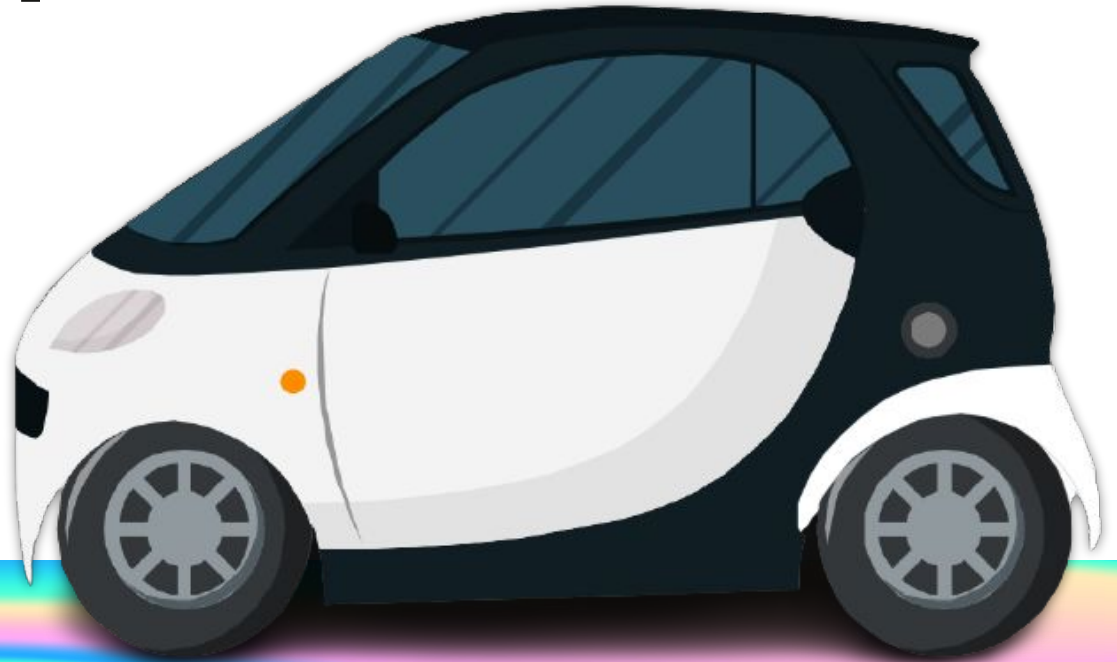


Vehicle Obstacle Detection System

Embedded System
CPE-311 & CPE-312



Member



Thanyaluck Yiemyod

1811310836



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1911310272



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- Flowchart
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05

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- Demo video

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Problem, Solution & Conclusion

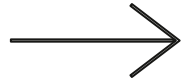
01 Overview



Requirements



Planning





Requirements

what we want to achieve

- When the car approaches an obstacle within 5 cm, **Speaker send a sound signal** before hitting the obstacle.
- Car be able to move forward and backward.



