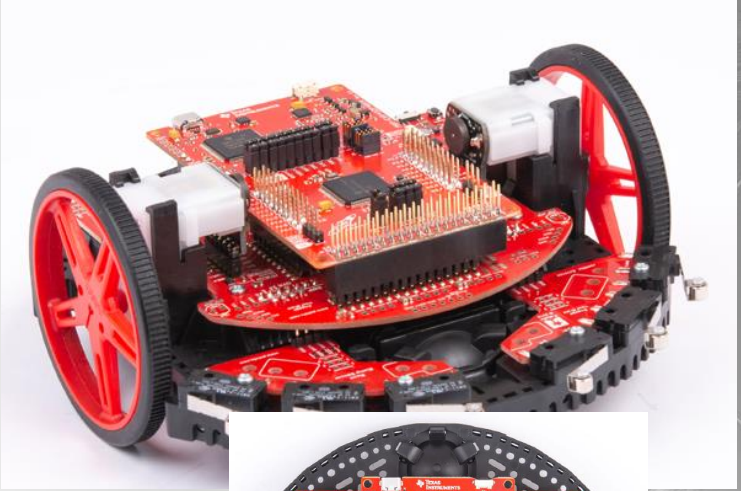
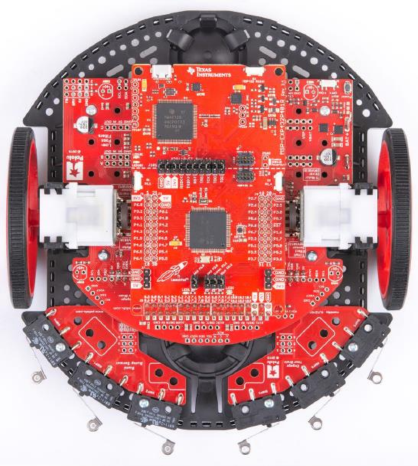
TI-RSLK MAX Workshop

Thorsten Lorenzen

TI-RSLK MAX getting started





Before we can start

Register for myTI account:

- ti.com
- Top right of the home page

Get access to CCS Cloud:

- https://dev.ti.com/
- Click on the buttons „Install“ and „Download“ to install the browser plugin
- Start CCS Cloud: https://dev.ti.com/ide

Review the home page of TI-RSLK robot:

- ti.com/rslk

Load the TI-RSLK User guide:

- http://www.ti.com/lit/ml/sekp166/sekp166.pdf

Review the TI page of TI-RSLK

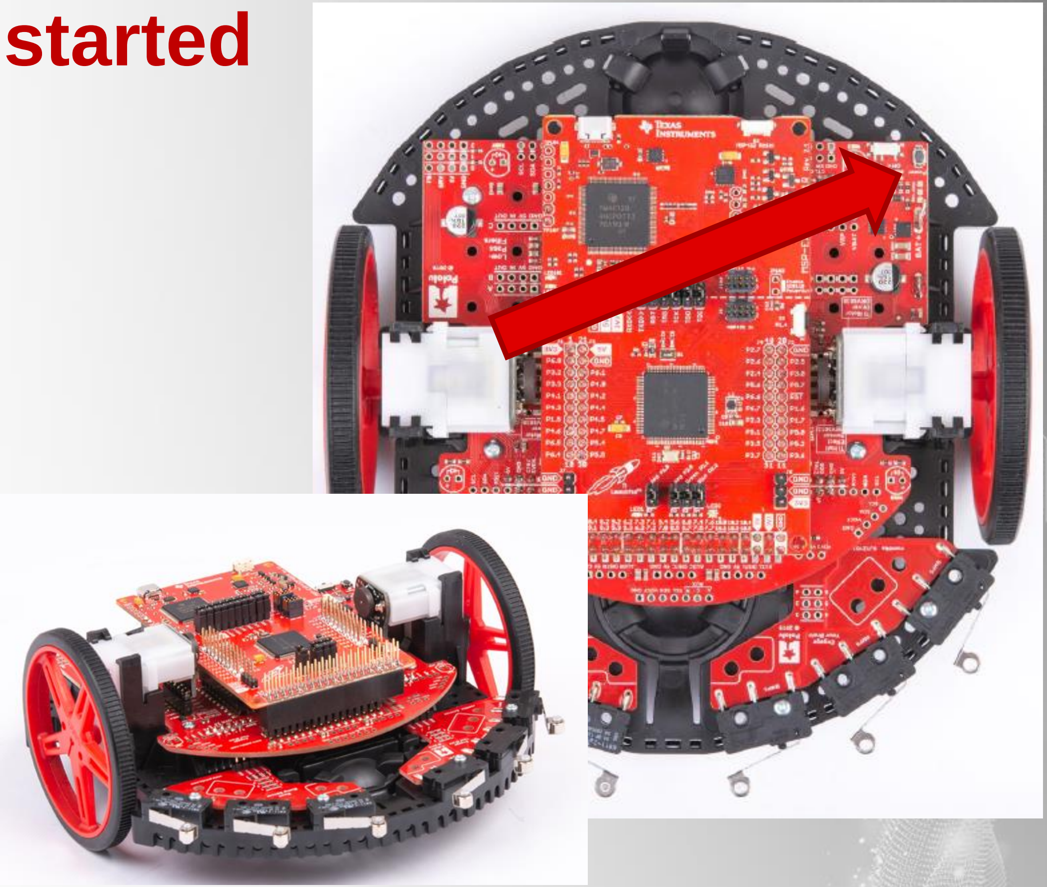
- http://www.ti.com/tool/TIRSLK-EVM?keyMatch=RSLK%20MAX&tisearch=Search-EN-everything&usecase=part-number

