Title Page

Gangsungnozo

초음파 센서를 이용한 자율 주행 자동차

강성노조

프로젝트 목적

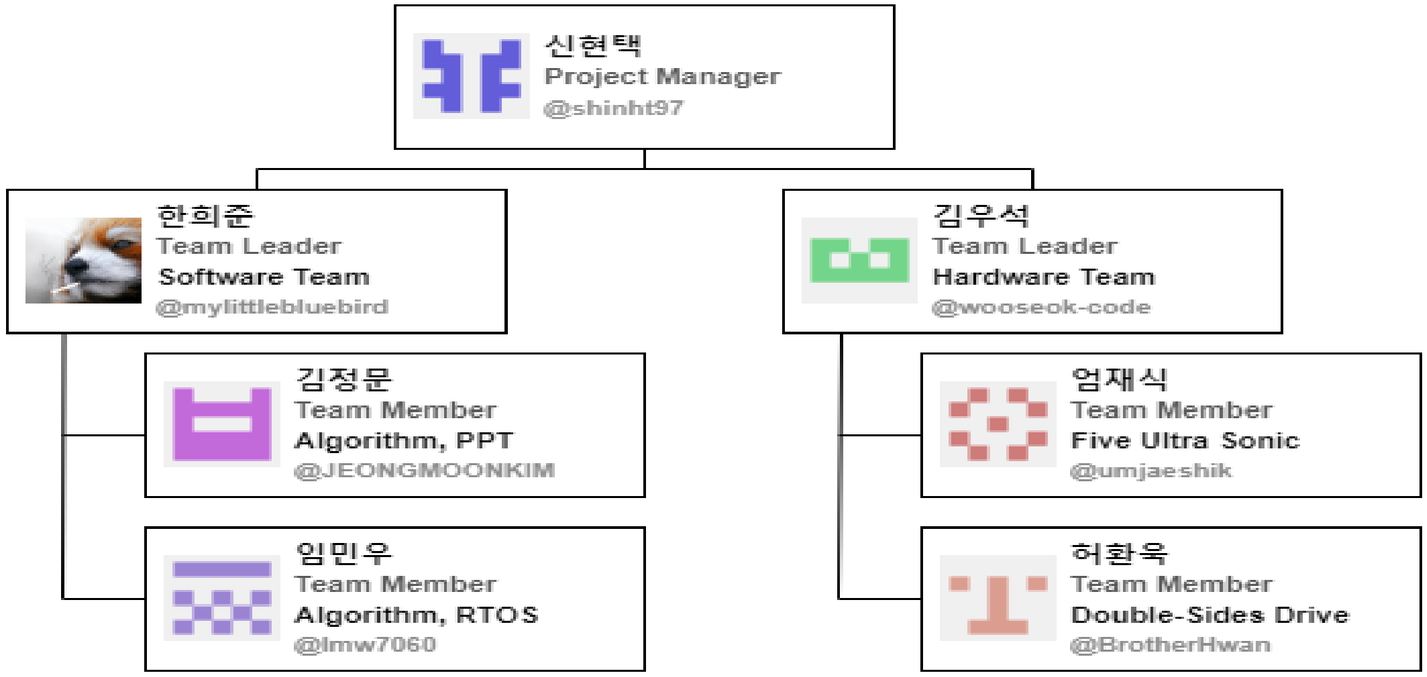
- 여러 개의 초음파 센서를 이용하여 거리를 측정 및 각 거리에 따른 자율주행이 가능한 자동차 제작

- STM32의 Embbeded Programming의 숙련도 향상

- 알고리즘 및 프로그래밍 기술 향상

- 다양한 문제를 해결함으로써 문제 해결 향상 및 창의적인 아이디어를 도입하는 경험을 통한 창의력 향상

R&R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Project Manager
@shinht97
한희준
Team Leader
Software Team
@mylittlebluebird
김우석
Team Leader
Hardware Team
@wooseok-code
김정문
Team Member
Algorithm, PPT
@JEONGMOONKIM
엄재식
Team Member
Five Ultra Sonic
@umjaeshik
임민우
Team Member
Algorithm, RTOS
@lmw7060
허환욱
Team Member
Double-Sides Drive
@BrotherHwan

