

Robotic 595R

# TILT SENSOR INTEGRATION

OFF-ROAD APPLICATION

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# The Mission



## Features:

- Tilt Sensors
- Warning LEDS.
- Alternative Routes.

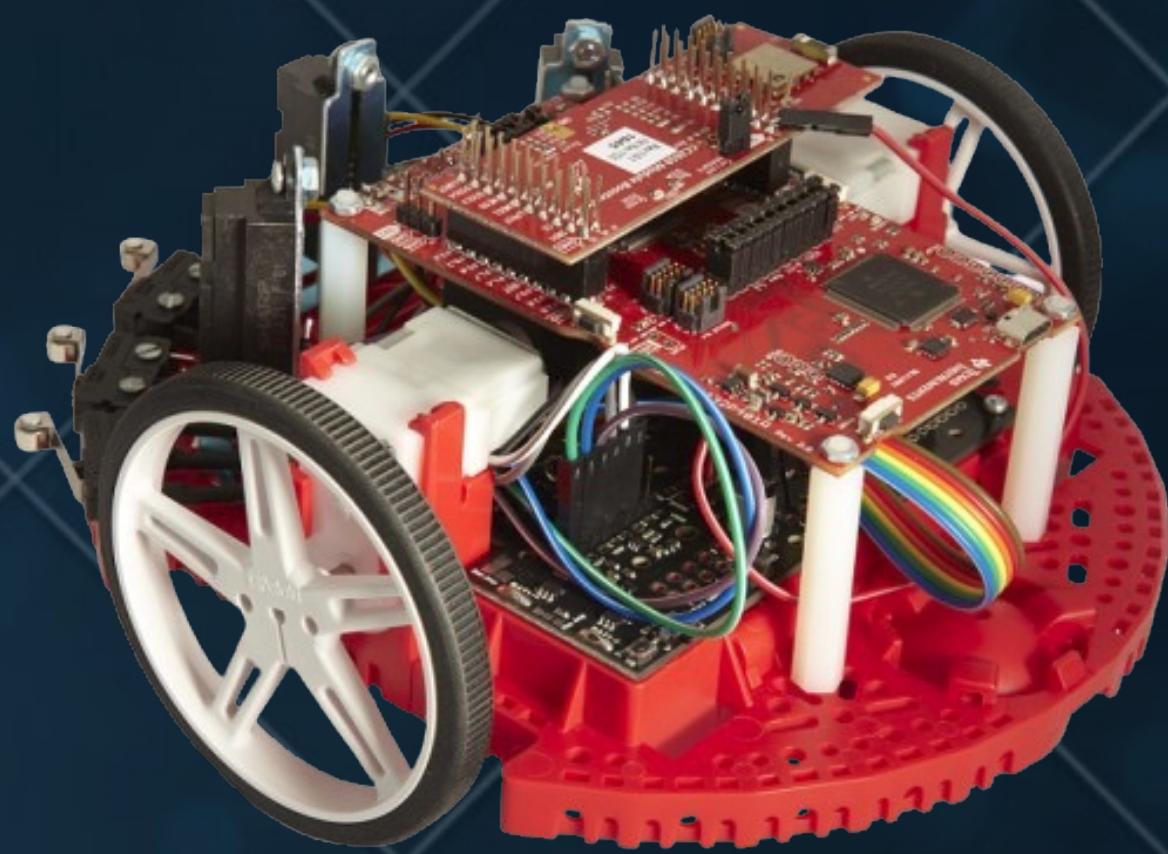
# Off-road Background

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- Used in 4x4 vehicles for many years for off-road driving.
- Simple bubble level mounted on the dashboard, providing a basic indication of the vehicle's inclination.



# Essential Components



MSP432 on TI Robotics Kit



Tilt Sensor  
Sensitivity Pots

# Plans

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- Original Plan: GPIO with Interrupts
- Change in Plan: GPIO with Polling

# Program Implementation

GPIO Pins Utilized on Robot:  
P4.0, P4.2, P4.4 & P4.5

$$\begin{array}{rcl} \text{P4.0} & = & 0x01 \\ \text{P4.2} & = & 0x04 \\ \text{P4.4} & = & 0x10 \\ + \quad \underline{\text{P4.5}} & = & 0x20 \\ & & = 0x35 \end{array}$$

```
void Tilt_Init()
{
    P4->SEL0 &= ~0x35;
    P4->SEL1 &= ~0x35;
    P4->REN |= 0x35;
    P4->DIR &= ~0x35;
    P4->OUT &= ~0x35;
}

uint8_t TILT_Status()
{
    uint8_t incerjeet = P4->IN & 0x35;
    return incerjeet;
}
```