TI-RSLK MAX getting started

First steps for getting started

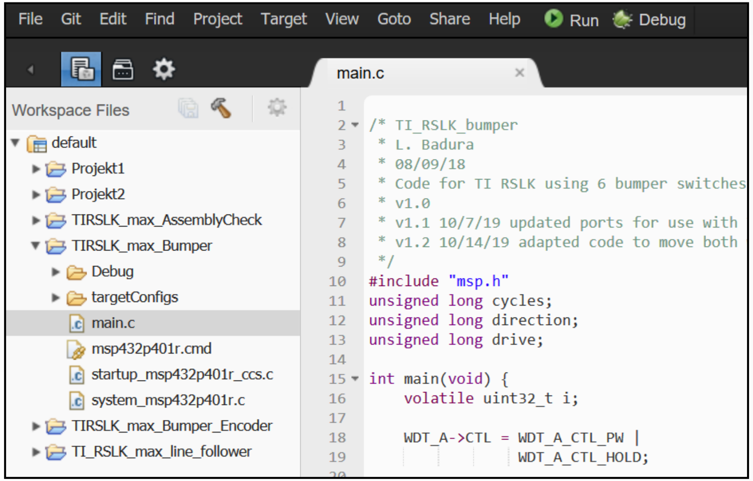
Wake up the robot for first out of the box experience

- Put the robot on your desk on its wheels
- Get familiar with your robot components it is built up
- Now flip your robot to get access to the battery compartment
- Put 6 batteries in the compartment with orientation MINUS pole to the spring
- Flip the robot back on its wheels on your desk
    - During the next step you will experience the move of the robut for 10cm. Don‘t worry ☺
- Hit the power button (RED arrow)
    - You will notice one Blue LED
- Robot should move for 10cm but halt after.
    - This is the prove the robot to be alive ☺
- Hit the power button again to turn off the robot



TI-RSLK MAX programming

- Programming with CCS cloud: https://dev.ti.com/
- Accessible from every computer (online account)
- Ready for coding in 5 minutes (browser add on download)

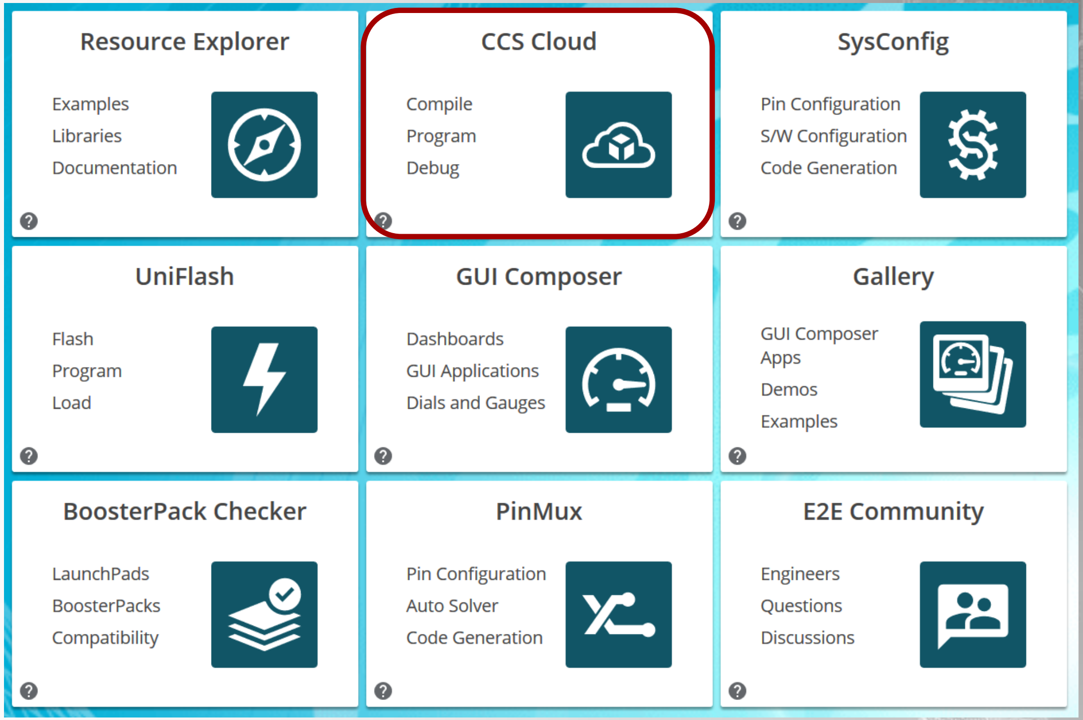


```

/* TI_RSLK_bumper
 * L. Badura
 * 08/09/18
 * Code for TI RSLK using 6 bumper switches
 * v1.0
 * v1.1 10/7/19 updated ports for use with
 * v1.2 10/14/19 adapted code to move both
 */
#include "msp.h"
unsigned long cycles;
unsigned long direction;
unsigned long drive;

int main(void) {
    volatile uint32_t i;

    WDT_A->CTL = WDT_A_CTL_PW |
                 WDT_A_CTL_HOLD;
```



Resource Explorer
Examples
Libraries
Documentation

CCS Cloud
Compile
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Debug

SysConfig
Pin Configuration
S/W Configuration
Code Generation

UniFlash
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GUI Composer
Dashboards
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BoosterPack Checker
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Compatibility

