EE-242 MICROPROCESSOR SYSTEMS

FINAL PROJECT

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Project Name:PARKING SENSOR WITH SOLAR PANEL

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Abstract:

In this part, general working principles of the circuit is explained. One of the main objects of this project is to implement Hc-Sr04 and renewable energy to our daily life , I achieved this by using Stm32F407G and solar panel. The circuit that designed combining of components listed below in this part. Firstly, general overview of project and used system information after the introduction and component lists. Next part after this part, mention about procedure of project and giving detailed information about connecting separating components such as Stm32F407G and sensor. Last part of procedure is giving code snipping to use Stm32 board for determining specific distance range and make a warning. Lastly, report has a conclusion about usage and steps of project.

2. LIST OF USED COMPONENTS:

- Stm32F407G
- Jumper Cables
- Breadboard
- Hc-Sr04 Sensor
- USB Cable
- Solar Panel
- Powerbank
- Powerbank USB Cable

3. OVERVIEW:

In the project, solar panel used to charge the powerbank and stored energy is used to power components in the circuit. Ultrasonic distance sensor determines the distance to an object by measuring the time taken by the led lamps to reflect back from that object. Purpose of this project is calculating distance between user and behind his/her. Therefore, system can calculate distance and should make a warning specific range that chosen distance . Ultrasonic system will connect with STM32 microcontroller for sending data from sensor and STM32 will process current distance information and make a decision that should do.

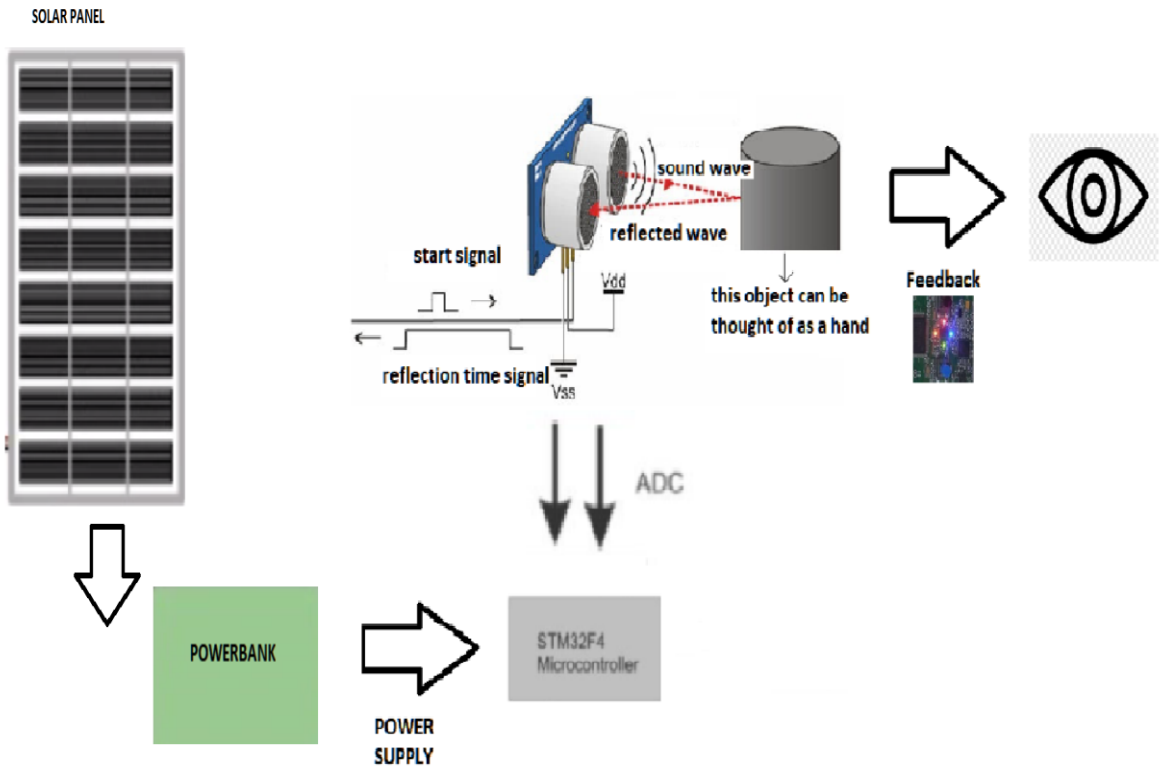
Fig. :Ultrasonic Sensor Of System

I have selected to use solar panel to save nature and prevent having waste batteries in the world. A lot of recycling methods to charge systems like wind, solar panel but solar panel used in this project because it is more useable and portable for my purpose.