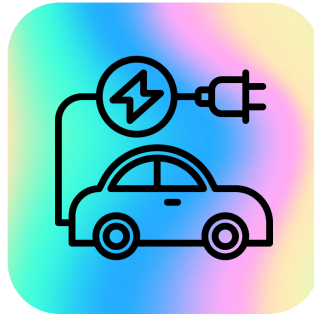
Planning

| 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

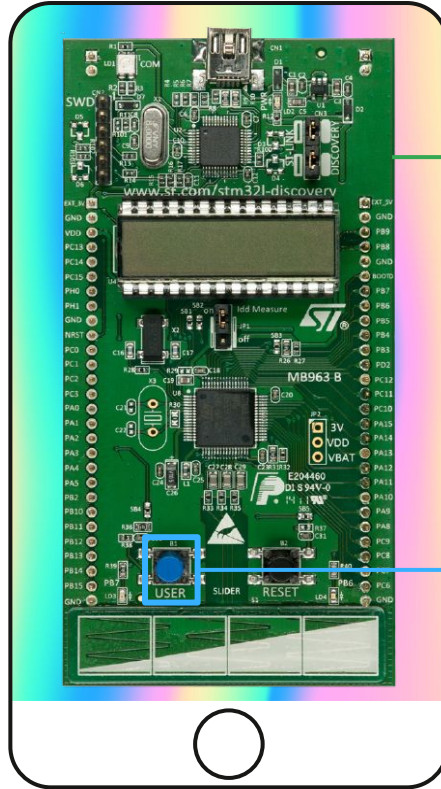
Create, develop and monitor
project

Language: C

Develop program



System information



MCU :
STM32L152RB

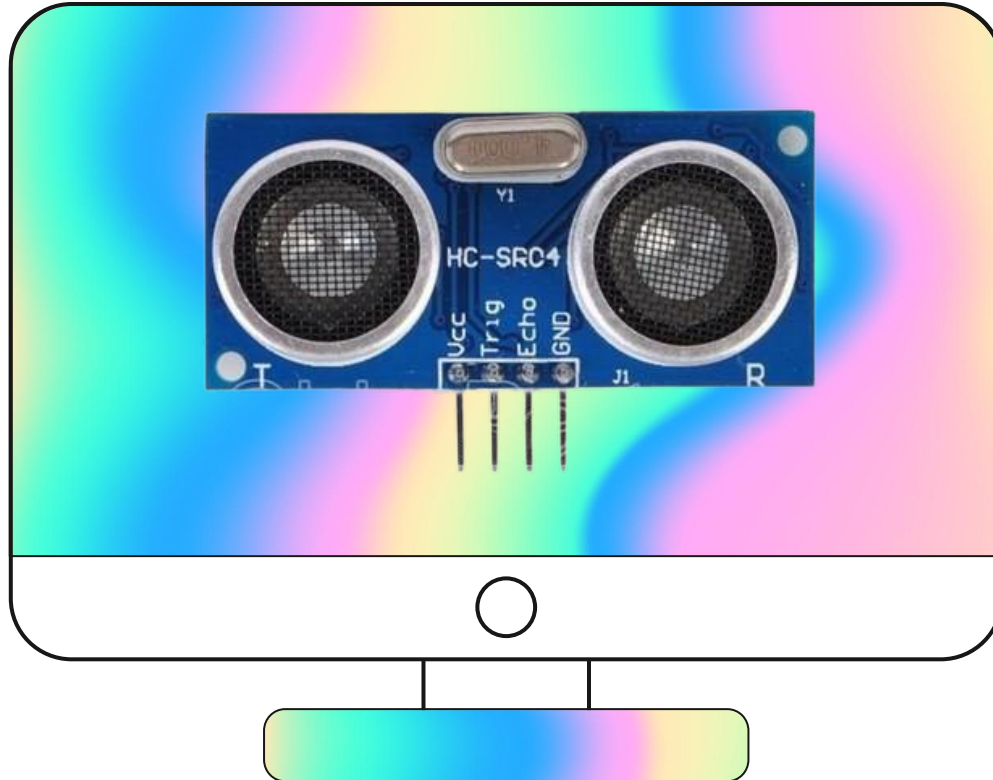
Process the entire program

USER Button

Press to moves motor
clockwise (move forward)