PinMux
Pin Configuration
Auto Solver
Code Generation

E2E Community
Engineers
Questions
Discussions

TI-RSLK MAX programming

First steps for getting started

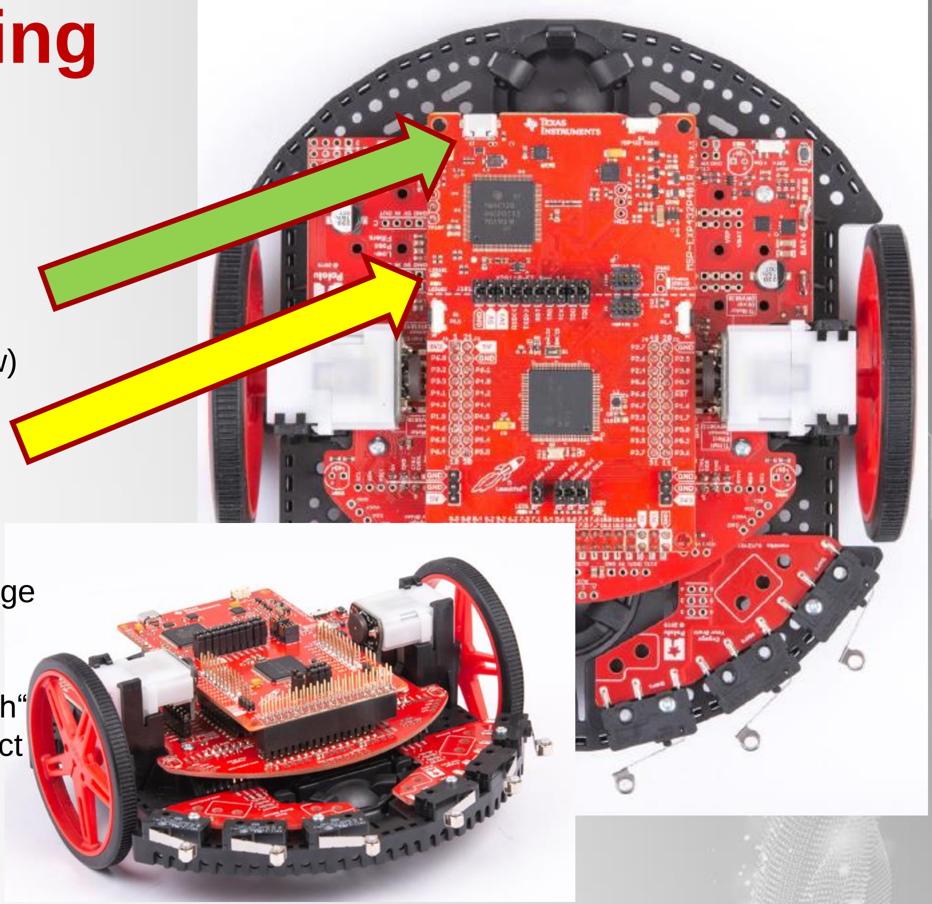
Establishing the connection RSLK to your computer

Connect USB cable to the connector (GREEN arrow)

- You should see the green LED to be illuminated (YELLOW arrow)
- It indicates the Computer to recognize the robot

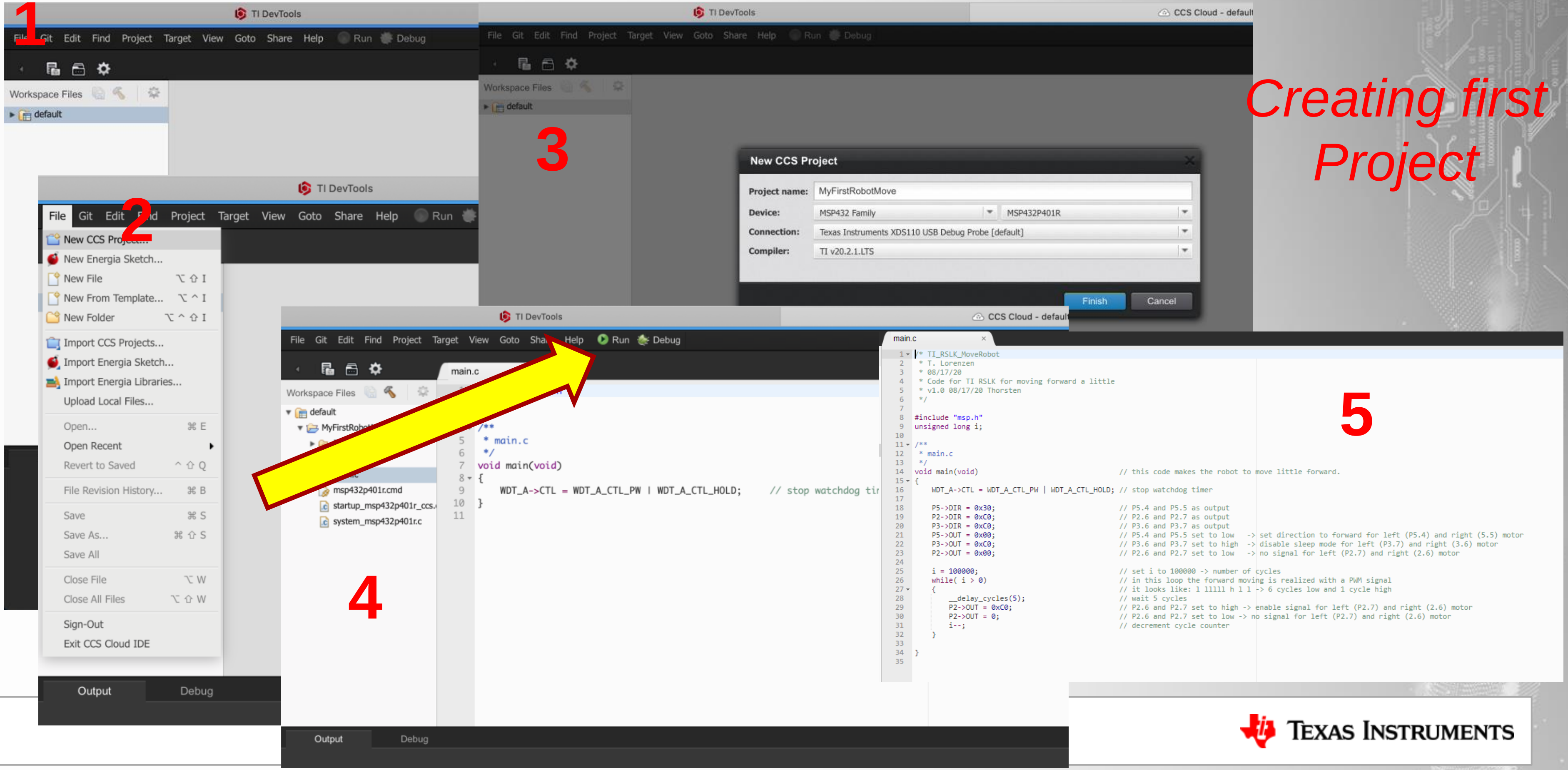
Open CCS Cloud Software Development Environment

- Start the link in your browser: https://dev.ti.com/
- Login with your myTI account details (top right of the page)
- On the left you see the statement „Start browsing“. Below the page indicates the robot‘s processor name „MSP432P401R “
- If not done so far click both the buttons „Install“ and „Download
- When finished scroll further down and click on the button „Launch“ in the field „CCS Cloud“ to start creating your first software project



TI-RSLK MAX Programming

Creating first Project



3 New CCS Project

Project name: MyFirstRobotMove

Device: MSP432 Family | MSP432P401R

Connection: Texas Instruments XDS110 USB Debug Probe [default]