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사용한 리소스 및 부품

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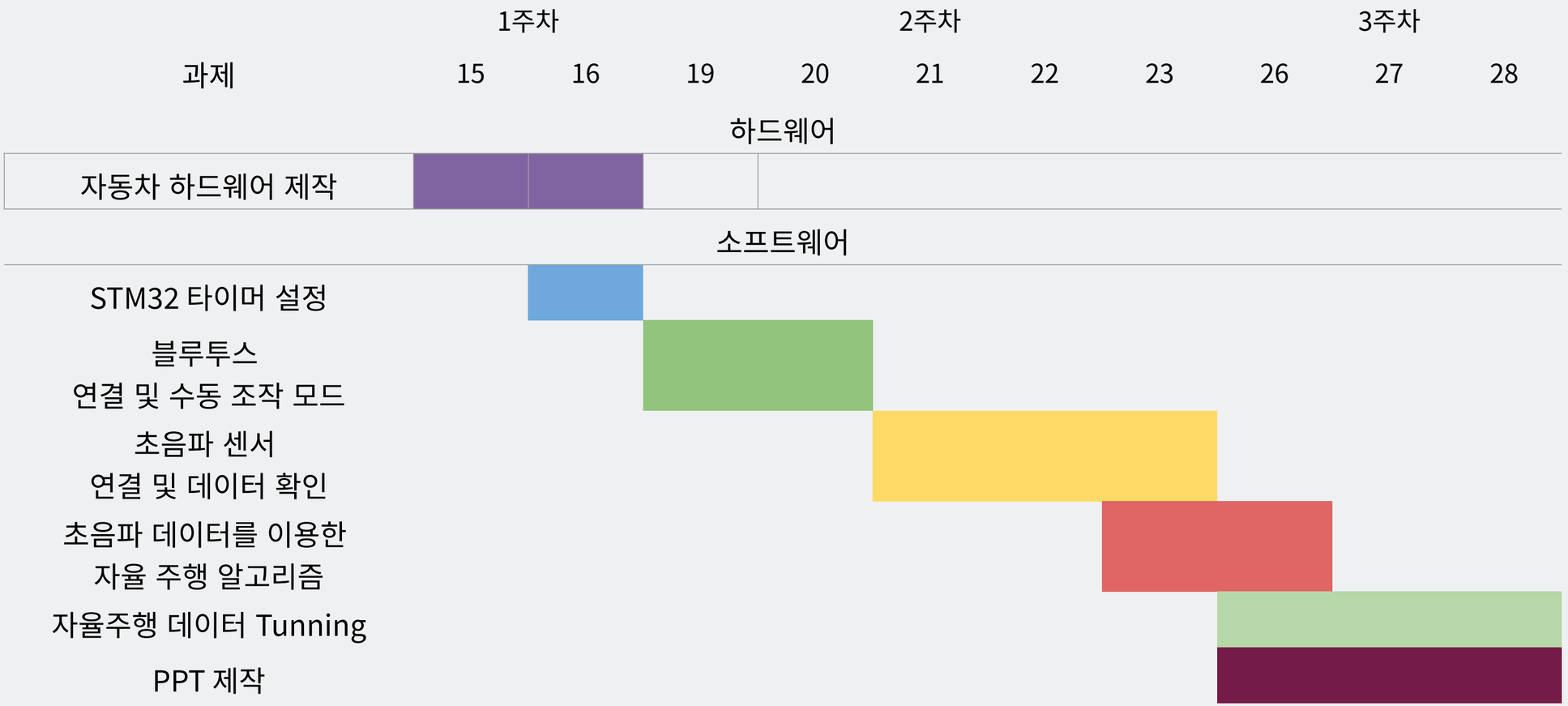
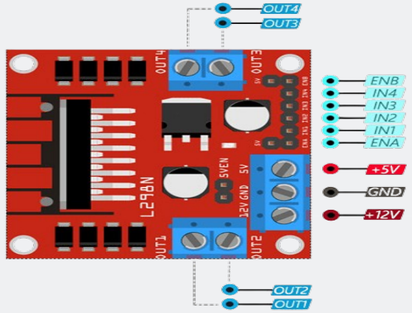
Project Plan