System information

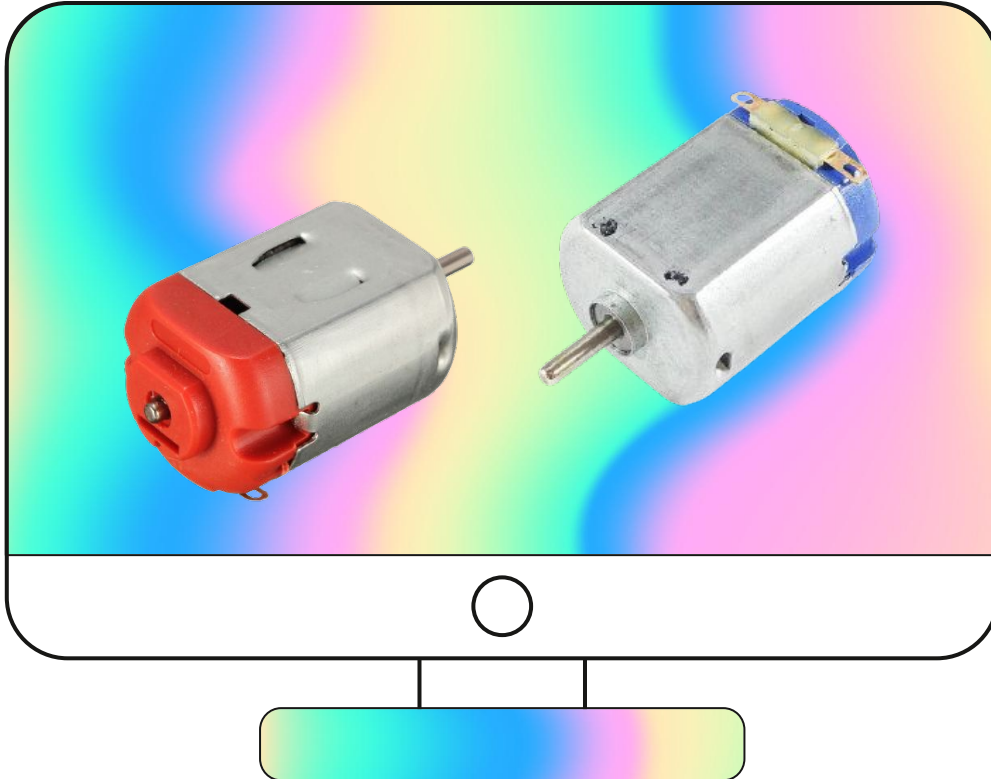


Ultrasonic sensor : HC-SR04 module

Measures the distance to an
obstacle using ultrasonic
sound waves



System information

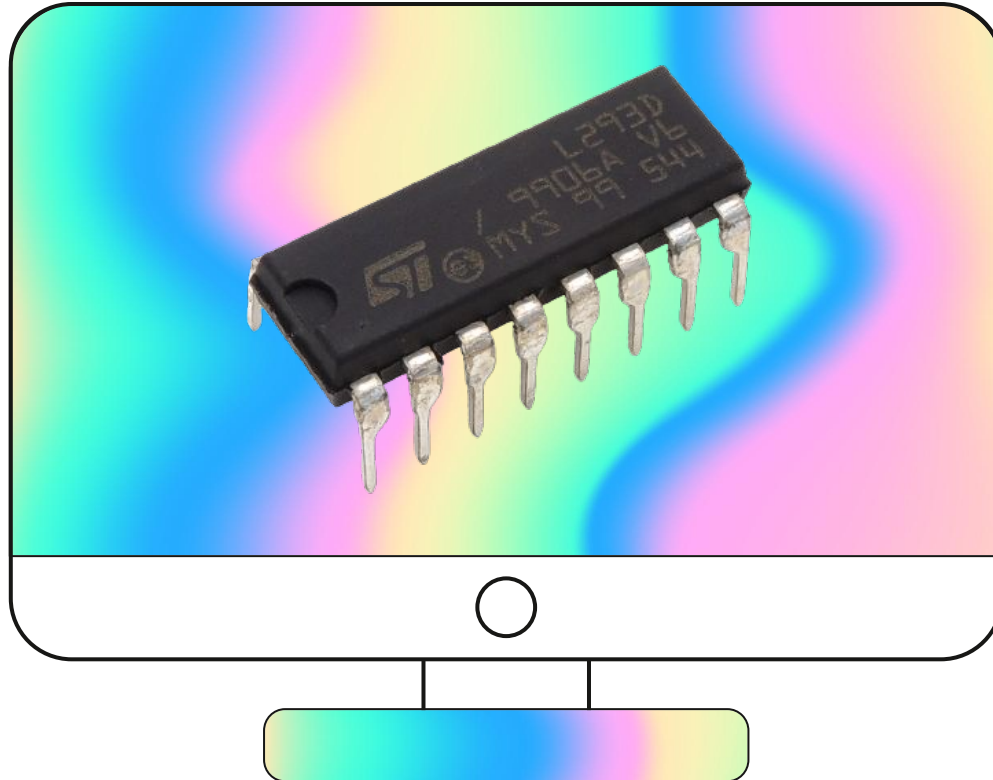


2 DC motors

Control movement speed
and direction (forward,
backward)