Compiler: TI v20.2.1.LTS

4 main.c

```
/**
 * main.c
 */
void main(void)
{
    WDT_A->CTL = WDT_A_CTL_PW | WDT_A_CTL_HOLD;     // stop watchdog tir
}
```

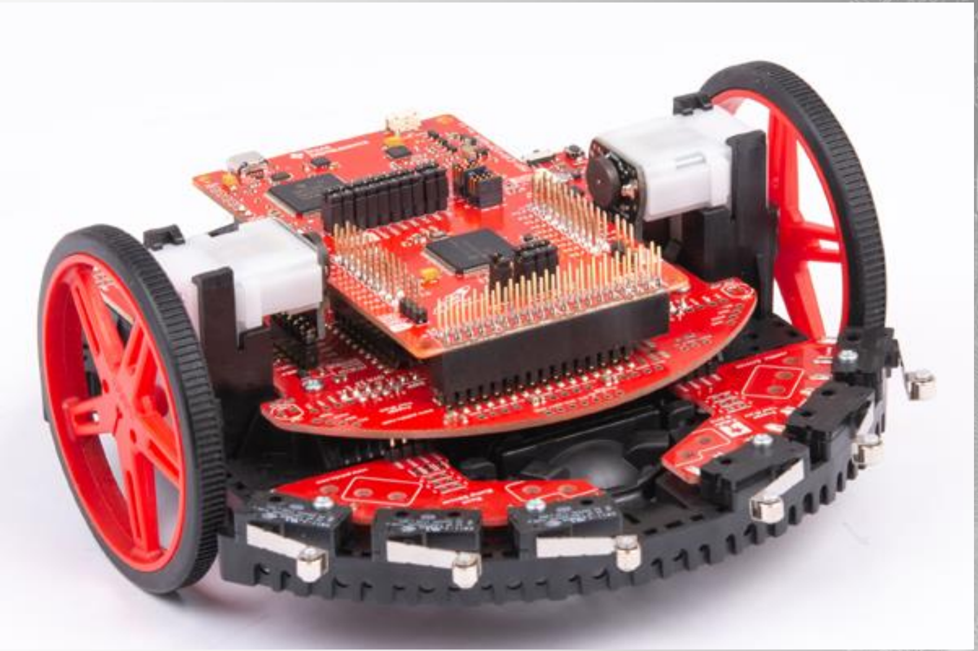
5 main.c

```
/* TI_RSLK_MoveRobot
 * T. Lorenzen
 * 08/17/20
 * Code for TI RSLK for moving forward a little
 * v1.0 08/17/20 Thorsten
 */

#include "msp.h"
unsigned long i;

/**
 * main.c
 */
void main(void)                                  // this code makes the robot to move little forward.
{
    WDT_A->CTL = WDT_A_CTL_PW | WDT_A_CTL_HOLD; // stop watchdog timer

    P5->DIR = 0x30;                              // P5.4 and P5.5 as output
    P2->DIR = 0xC0;                              // P2.6 and P2.7 as output
    P3->DIR = 0xC0;                              // P3.6 and P3.7 as output
    P5->OUT = 0x00;                              // P5.4 and P5.5 set to low   -> set direction to forward for left (P5.4) and right (5.5) motor
    P3->OUT = 0xC0;                              // P3.6 and P3.7 set to high  -> disable sleep mode for left (P3.7) and right (3.6) motor
    P2->OUT = 0x00;                              // P2.6 and P2.7 set to low   -> no signal for left (P2.7) and right (2.6) motor

    i = 100000;                                  // set i to 100000 -> number of cycles
    while( i > 0)                                // in this loop the forward moving is realized with a PWM signal
    {                                            // it looks like: l lllll h l l -> 6 cycles low and 1 cycle high
        __delay_cycles(5);                       // wait 5 cycles
        P2->OUT = 0xC0;                          // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0;                             // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        i--;                                     // decrement cycle counter
    }

}
```

TI-RSLK MAX introduction

MSP432P401R

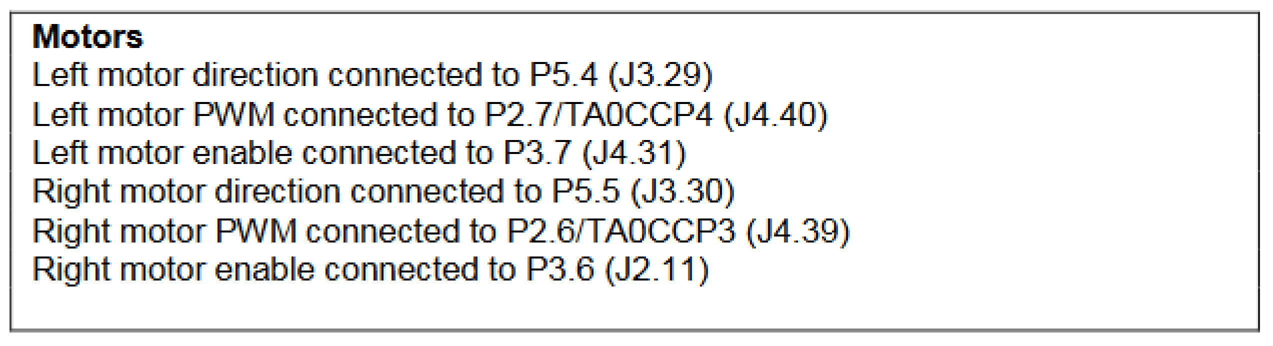
- Arm® 32-bit Cortex®-M4F CPU with floating-point unit and memory protection unit
- Up to 256KB of flash main memory (organized into two banks enabling simultaneous read or execute during erase)
- Up to 64KB of SRAM (including 6KB of backup memory)
- LPM4.5: 25 nA



TI-RSLK MAX Motor Control

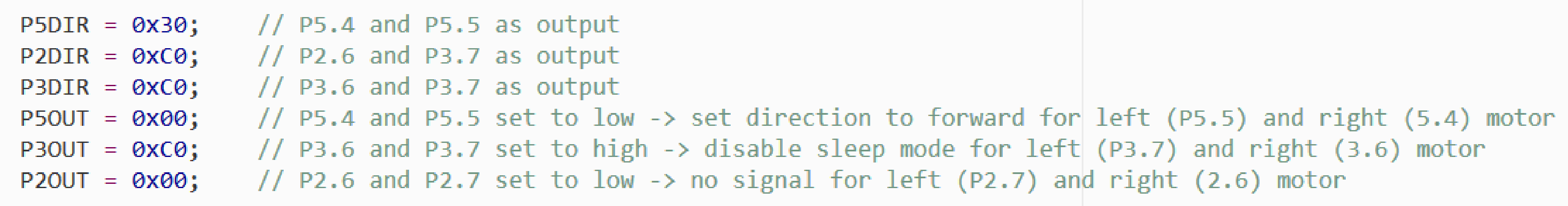
TI-RSLK MAX motors

- TI-RSLK MAX contains 2 motors with motor drivers and encoders.



