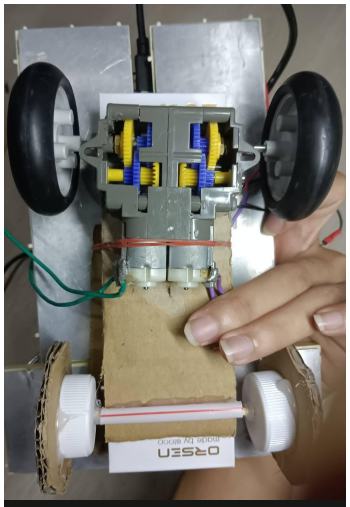
The final product

Demo Video

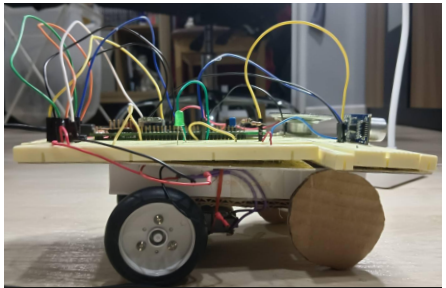
The final product



Top



Bottom



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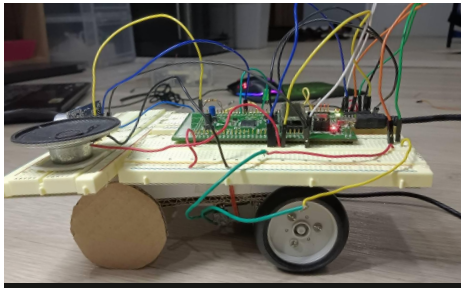
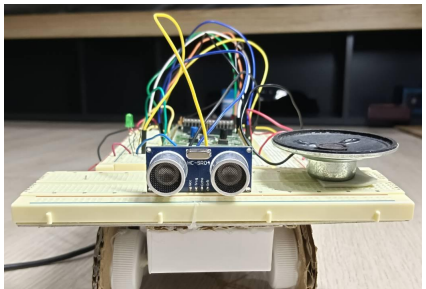
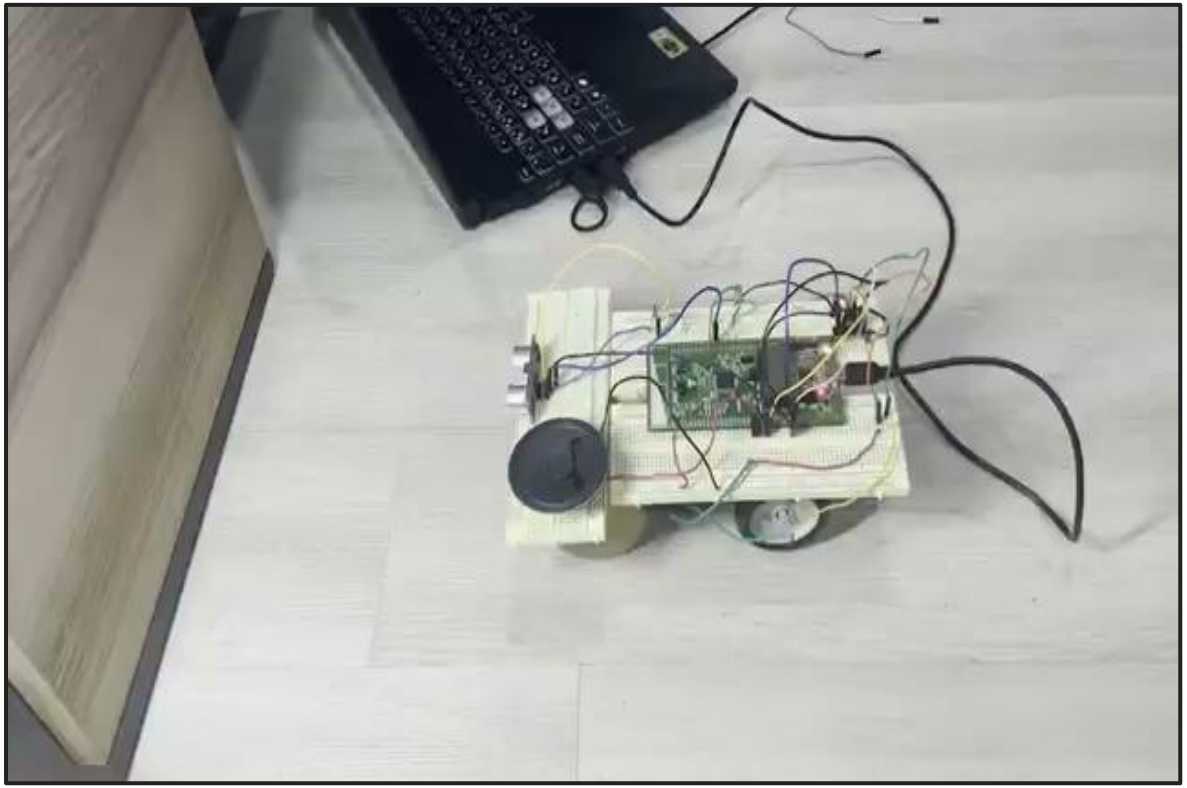