# Program Implementation

```
switch(incerjeet){  
    case 0x00:  
        // All LEDS on - Negative Logic  
        LED2_Output(RGB_LED_SKY_BLUE);  
        Motor_Forward(1000,1000);  
        break;  
    case 0x04:  
        // LED 2 OFF - Warning  
        LED2_Output(RGB_LED_YELLOW);  
        break;  
    case 0x05:  
        // LED 1 & 2 ARE OFF and LED 3 & 4 ARE ON  
        LED2_Output(RGB_LED_RED);  
        Motor_Backward(1000,1000);  
        break;  
    case 0x20:  
        // LED 4 is OFF  
        LED2_Output(RGB_LED_YELLOW);  
        Motor_Forward(1000,1000);  
        break;  
    case 0x30:  
        // LED 3 and 4 are off  
        LED2_Output(RGB_LED_RED);  
        Motor_Backward(1000,1000);  
        Clock_Delay1ms(3000);  
        Motor_Stop();  
        Clock_Delay1ms(2500);  
        break;  
    default:  
        LED2_Output(RGB_LED_OFF);  
        Motor_Stop();  
        break;  
}
```

# Demonstration

Video Demo LINK:

<https://youtube.com/shorts/D-K7hyaTdlc>

# Issues We Ran Into

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- LEDs displayed the opposite of the expected behavior.

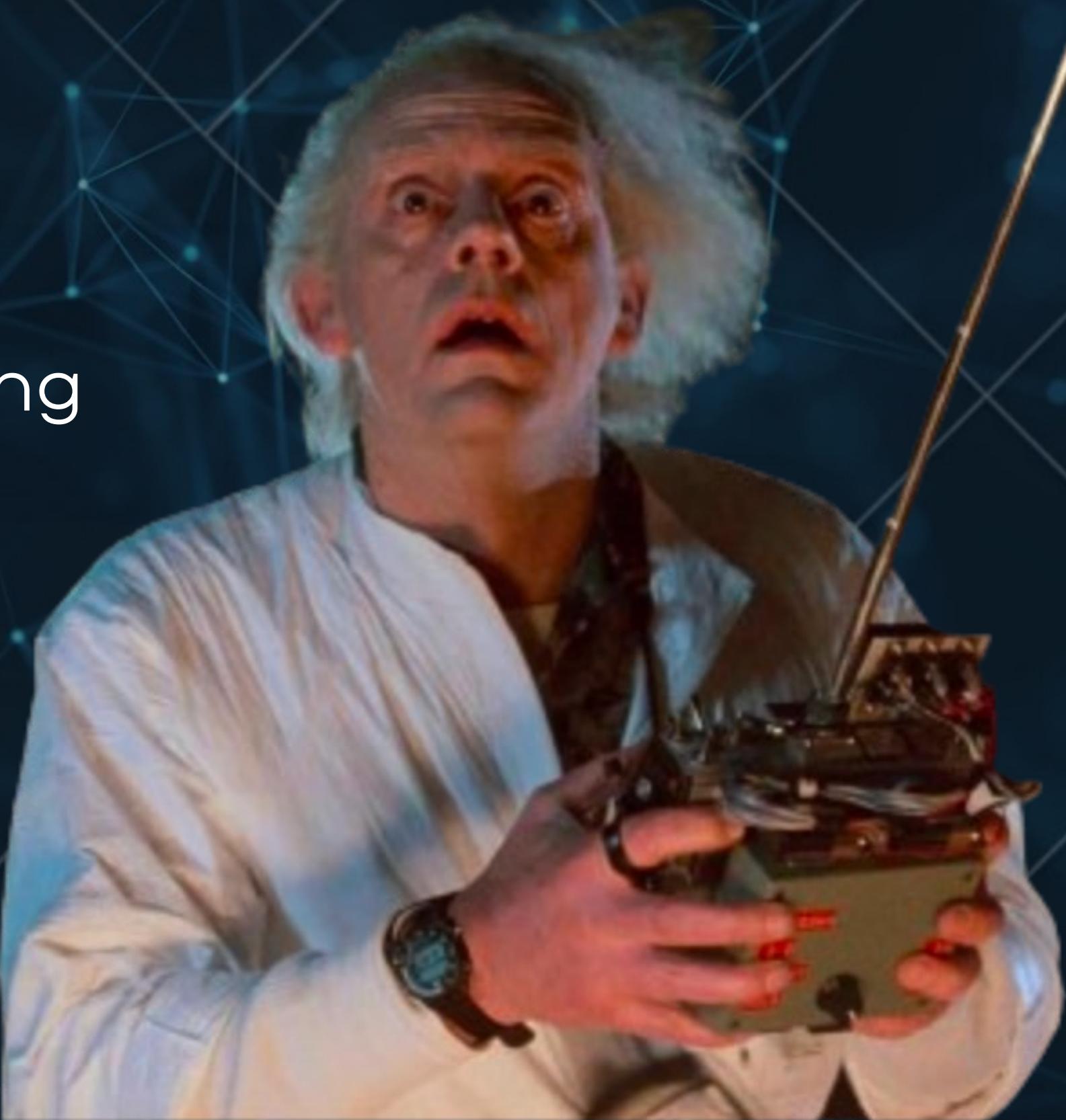
```
P4->OUT &= ~0x35;
```

- Flickering of sensor due to calibration issues.