Motors
Left motor direction connected to P5.4 (J3.29)
Left motor PWM connected to P2.7/TA0CCP4 (J4.40)
Left motor enable connected to P3.7 (J4.31)
Right motor direction connected to P5.5 (J3.30)
Right motor PWM connected to P2.6/TA0CCP3 (J4.39)
Right motor enable connected to P3.6 (J2.11)

- Motor driver pins are connected to MSP432 GPIO



```
P5DIR = 0x30;     // P5.4 and P5.5 as output
P2DIR = 0xC0;     // P2.6 and P3.7 as output
P3DIR = 0xC0;     // P3.6 and P3.7 as output
P5OUT = 0x00;     // P5.4 and P5.5 set to low -> set direction to forward for left (P5.5) and right (5.4) motor
P3OUT = 0xC0;     // P3.6 and P3.7 set to high -> disable sleep mode for left (P3.7) and right (3.6) motor
P2OUT = 0x00;     // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
```

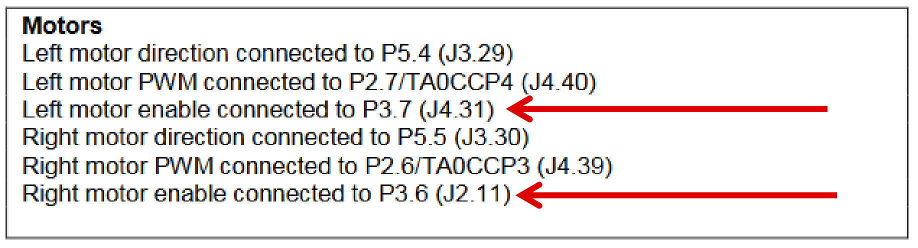
PORT register syntax

Output Registers (PxOUT)

- Bit = 0: Output is low
- Bit = 1: Output is high

Direction Registers (PxDIR)

- Bit = 0: Port pin is switched to input direction
- Bit = 1: Port pin is switched to output direction



Motors
Left motor direction connected to P5.4 (J3.29)
Left motor PWM connected to P2.7/TA0CCP4 (J4.40)
Left motor enable connected to P3.7 (J4.31)
Right motor direction connected to P5.5 (J3.30)
Right motor PWM connected to P2.6/TA0CCP3 (J4.39)
Right motor enable connected to P3.6 (J2.11)

P3OUT = 0xC0;

P3OUT Bits	7	6	5	4	3	2	1	0
register value	8	4	2	1	8	4	2	1
pin state	1	1	0	0	0	0	0	0

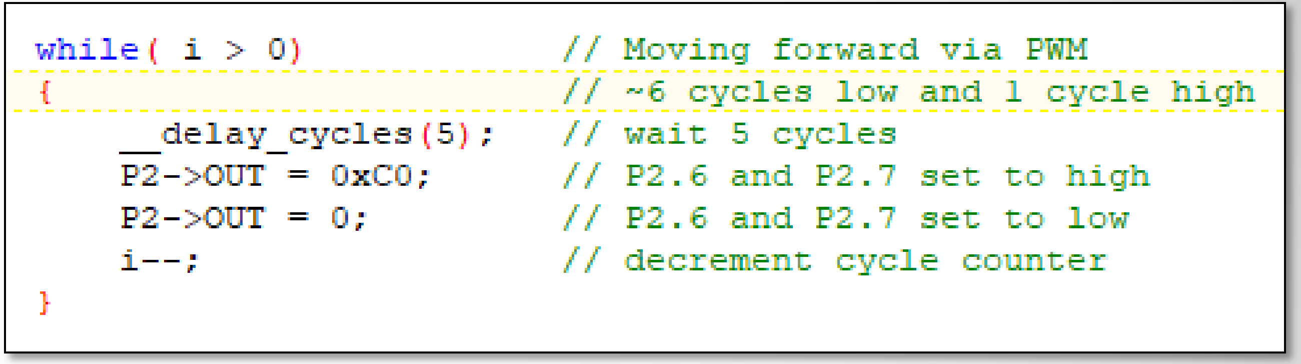
P3DIR = 0xC0;

P3DIR Bits	7	6	5	4	3	2	1	0
register value	8	4	2	1	8	4	2	1
pin state	1	1	0	0	0	0	0	0

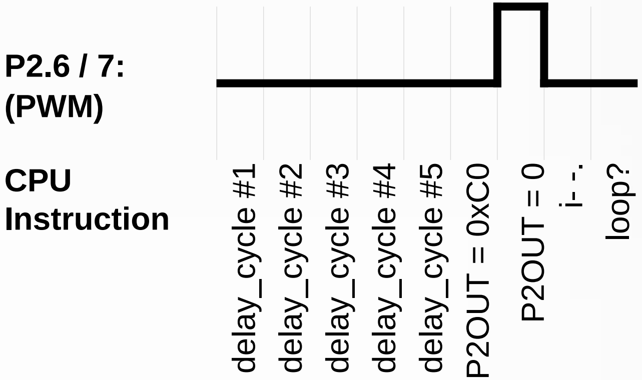
8 + 4 + 0 + 0
= 12 -> 0xC

Pulse Width Modulation for motor control

- Software PWM with CPU control



```
while( i > 0)                // Moving forward via PWM
{                            // ~6 cycles low and 1 cycle high
    __delay_cycles(5);       // wait 5 cycles
    P2->OUT = 0xC0;          // P2.6 and P2.7 set to high
    P2->OUT = 0;             // P2.6 and P2.7 set to low
    i--;                     // decrement cycle counter
}
```