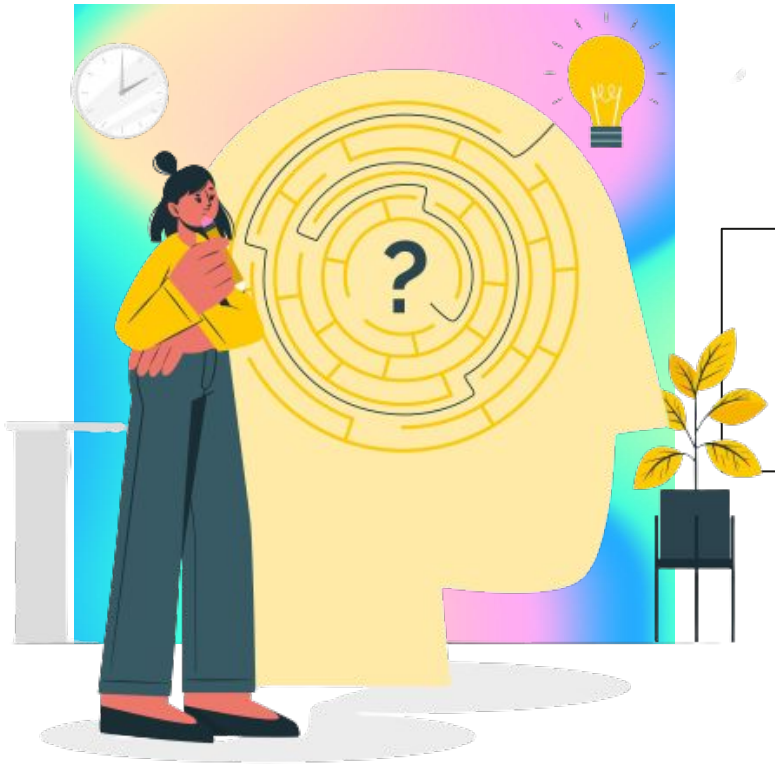
Right



Back

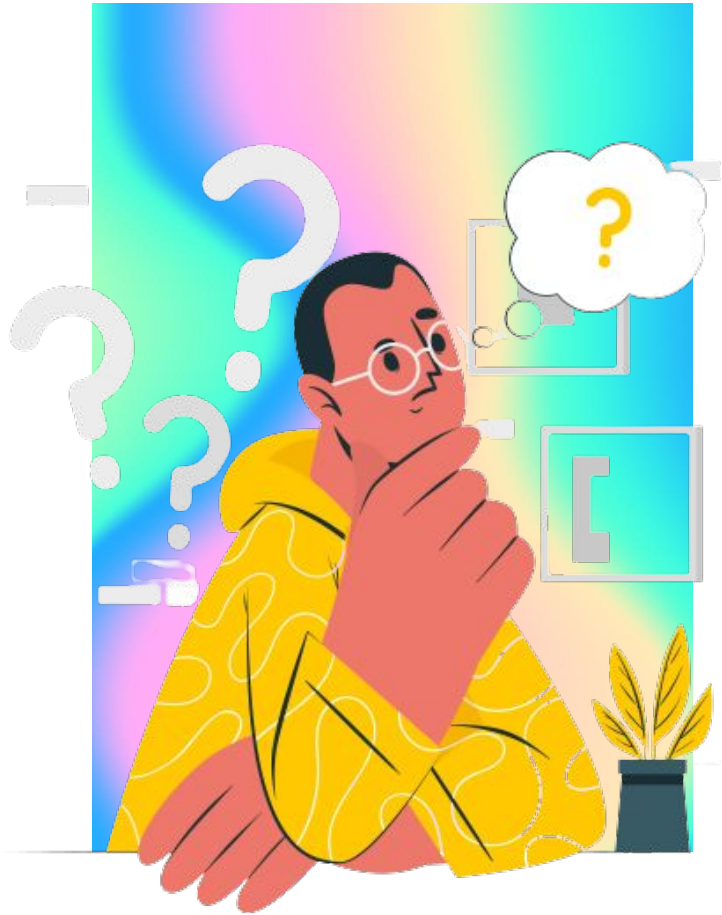
Demo Video





06

Problem & Solution



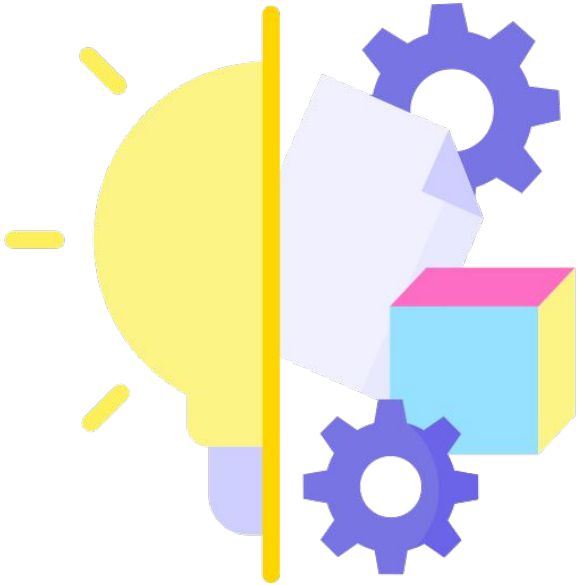
Problem

- Online communication
- Insufficient equipment
- The results were not as expected

Solution

- Use GitHub to collaborate and plan project
- Instead, use different equipment
- Adjust some functions

Conclusion

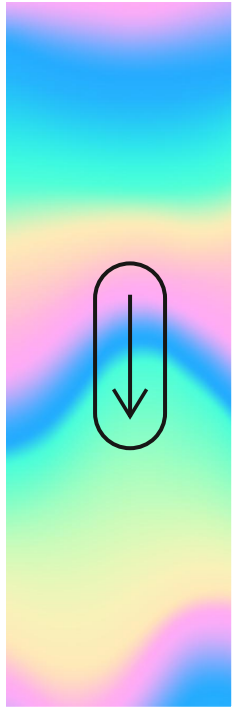


1

The result would be excellent tools for further development in the future projects

2

To improve the project's efficiency, some functions can be added and altered.



Thank You!