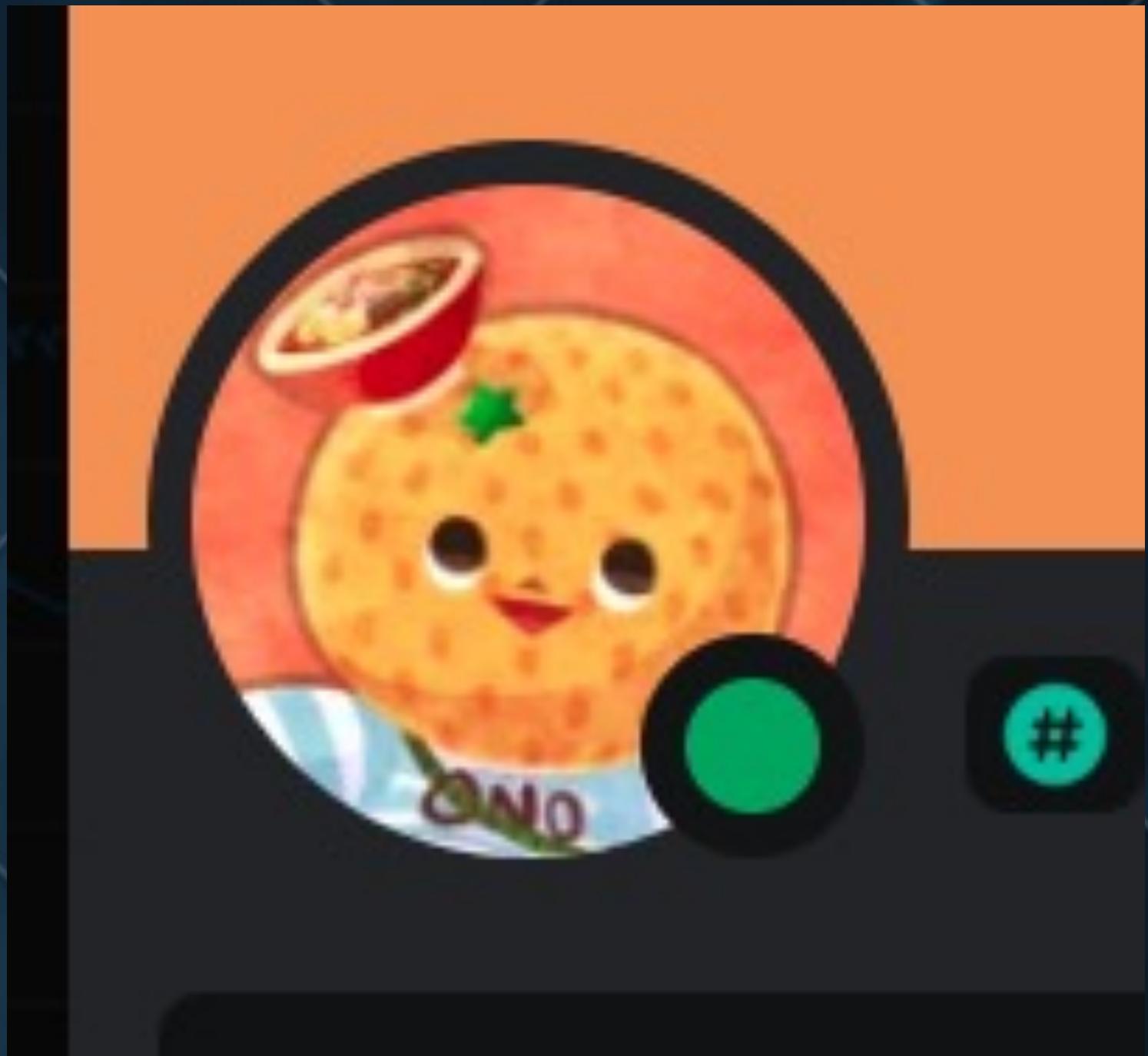
# Future Development

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- Multiple Cores
- Systick Counter to Fix Flickering
- Automatic Terrain Tracking
- AI Crawl Control



# Sources



MATTI GAEIDI

Conquer Terrain with Ease,  
Anywhere That You Please!

Unlike these presentations,  
our inclinometer will keep  
you level-headed.



Mani Saeidi



Matthew Gordon