System information

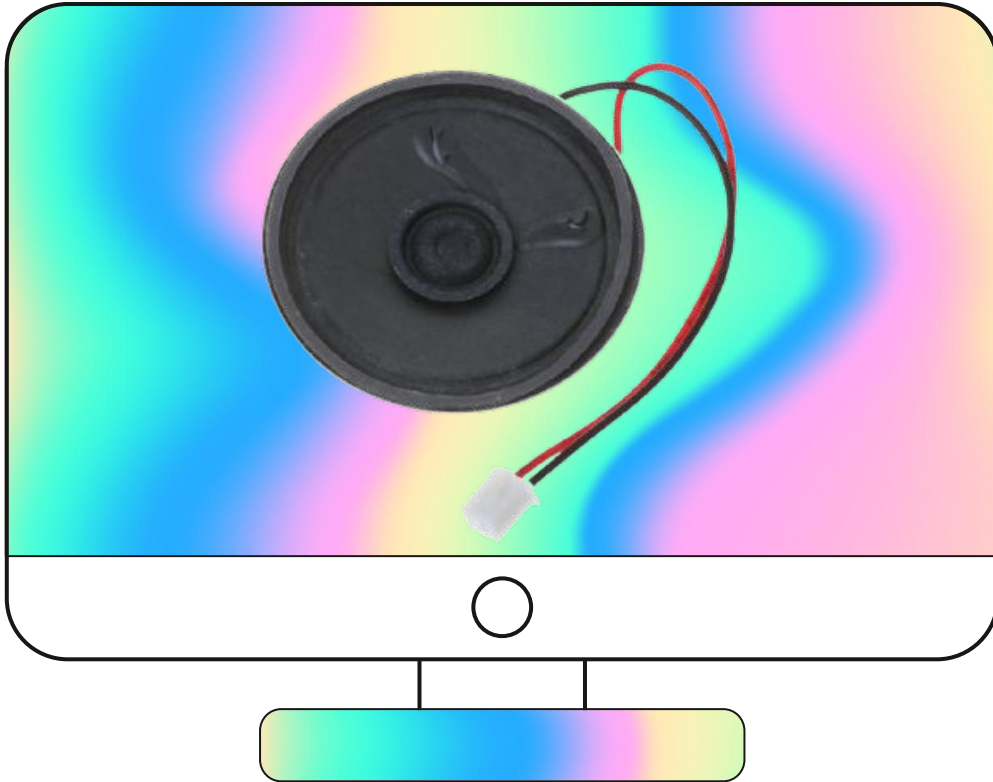


IC : L293D module

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



System information

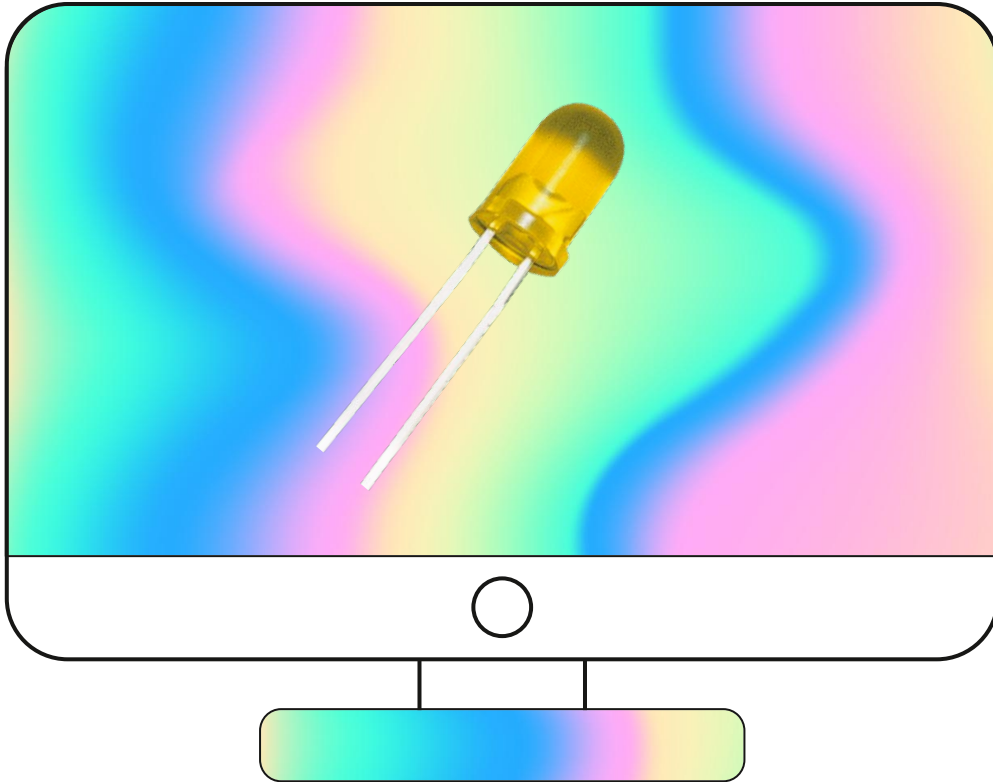


Speaker

Sound an alarm when an obstacle is within the specified range



System information

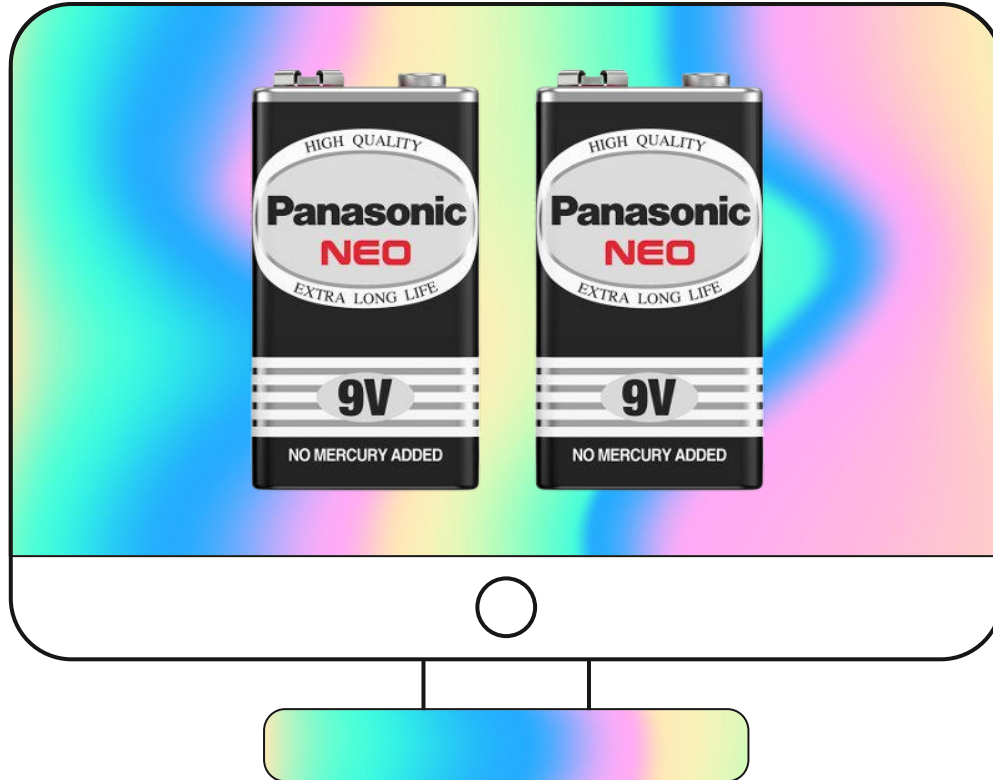


LED

The light flashes when an obstacle is within the specified range



System information



9V Battery

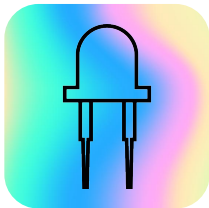
Provide electric power to
drive the motor



Function



Control movement
(Motor)



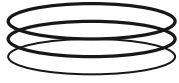
Flashing light
(LED action)



Calculate distance
(Ultrasonic sensor)



Alert
(Speaker)



Behavior

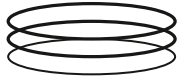
Movement Path

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

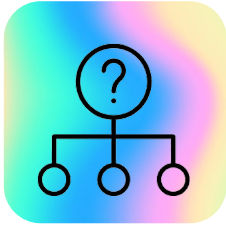
1. Calculate distance from car to obstacle
2. When a car almost hit obstacle (within 5 cm.), motor stopped
3. sent signal to speaker

Speaker

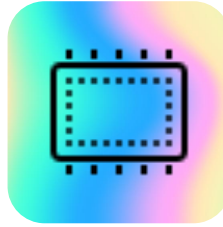
1. Alert while near object
2. Stop sound when car stopped