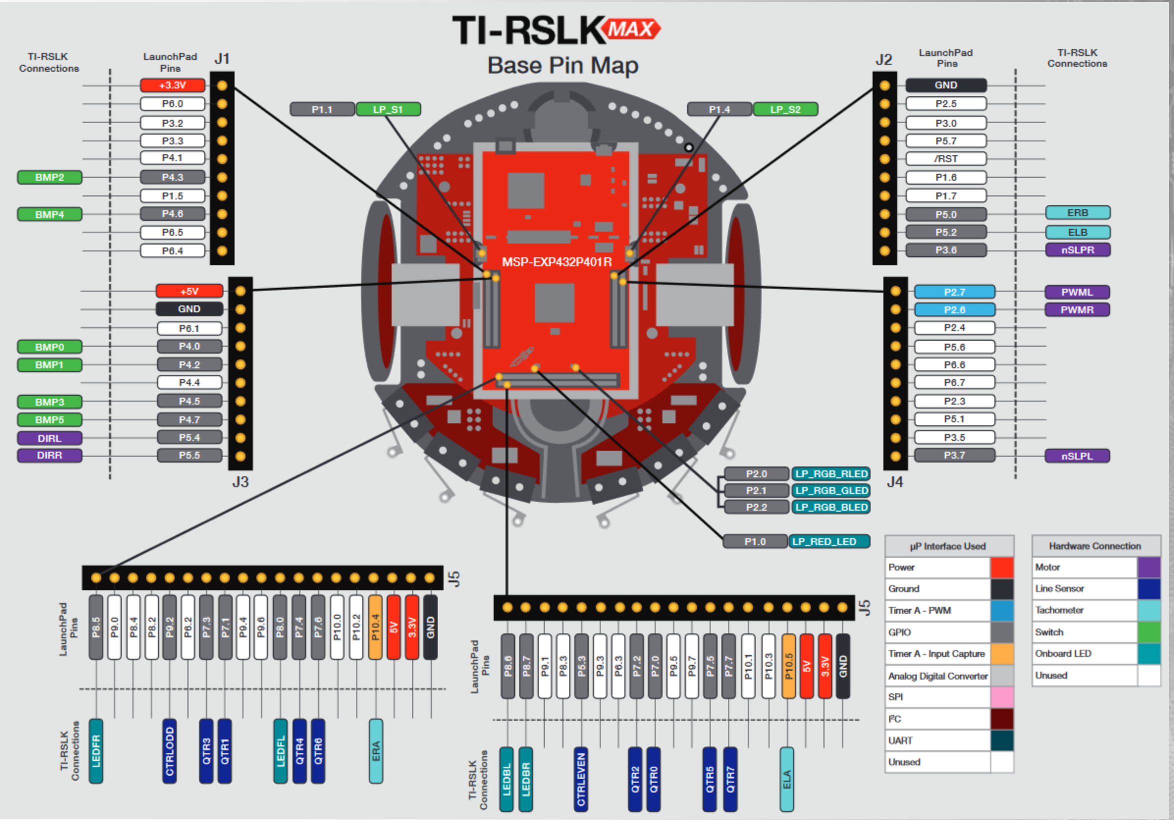


A few details to keep in mind:

- Initialization of pins and variables (not shown here)
- Number of CPU clocks per instruction (see datasheet, or Oscilloscope)
- CPU power used for software PWM (anything else would need interrupts)
- Handling of interrupts during high phase?