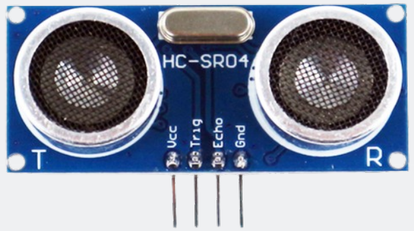


Component

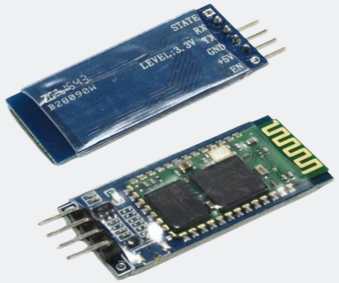
NUCLEO-F411RE



L298N



HC-SR04



HC-06 BLUETOOTH

DC-MOTOR

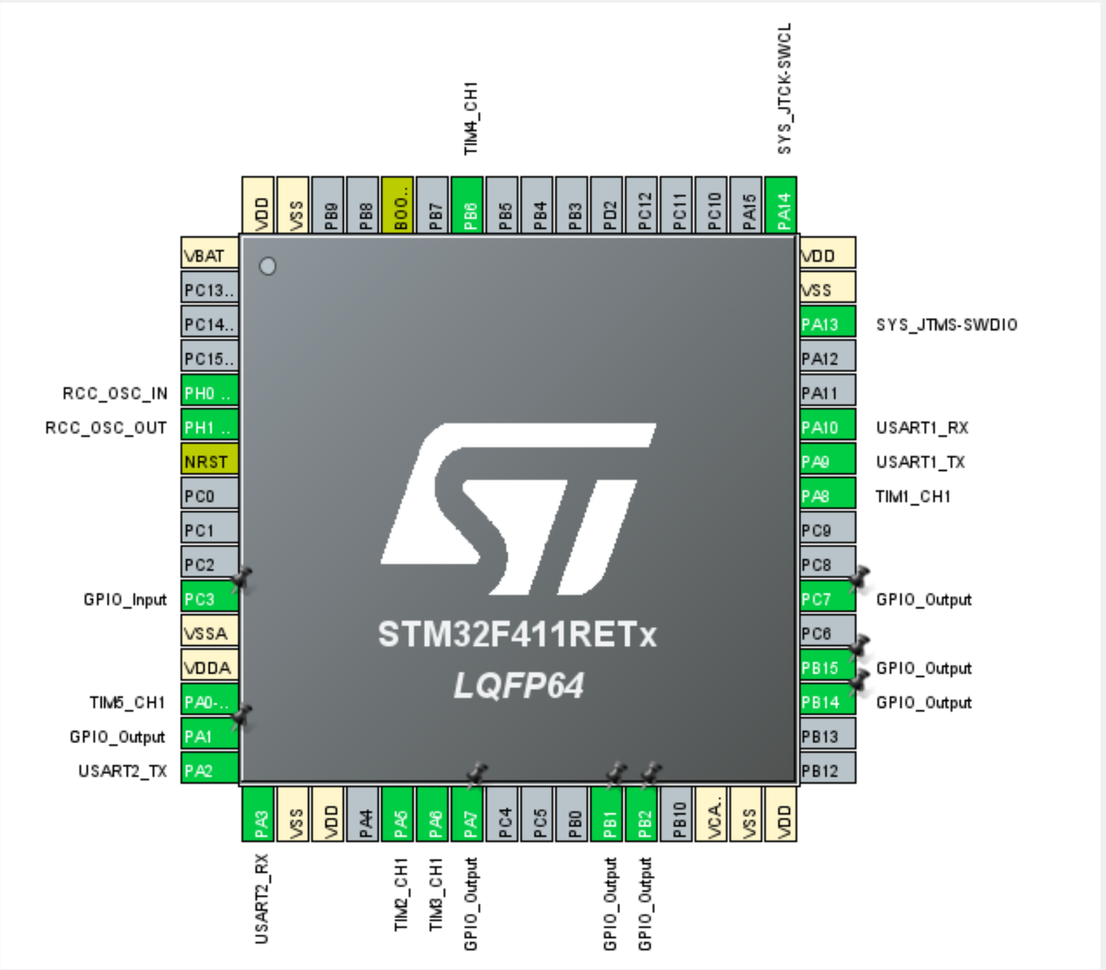
Pin Mapping

PB14 MOTOR제어핀
PB15 MOTOR제어핀
PB1 MOTOR제어핀
PB2 MOTOR제어핀

PA8 TIM1 PWM제어
PA5 TIM2 PWM제어
PA6 TIM3 초음파센서 echo핀
PB6 TIM4 초음파센서 echo핀
PA0 TIM5 초음파센서 echo핀

PA1 gpio 초음파센서 TRIG핀
PA7 GPIO 초음파센서 TRIG핀
PC7 GPIO 초음파센서 TRIG핀

PA10 블루투스 RX
PA9 블루투스 TX



Track

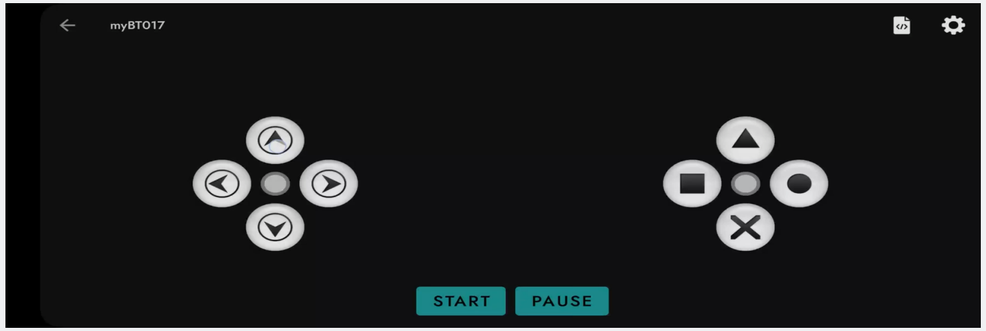
수동조작 코드

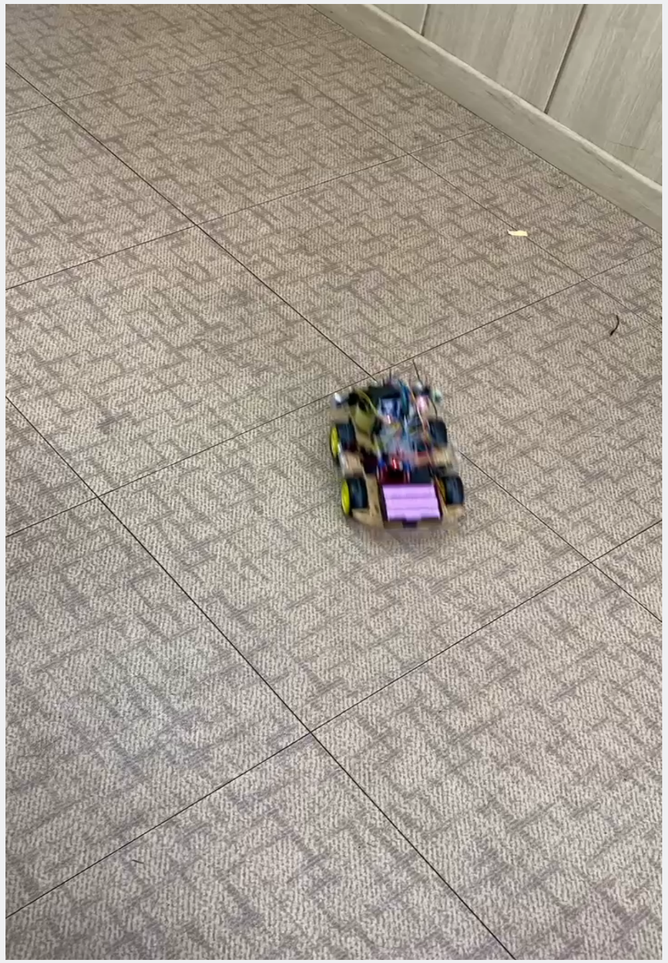
```
if (mode == 0)
{
    if(rxData[0] == 'w')
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 1);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

        TIM1->CCR1 = SPEED;

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 1);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

        TIM2->CCR1 = SPEED;
    }
    else if(rxData[0] == 's')
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 1);

        TIM1->CCR1 = SPEED;

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 1);

        TIM2->CCR1 = SPEED;
```

```
    else if(rxData[0] == 'a')
    {
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

      TIM1->CCR1 = SPEED;

      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 1);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

      TIM2->CCR1 = SPEED;
    }
    else if(rxData[0] == 'd')
    {
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 1);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

      TIM1->CCR1 = SPEED;

      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

      TIM2->CCR1 = SPEED;
    }
```

```
    else if(rxData[0] == 'k')
    {
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
      HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);
    }
    else if(rxData[0] == 0)
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);
    }
```