Fig. :Solar Panel Of System

4. PROCEDURE:

Using the energy provided from solar panel which then transferred to Stm32F407G powered,necessary calculations and processes are done for distance sensor to measure distance.First of all,the circuit was constructed.The connections of the components were done according similarly to the data sheet of Stm32F407G as shown in the figure below.



In here c codes steps will explain in this below. Starting of code is defining pins that we need to use for input/output and trig pin

of sensor. Distance can calculate from 2cm to 400cm in the ultrasonic sensor. I defined values that determine maximum and minimum range for each led and give warning thanks to leds on the Stm32. Then we initialize mode of pins. Trigpin is in OUTPUT mode because they are from Stm32 to output. Echo pin is in INPUT mode because it is from sensor to Stm32. After these operations we define function that send signal end get signal thanks to low and high type we determine time for result from our pin. If we divide our time by 58, I can get distance that I calculated. After these operations we check our specific distance range that we defined in start of code. This calculation function return distance.

MAIN.C CODE:

```
#include "main.h"

#include "dwt_stm32_delay.h"
void SystemClock_Config(void);
static void MX_GPIO_Init(void);

uint32_t sensor_time;
uint16_t distance;

uint32_t Read_HCSR04()
{
      uint32_t local_time = 0;

      HAL_GPIO_WritePin(GPIOA, GPIO_PIN_1, GPIO_PIN_SET);        //
pull the trig pin high
      DWT_Delay_us(10);
            // wait for 10 us
      HAL_GPIO_WritePin(GPIOA, GPIO_PIN_1, GPIO_PIN_RESET); // pull
the trig pin low

      // wait for the echo pin to go high

      while(!(HAL_GPIO_ReadPin(GPIOA, GPIO_PIN_2)));

      while(HAL_GPIO_ReadPin(GPIOA, GPIO_PIN_2))                 //
while the pin is high
      {
            local_time++;
            // increment local time
            DWT_Delay_us(1);
      // every 1 us
      }

      return local_time * 2;
}

int main(void)
{
  HAL_Init();

  SystemClock_Config();

  MX_GPIO_Init();
  DWT_Delay_Init();

  while (1)
  {

        sensor_time = Read_HCSR04();
// get the high time
        distance = sensor_time * .034 / 2;  // user the formula to
get the distance
```

```
        if(distance <= 4)
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_All, GPIO_PIN_SET);
        else if(distance > 4 && distance <= 6)
        {
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_12 | GPIO_PIN_13 |
GPIO_PIN_14, GPIO_PIN_SET);
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_15, GPIO_PIN_RESET);
        }
        else if(distance > 6 && distance <= 8)
        {
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_12 | GPIO_PIN_13,
GPIO_PIN_SET);
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_14 | GPIO_PIN_15,
GPIO_PIN_RESET);
        }
        else if(distance > 8 && distance <= 10)
        {
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_12, GPIO_PIN_SET);
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_13 | GPIO_PIN_14 |
GPIO_PIN_15, GPIO_PIN_RESET);
        }
        else
        {
             HAL_GPIO_WritePin(GPIOD, GPIO_PIN_All, GPIO_PIN_RESET);
        }
  }
  /* USER CODE END 3 */
}