03 Architectural design



Block diagram



**Hardware detail
selection**



**STM32L152RB
Pin allocation**



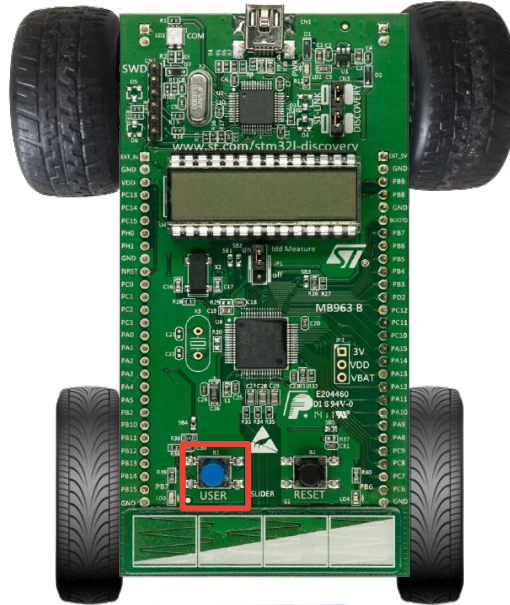
Block diagram



10 ~~11~~ 15



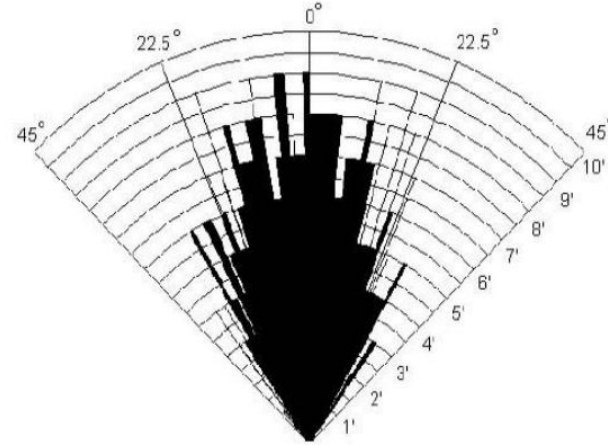
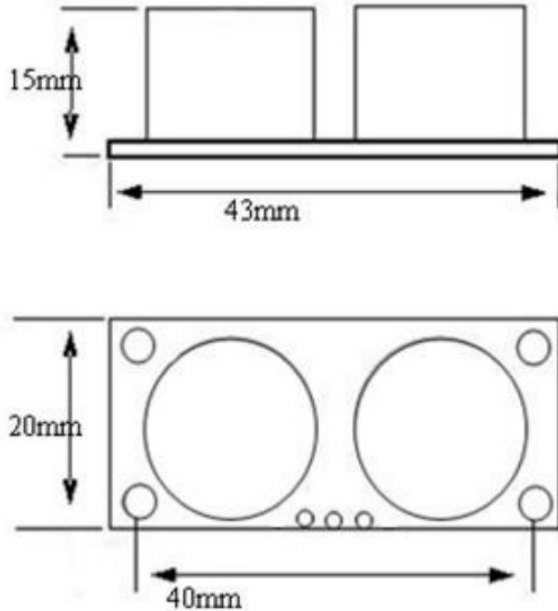
counterclockwise





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

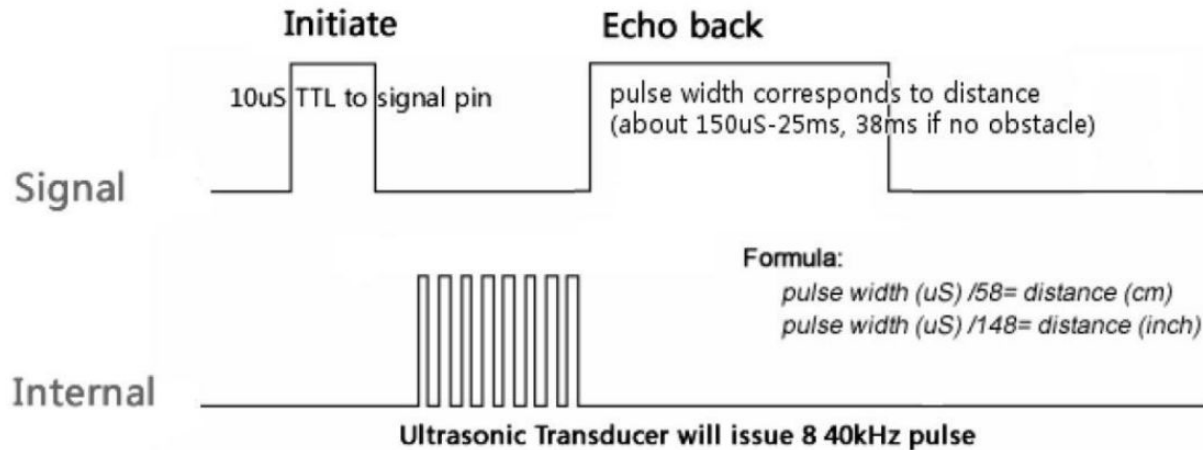
| | |
|-----------------------------|---|
| Working Voltage | DC 5 V |
| Working Current | 15mA |
| Working Frequency | 40Hz |
| Max Range | 4m |
| Min Range | 2cm |
| MeasuringAngle | 15 degree |
| Trigger Input Signal | 10uS TTL pulse |
| Echo Output Signal | Input TTL lever signal and the range in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

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 solenoids, 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.



SO(12+4+4)



Powerdip (12+2+2)

ORDERING NUMBERS:

L293DD

L293D

The L293D is assembled in a 16 lead plastic package 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.