수동조작 영상





자율주행 코드

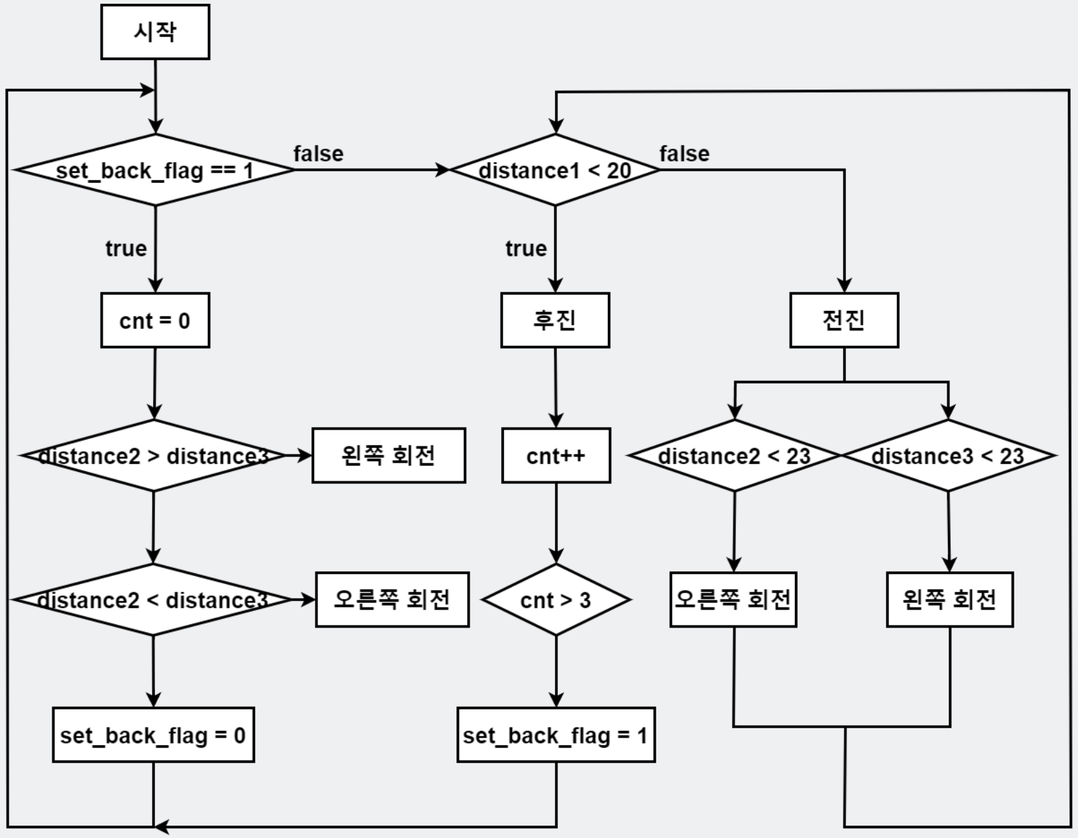
```
else
{
    HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 1);
    HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

    TIM1->CCR1 = SPEED;

    HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 1);
    HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

    TIM2->CCR1 = SPEED;

    if (distance2 < 18)
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 1);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

        TIM1->CCR1 = SPEED;

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

        TIM2->CCR1 = SPEED;
    }
```

```
else
{
    if (distance1 < 20)
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 1);

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 1);

        if (distance2 > distance3)
        {
            TIM1->CCR1 = (SPEED + 10) * 2.4;

            TIM2->CCR1 = SPEED;
        }
        else if (distance2 < distance3)
        {
            TIM1->CCR1 = SPEED;

            TIM2->CCR1 = SPEED * 2.4;
        }
    }
```