TI-RSLK MAX pin map

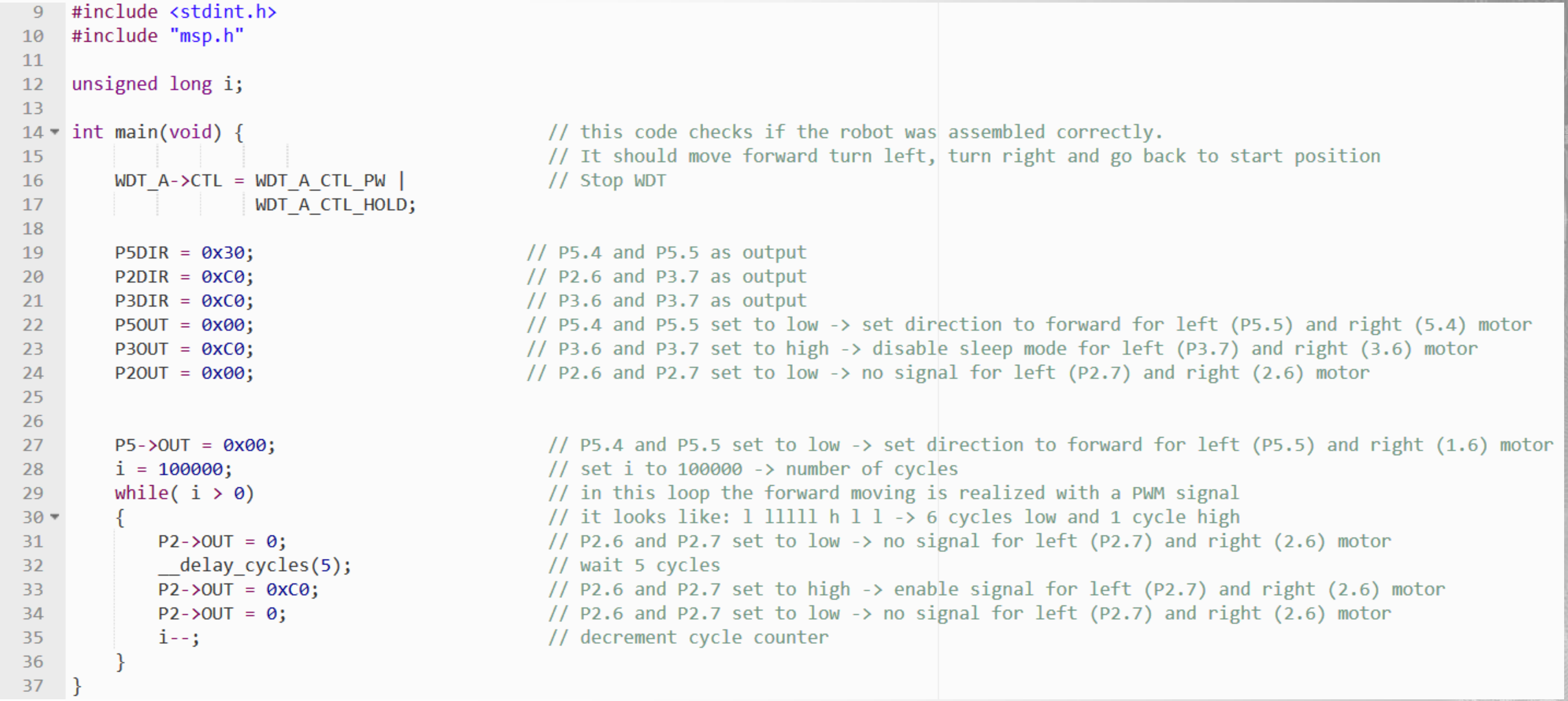
http://www.ti.com/lit/pdf/SEKP171



TEXAS INSTRUMENTS

TI-RSLK MAX First Move

Final code for driving the robot forward



```c
#include <stdint.h>
#include "msp.h"

unsigned long i;

int main(void) {                            // this code checks if the robot was assembled correctly.
                                            // It should move forward turn left, turn right and go back to start position
    WDT_A->CTL = WDT_A_CTL_PW |             // Stop WDT
                 WDT_A_CTL_HOLD;

    P5DIR = 0x30;                         // P5.4 and P5.5 as output
    P2DIR = 0xC0;                         // P2.6 and P3.7 as output
    P3DIR = 0xC0;                         // P3.6 and P3.7 as output
    P5OUT = 0x00;                         // P5.4 and P5.5 set to low -> set direction to forward for left (P5.5) and right (5.4) motor
    P3OUT = 0xC0;                         // P3.6 and P3.7 set to high -> disable sleep mode for left (P3.7) and right (3.6) motor
    P2OUT = 0x00;                         // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor


    P5->OUT = 0x00;                         // P5.4 and P5.5 set to low -> set direction to forward for left (P5.5) and right (1.6) motor
    i = 100000;                             // set i to 100000 -> number of cycles
    while( i > 0)                           // in this loop the forward moving is realized with a PWM signal
    {                                       // it looks like: l lllll h l l -> 6 cycles low and 1 cycle high
        P2->OUT = 0;                        // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(5);                  // wait 5 cycles
        P2->OUT = 0xC0;                     // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0;                        // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        i--;                                // decrement cycle counter
    }
}
```

Final code for driving the robot forward

Source code robot move

- You can copy and paste the code to your CCS Cloud project and hit “Run”

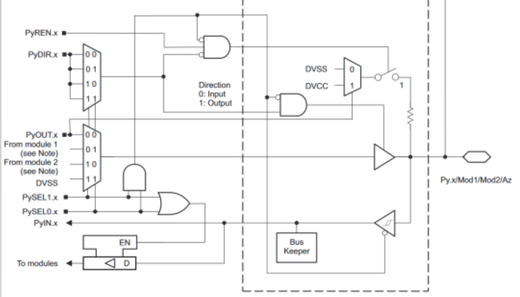
```
/* TI_RSLK_MoveRobot
 * T. Lorenzen
 * 08/17/20
 * Code for TI RSLK for moving forward a little
 * v1.0 08/17/20 Thorsten
 */

#include "msp.h"
unsigned long i;

/**
 * main.c
 */
void main(void)                              // this code makes the robot to move little forward.
{
                WDT_A->CTL = WDT_A_CTL_PW | WDT_A_CTL_HOLD; // stop watchdog timer

   P5->DIR = 0x30;                           // P5.4 and P5.5 as output
   P2->DIR = 0xC0;                           // P2.6 and P2.7 as output
   P3->DIR = 0xC0;                           // P3.6 and P3.7 as output
   P5->OUT = 0x00;                           // P5.4 and P5.5 set to low   -> set direction to forward for left (P5.4) and right (5.5) motor
   P3->OUT = 0xC0;                           // P3.6 and P3.7 set to high  -> disable sleep mode for left (P3.7) and right (3.6) motor
   P2->OUT = 0x00;                           // P2.6 and P2.7 set to low   -> no signal for left (P2.7) and right (2.6) motor

   i = 100000;                           // set i to 100000 -> number of cycles
   while( i > 0)                         // in this loop the forward moving is realized with a PWM signal
   {                                 // it looks like: l lllll h l l -> 6 cycles low and 1 cycle high
      __delay_cycles(5);                     // wait 5 cycles
      P2->OUT = 0xC0;                         // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
      P2->OUT = 0;                          // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
      i--;                           // decrement cycle counter
   }

}
```

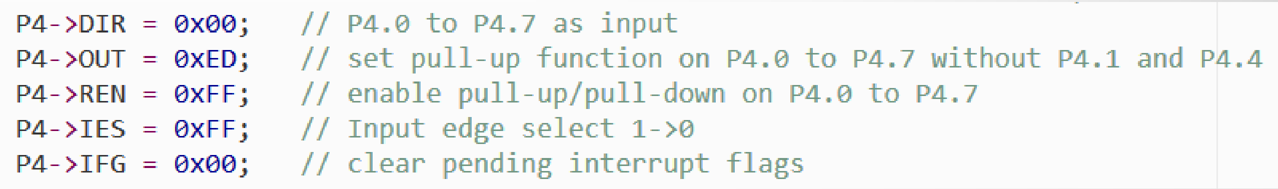
TI-RSLK MAX Use Bumper Support

Bumper code implementation

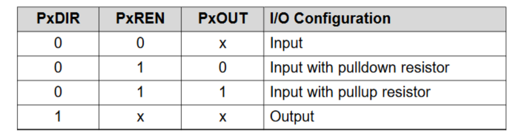
- TI-RSLK MAX contains 6 bumpers realized as switches configured as pull-up

Negative logic bump sensors
P4.7 Bump5, left side of robot
P4.6 Bump4
P4.5 Bump3
P4.3 Bump2
P4.2 Bump1
P4.0 Bump0, right side of robot

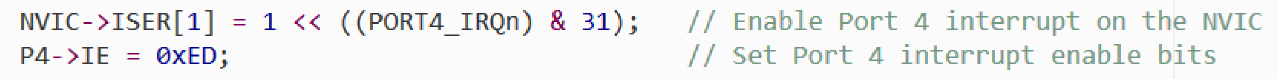




```
P4->DIR = 0x00;    // P4.0 to P4.7 as input
P4->OUT = 0xED;    // set pull-up function on P4.0 to P4.7 without P4.1 and P4.4
P4->REN = 0xFF;    // enable pull-up/pull-down on P4.0 to P4.7
P4->IES = 0xFF;    // Input edge select 1->0
P4->IFG = 0x00;    // clear pending interrupt flags
```