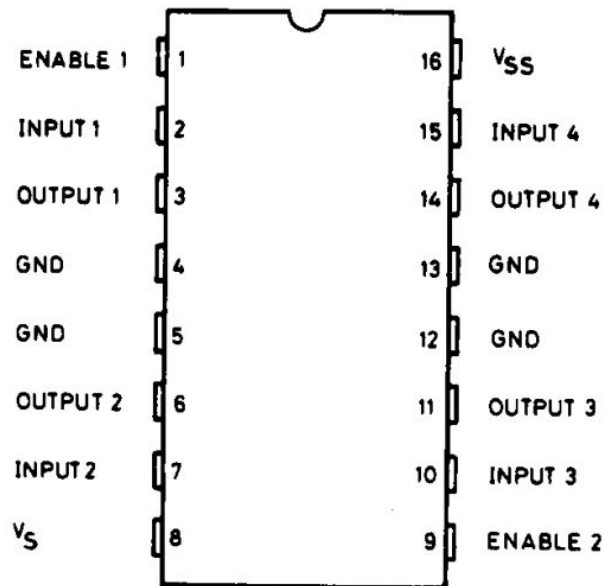
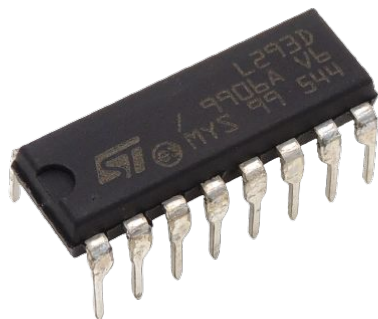


Hardware detail selection



L293D
L293DD

PUSH-PULL FOUR CHANNEL DRIVER WITH DIODES



S-6574

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 | / | | | |
| Battery 9V | 2 | | 7-ELEVEN | 42 | 84 |
| Toy car wheels | 4 | / | | | |
| | | | | | 84 |



PIN Allocation

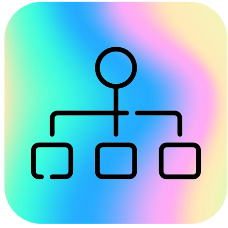
| PIN\PORT | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|----------|------------|------------|--------|------------|-------|------|--------|------|------|------|------|------|------|------------|------------|------|
| A | Blue | Purple | Purple | | Green | | Grey | Grey | | | | | | Light Blue | Light Blue | |
| B | Grey | Grey | | Light Blue | Red | Red | Yellow | Red | | | | | | | | |
| C | | | | | Grey | Grey | | | | | | | | Grey | Grey | Grey |
| D | Grey | Grey | | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey |
| H | Light Blue | Light Blue | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey |

| |
|----------------|
| Available pins |
| Special pins |
| No pin out |

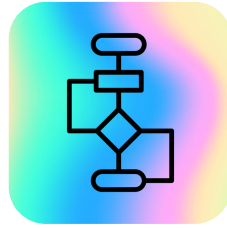
| Input 1 | Input 2 | Output1 | Output 2 | output 3 |
|-------------|------------|---------|----------|----------|
| User button | UltraSonic | Motor | LED | Speaker |