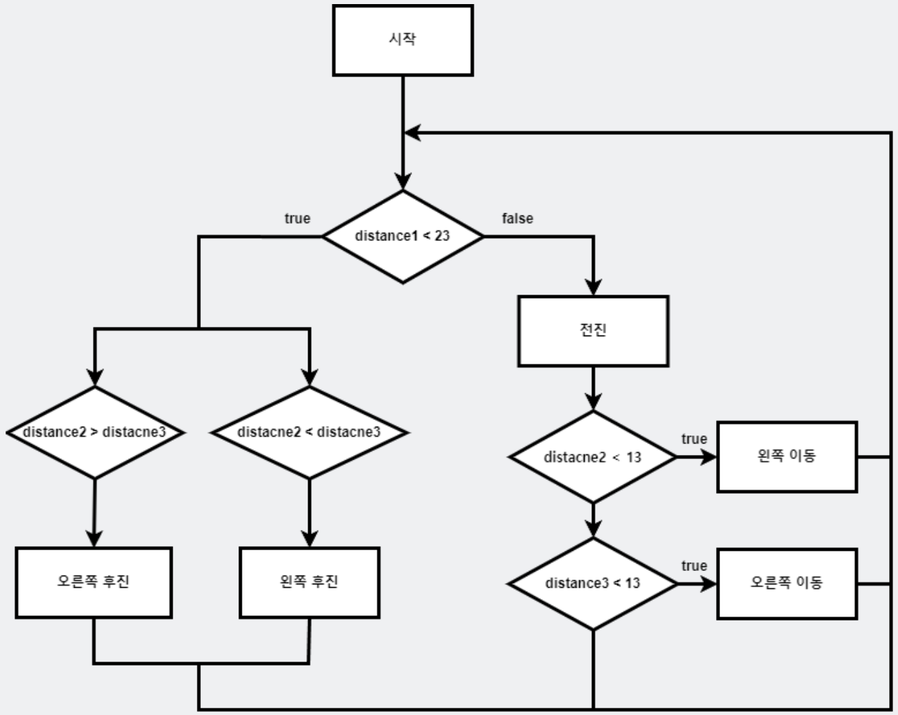
```
    if (distance3 < 18)
    {
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_15, 0);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_14, 0);

        TIM1->CCR1 = SPEED;

        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_1, 1);
        HAL_GPIO_WritePin(GPIOB, GPIO_PIN_2, 0);

        TIM2->CCR1 = SPEED;
    }
}
```

