Development of high-performance but low-cost sensing node for intelligent monitoring system

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Introduction

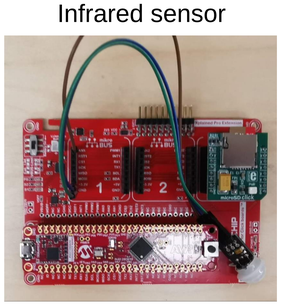
As society grows and urbanization continues to increase, cities are becoming larger and more diverse in their social functions, and at the same time, the number of potential hazards in cities has increased dramatically, such as whether the city's infrastructure is still robust after daily exposure to the elements, whether there are excessive pollutants in the river water, whether there are aging circuits and fire risks in the power lines and signal networks that travel through the city, and so on. In a modern city of this size, it is not practical to manually count every data and report the potential dangers. So, in this context, the research project becomes very important. We want to make reliable and stable sensors for detecting information about the external environment at low prices, there are many types of sensors and different sensors will be responsible for different functional boards. Thousands of sensors will be dropped by drones to all corners of the city, because of their tiny size, do not require continuous charging, and inexpensive, so after they lose their ability to work in the city can be naturally degraded without the need for manual recovery. These sensors will be able to weave a web of information in the city, reporting potential crises to detection centers in real time.

Project method

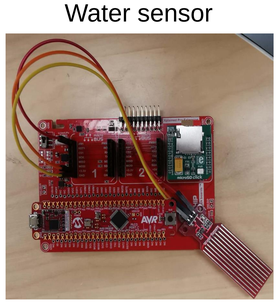
- Individuals targeted by the project are big cities that need sensors to collect specific data such as temperature, distance, and so on.
- Implement microcontroller AVR128DB48 onto the broad as well as SD card receiver and infrared sensors
- Connect microcontroller AVR128db48 with the computer.
- Open MPLAB to check connection with AVR128DB48
- Implement simple projects such as “Hello World” to check the operation of UART.
- Build connection for microcontroller in MPLAB.
- Build and implement the code from MPLAB to the microcontroller.
- Open Data Visualizer in MPLAB to capture reading from the sensor.
- Change to another water sensor and repeat the step above.

Infrared sensor

Water sensor

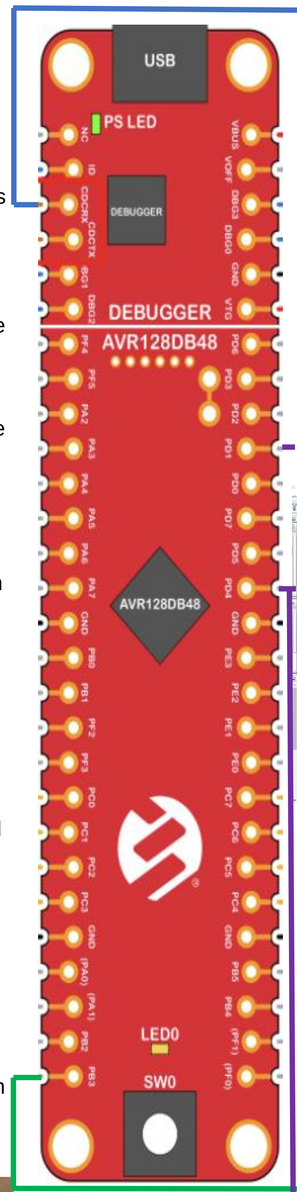


Infrared sensor connection



Water sensor connection

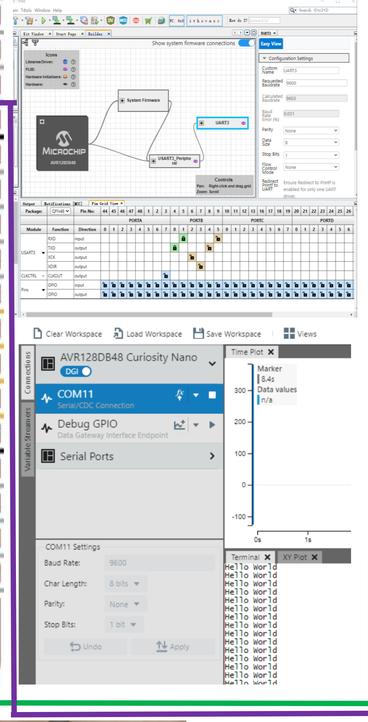
Project Demo



- *Hello World print*

PB0 USART3 TX CDC RX
PB1 USART3 RX CDC TX

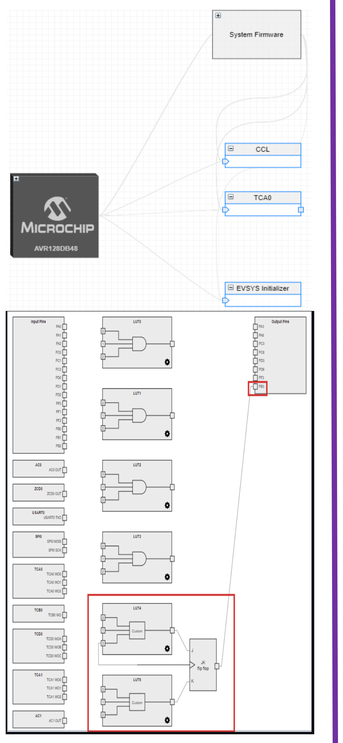
```
#define STRING_END '\0'

int main(void)
{
    SYSTEM_Initialize();

    while(1)
    {
        /* Configured USART3 for printing, so this is one way of
         * writing text over USART.
         */
        printf("Hello ");

        /* Another way is to use the USART3_Write function directly
         * Can also be used to send uint8_t values directly */
        char world[] = "World \r\n";
        for(uint8_t i = 0; world[i] != STRING_END; i++){
            /* Checks if USART3 is ready to send data */
            while(!USART3_IsTxReady());
            USART3_Write(world[i]);
        }

    }
}
```