04 Detailed design



Top-down design



Flowchart



Gantt chart



Top-down design

Vehicle Obstacle Detection System

Function:
SystemClock
configuration

Function:
LED configuration

Function:
Set motor speed

Function:
Motor GPIO
configuration

Function:
Motor Timebase
configuration

Function:
Duration of sound
is played

Function:
Set loudness level of
sound with notes are
assigned

Function:
Sound Timebase
configuration

Function:
Sound GPIO
configuration

Function:
Ultrasonic
configuration

Function:
Interaction with user
by User Button

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

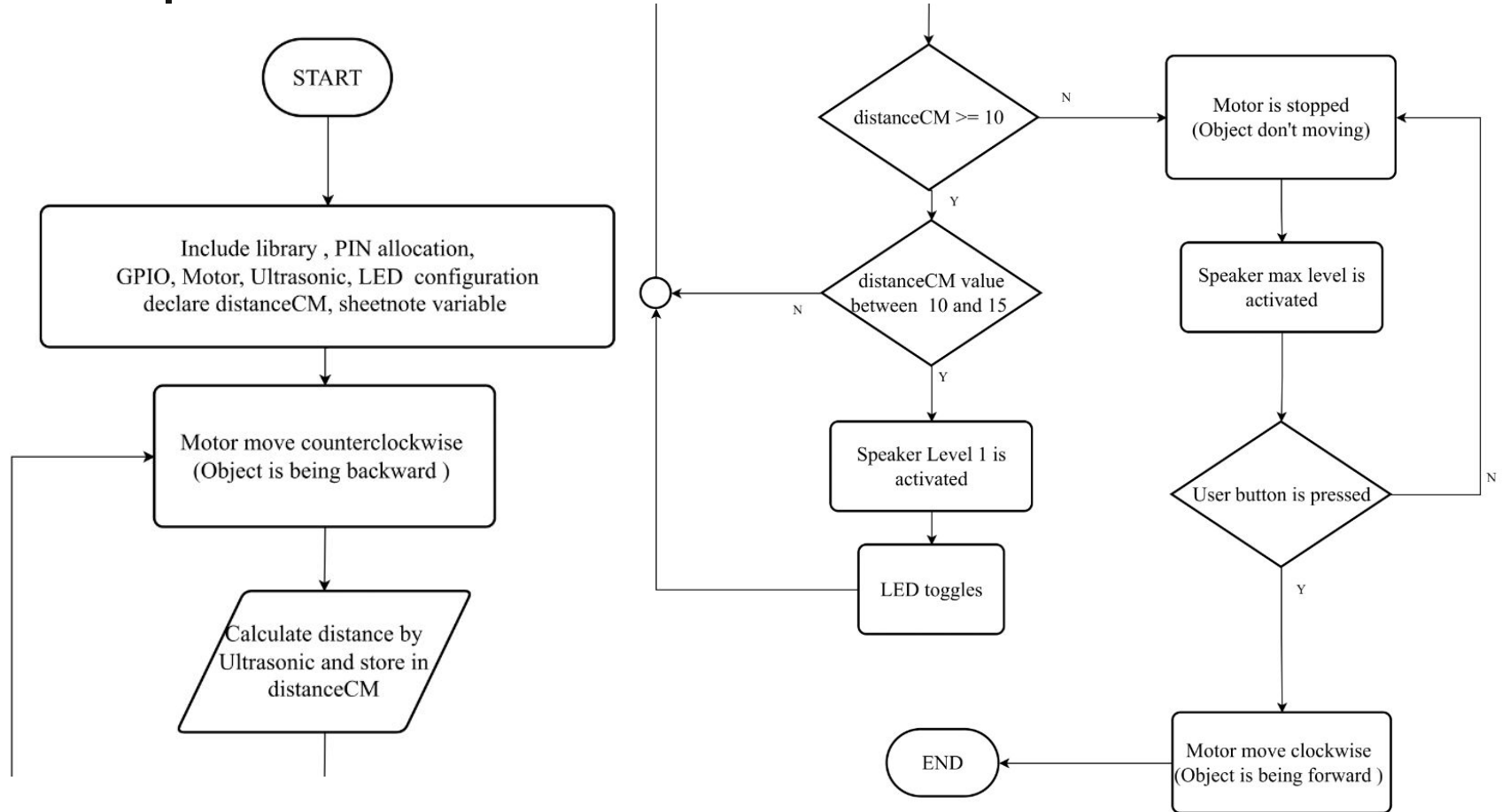
Motor

Speaker

Ultrasonic

User Button

Flowchart





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 | | | | | | | | | | | | | | | |
| | | | 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 | Plan | | |
| | | | | | | | | | | | Done | Done | Done | Done | Done | Done | Done | Done | Done | Done | Done | Done | Done | Done | Delay | |
| Presentation | EVERYONE | | | | | | | | | | | | | | | | | | | | | | | | Plan | |
| | | | | | | | | | | | | | | | | | | | | | | | | Done | Done | |



Plan



Done



Delay

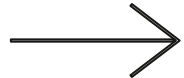
05 Project Demo



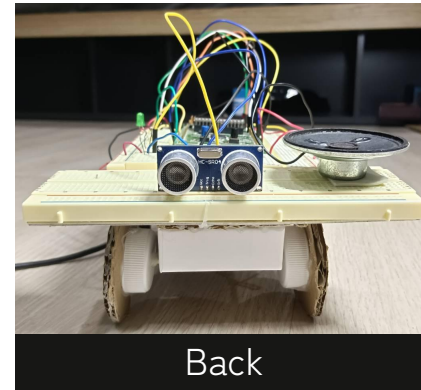
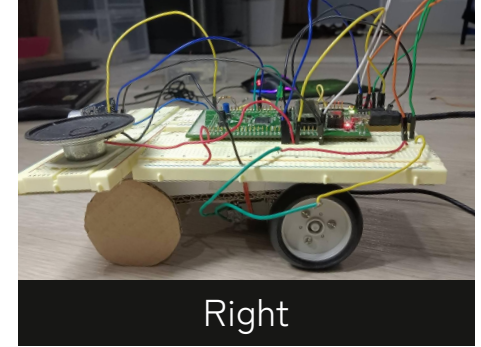
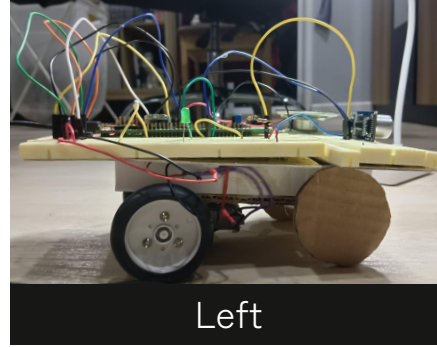
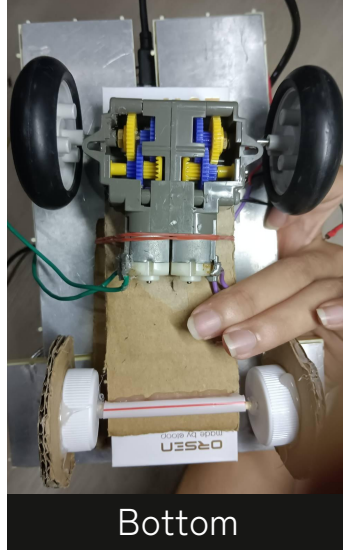
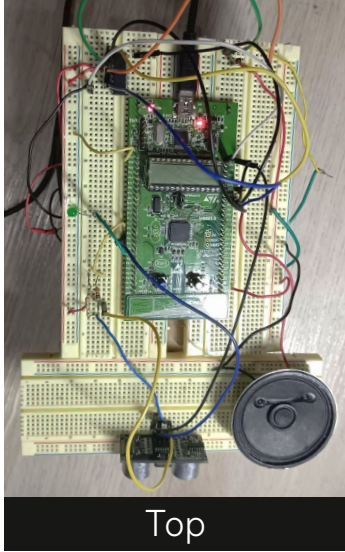
**The final
product**