자율주행 영상

Workflow
개선 전



Workflow
개선 후



문제점

초음파 노이즈 발생

인터럽트 우선순위 꼬임 발생
모터작동 시 자기장 발생

잦은 인터럽트 발생

잦은 인터럽트 발생으로 인해
코드 꼬임현상이 발생

거리 알고리즘

전방과 좌, 우측의 초음파센서의
예외발생

해결방안/개선사항

초음파 노이즈 제거

필터 적용
인터럽트 우선순위 설계
모터 사용 시 자기장으로 거리두기
호일로 모터 감싸기

잦은 인터럽트 제어

RTOS사용

거리 알고리즘 제어

Set-back flag를 통해 제어
CNT를 통해 제어

RTOS 코드

```
defaultTaskHandle = osThreadNew(StartDefaultTask, NULL, &defaultTask_attributes);

/* creation of distance1 */
distance1Handle = osThreadNew(distanceTask1, NULL, &distance1_attributes);

/* creation of distance2 */
distance2Handle = osThreadNew(distanceTask2, NULL, &distance2_attributes);

/* creation of distance3 */
distance3Handle = osThreadNew(distanceTask3, NULL, &distance3_attributes);
```

```
void distanceTask1(void *argument)
{
  /* USER CODE BEGIN distanceTask1 */
  /* Infinite loop */
  for(;;)
  {
      HCSR04_Read(GPIOA, GPIO_PIN_7, &htim3);

      osDelay(50);
  }
  /* USER CODE END distanceTask1 */
}
```

```
void distanceTask2(void *argument)
{
  /* USER CODE BEGIN distanceTask2 */
  /* Infinite loop */
  for(;;)
  {
      HCSR04_Read(GPIOC, GPIO_PIN_7, &htim4);

      osDelay(50);
  }
  /* USER CODE END distanceTask2 */
}
```

```
void distanceTask3(void *argument)
{
  /* USER CODE BEGIN distanceTask3 */
  /* Infinite loop */
  for(;;)
  {
      HCSR04_Read(GPIOA, GPIO_PIN_1, &htim5);

      osDelay(50);
  }
  /* USER CODE END distanceTask3 */
}
```

Conclusion 및 고찰

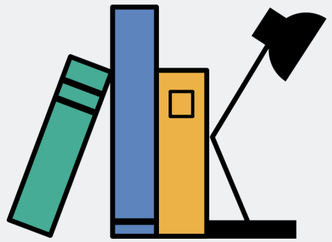
- 센서 통합, 알고리즘 설계, 제어 시스템 구현 등 해결하면서 문제 해결 능력이 강화