- *LED Blinking*

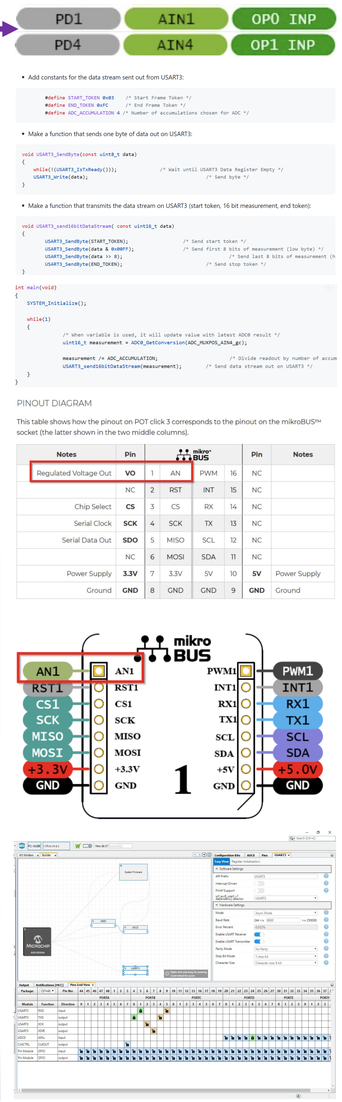
LED0 PB3

```
#include "mcc_generated_files/system/system.h"

/*
    Main application
*/

int main(void)
{
    SYSTEM_Initialize();


    while(1)
    {
    }
}
```

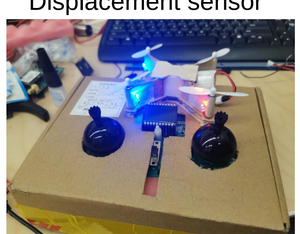


- *Analog Read Serial Write*

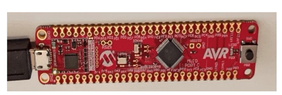
PD1 AIN1 OP0 INP
PD4 AIN4 OP1 INP

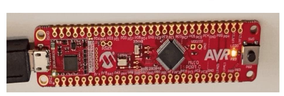


Displacement sensor

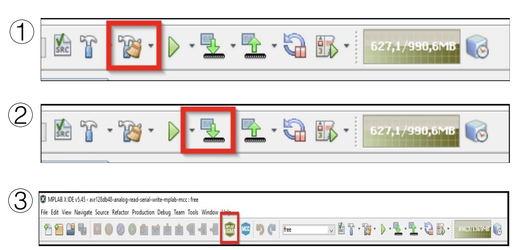


Drone and handle



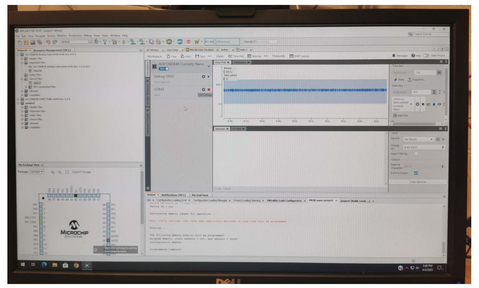


- *How to start running*

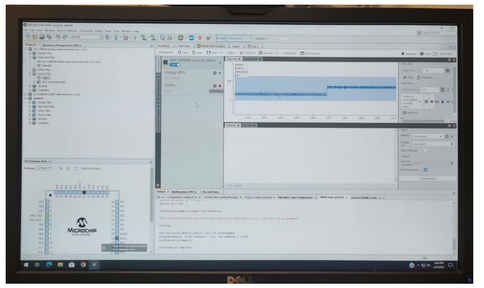


Project Result

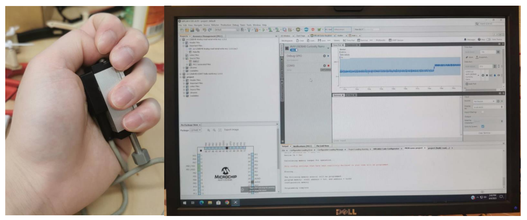
The result of this project is after several demos in MPLAB, we can successfully implement our code into our sensors. After implementing our water, infrared and displacement sensor, we can successfully collect data. Thus, our sensor can be used in future real application such as water, displacement, and number of people sensing.



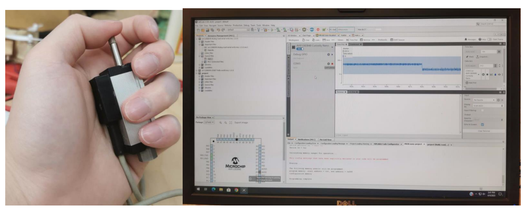
Infrared sensor reading when people passing



Water sensor reading when detect water

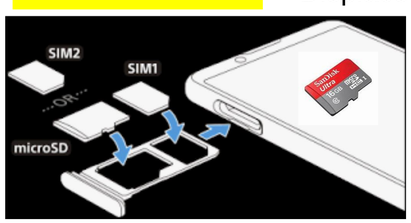


Displacement sensor reading when pushing



Displacement sensor reading when releasing

Future Plan



Use SD card to transfer sensor data

Use Drones to deliver our sensors

Reference

https://github.com/microchip-pic-avr-examples/avr128db48-hello-world-over-usart-mplab-mcc
https://github.com/microchip-pic-avr-examples/avr128db48-blink-led-ccl-mplab-mcc
https://github.com/microchip-pic-avr-examples/avr128db48-analog-read-serial-write-mplab-mcc