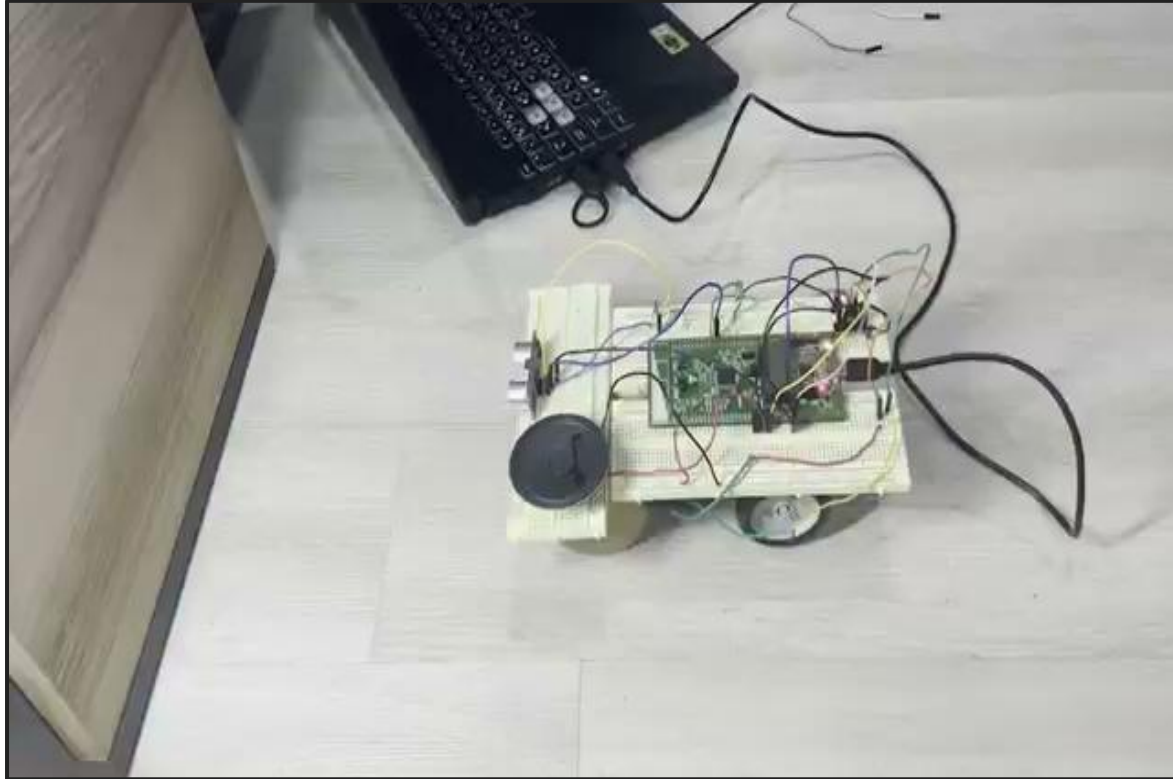
Demo Video

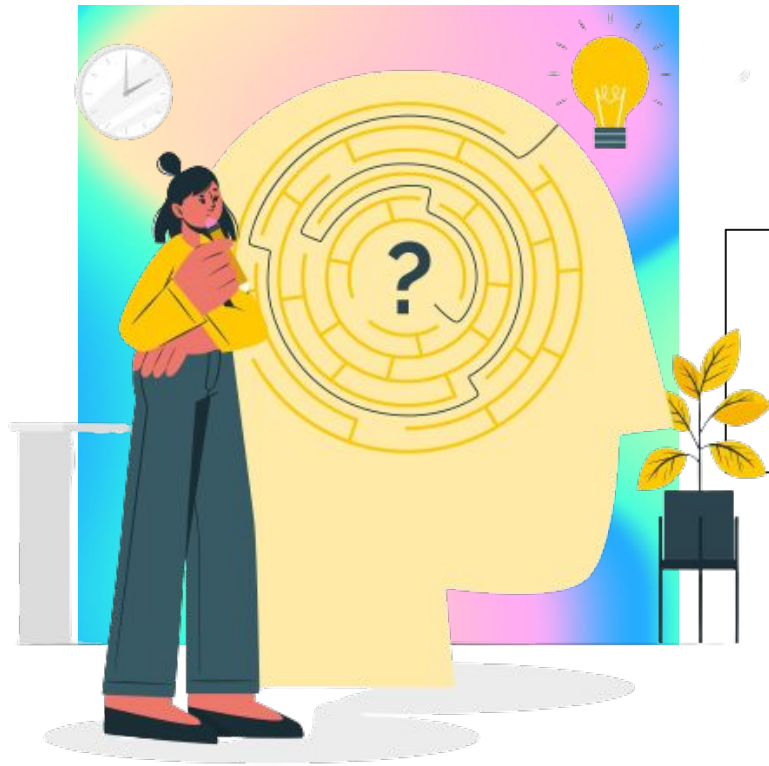


The final product



Demo Video





06

Problem & Solution



Problem

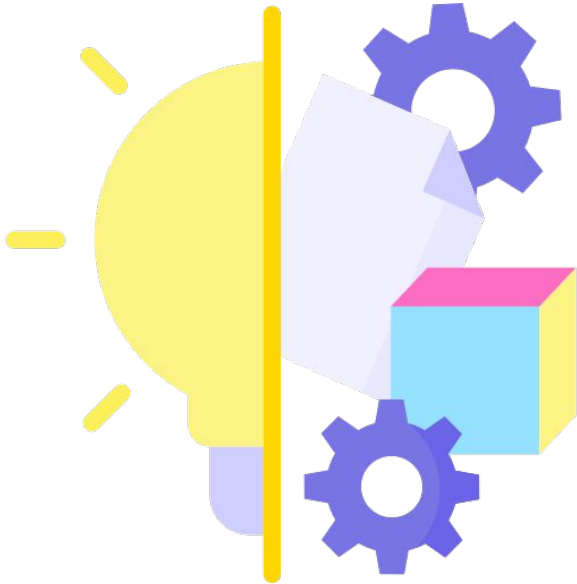
- Online communication
- Insufficient equipment
- The results were not as expected

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!