- 프로젝트를 통해 팀원간의 팀 협업 능력 또한 강화

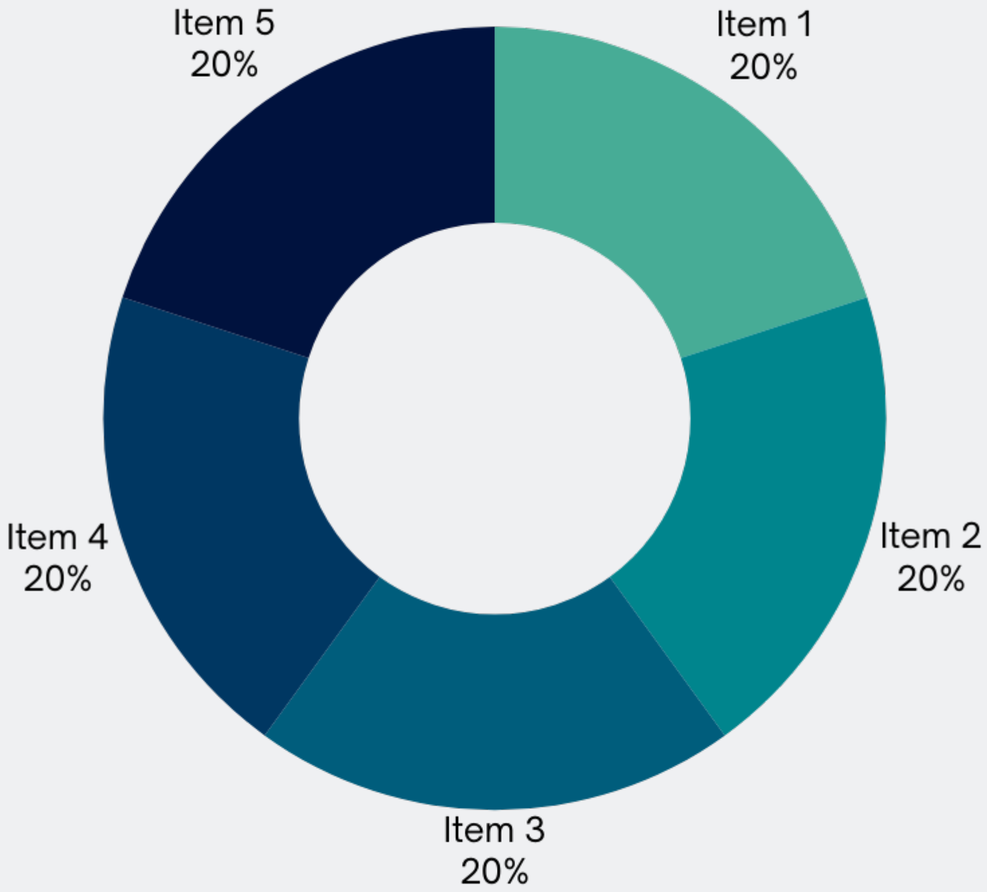
- 팀원과의 의사소통, 역할 분배, 공동 작업 등 협업 경험

- 성공적으로 자율 주행에 성공하여 성취감을 획득

Q&A



Q & A



Process

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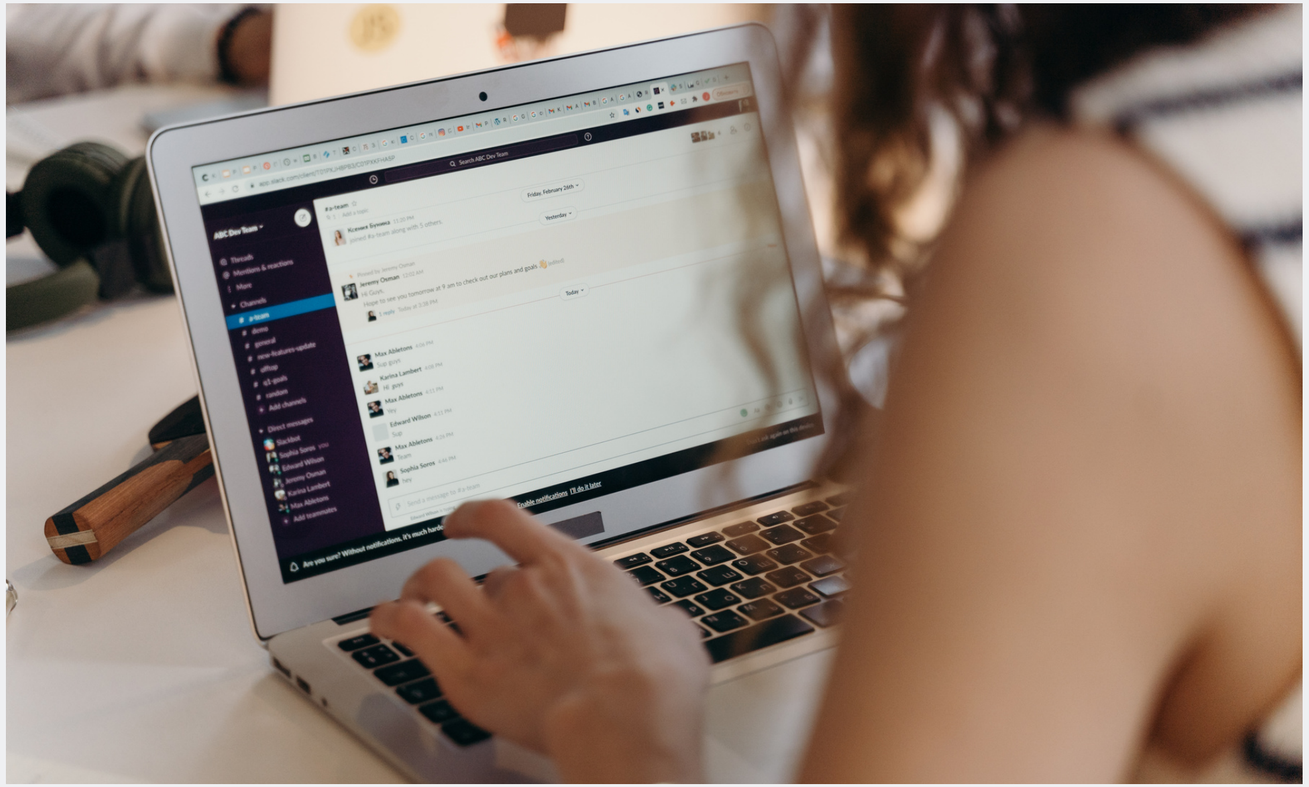
Conclusion



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