void SystemClock_Config(void)
{
  RCC_OscInitTypeDef RCC_OscInitStruct = {0};
  RCC_ClkInitTypeDef RCC_ClkInitStruct = {0};

  __HAL_RCC_PWR_CLK_ENABLE();
  __HAL_PWR_VOLTAGESCALING_CONFIG(PWR_REGULATOR_VOLTAGE_SCALE1);
  /** Initializes the CPU, AHB and APB busses clocks
  */
  RCC_OscInitStruct.OscillatorType = RCC_OSCILLATORTYPE_HSE;
  RCC_OscInitStruct.HSEState = RCC_HSE_ON;
  RCC_OscInitStruct.PLL.PLLState = RCC_PLL_ON;
  RCC_OscInitStruct.PLL.PLLSource = RCC_PLLSOURCE_HSE;
  RCC_OscInitStruct.PLL.PLLM = 4;
  RCC_OscInitStruct.PLL.PLLN = 168;
  RCC_OscInitStruct.PLL.PLLP = RCC_PLLP_DIV2;
  RCC_OscInitStruct.PLL.PLLQ = 4;
  if (HAL_RCC_OscConfig(&RCC_OscInitStruct) != HAL_OK)
  {
    Error_Handler();
  }
  /** Initializes the CPU, AHB and APB busses clocks
  */
  RCC_ClkInitStruct.ClockType =
RCC_CLOCKTYPE_HCLK|RCC_CLOCKTYPE_SYSCLK
```

```
|RCC_CLOCKTYPE_PCLK1|RCC_CLOCKTYPE_PCLK2;
  RCC_ClkInitStruct.SYSCLKSource = RCC_SYSCLKSOURCE_PLLCLK;
  RCC_ClkInitStruct.AHBCLKDivider = RCC_SYSCLK_DIV1;
  RCC_ClkInitStruct.APB1CLKDivider = RCC_HCLK_DIV4;
  RCC_ClkInitStruct.APB2CLKDivider = RCC_HCLK_DIV2;

  if (HAL_RCC_ClockConfig(&RCC_ClkInitStruct, FLASH_LATENCY_5) !=
HAL_OK)
  {
    Error_Handler();
  }
}

/**
  * @brief GPIO Initialization Function
  * @param None
  * @retval None
  */
static void MX_GPIO_Init(void)
{
  GPIO_InitTypeDef GPIO_InitStruct = {0};

  /* GPIO Ports Clock Enable */
  __HAL_RCC_GPIOH_CLK_ENABLE();
  __HAL_RCC_GPIOA_CLK_ENABLE();
  __HAL_RCC_GPIOD_CLK_ENABLE();

  /*Configure GPIO pin Output Level */
  HAL_GPIO_WritePin(GPIOA, GPIO_PIN_1, GPIO_PIN_RESET);

  /*Configure GPIO pin Output Level */
  HAL_GPIO_WritePin(GPIOD,
GPIO_PIN_12|GPIO_PIN_13|GPIO_PIN_14|GPIO_PIN_15, GPIO_PIN_RESET);

  /*Configure GPIO pin : PA1 */
  GPIO_InitStruct.Pin = GPIO_PIN_1;
  GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
  GPIO_InitStruct.Pull = GPIO_NOPULL;
  GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_LOW;
  HAL_GPIO_Init(GPIOA, &GPIO_InitStruct);

  /*Configure GPIO pin : PA2 */
  GPIO_InitStruct.Pin = GPIO_PIN_2;
  GPIO_InitStruct.Mode = GPIO_MODE_INPUT;
  GPIO_InitStruct.Pull = GPIO_NOPULL;
  HAL_GPIO_Init(GPIOA, &GPIO_InitStruct);

  /*Configure GPIO pins : PD12 PD13 PD14 PD15 */
  GPIO_InitStruct.Pin =
GPIO_PIN_12|GPIO_PIN_13|GPIO_PIN_14|GPIO_PIN_15;
  GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
  GPIO_InitStruct.Pull = GPIO_NOPULL;
  GPIO_InitStruct.Speed = GPIO_SPEED_FREQ_LOW;
  HAL_GPIO_Init(GPIOD, &GPIO_InitStruct);
```

```
}

void Error_Handler(void)
{
  /* USER CODE BEGIN Error_Handler_Debug */
  /* User can add his own implementation to report the HAL error
return state */

  /* USER CODE END Error_Handler_Debug */
}

#ifdef  USE_FULL_ASSERT
void assert_failed(uint8_t *file, uint32_t line)
{
}
#endif /* USE_FULL_ASSERT */
```

5. CONCLUSION:

I believe that this project is helping people for daily activities as it helps people to parking by the car, to keep in mind the social distance rules,while doing this usage of solar power allows me to address another global problem which is Global Warming. Thanks to this project, I hope that I achieved a reduction of social distance,Global Warming and parking problem.

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