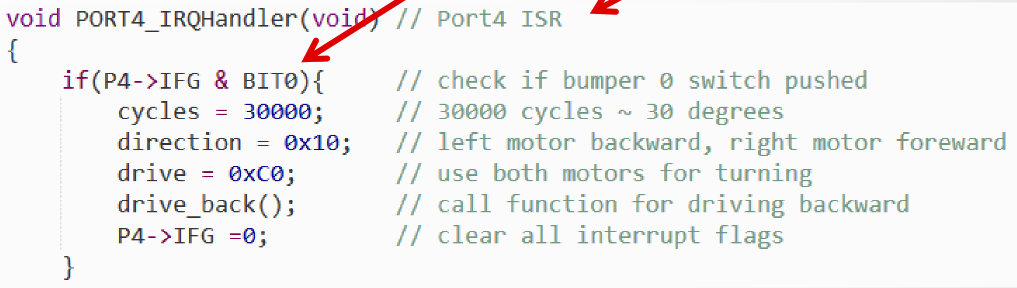
PxDIR	PxREN	PxOUT	I/O Configuration
0	0	x	Input
0	1	0	Input with pulldown resistor
0	1	1	Input with pullup resistor
1	x	x	Output



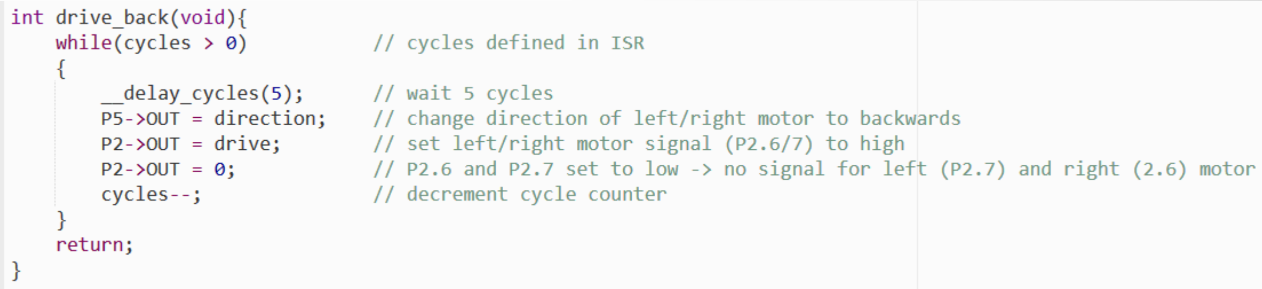
```
NVIC->ISER[1] = 1 << ((PORT4_IRQn) & 31);   // Enable Port 4 interrupt on the NVIC
P4->IE = 0xED;                              // Set Port 4 interrupt enable bits
```

Bumper code implementation

- Pushing one of the switches, results in a jump to the interrupt service routine.
- Within the ISR it is checked which switch was pushed

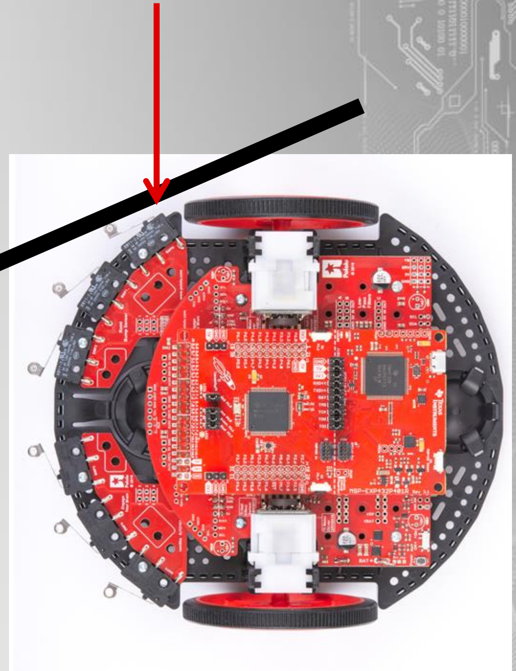


```
void PORT4_IRQHandler(void) // Port4 ISR
{
    if(P4->IFG & BIT0){       // check if bumper 0 switch pushed
        cycles = 30000;       // 30000 cycles ~ 30 degrees
        direction = 0x10;     // left motor backward, right motor foreward
        drive = 0xC0;         // use both motors for turning
        drive_back();         // call function for driving backward
        P4->IFG =0;           // clear all interrupt flags
    }
```



```
int drive_back(void){
    while(cycles > 0)           // cycles defined in ISR
    {
        __delay_cycles(5);      // wait 5 cycles
        P5->OUT = direction;    // change direction of left/right motor to backwards
        P2->OUT = drive;        // set left/right motor signal (P2.6/7) to high
        P2->OUT = 0;            // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        cycles--;               // decrement cycle counter
    }
    return;
}
```

Bumper 0
=> P4.0



Final code for controlling the robot with bumpers

Source code robot bumper

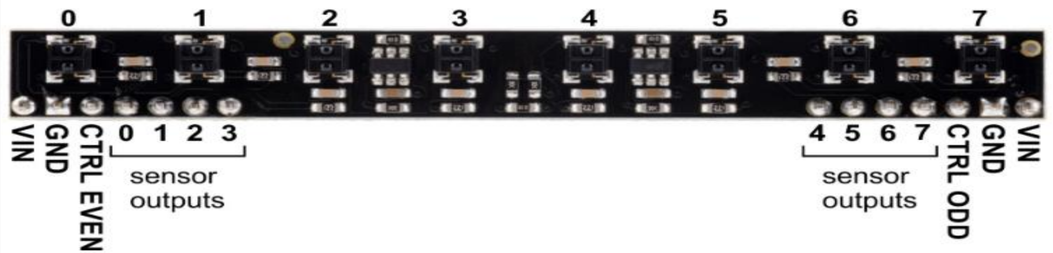
- You can copy and paste the code to your CCS Cloud project and hit “Run”

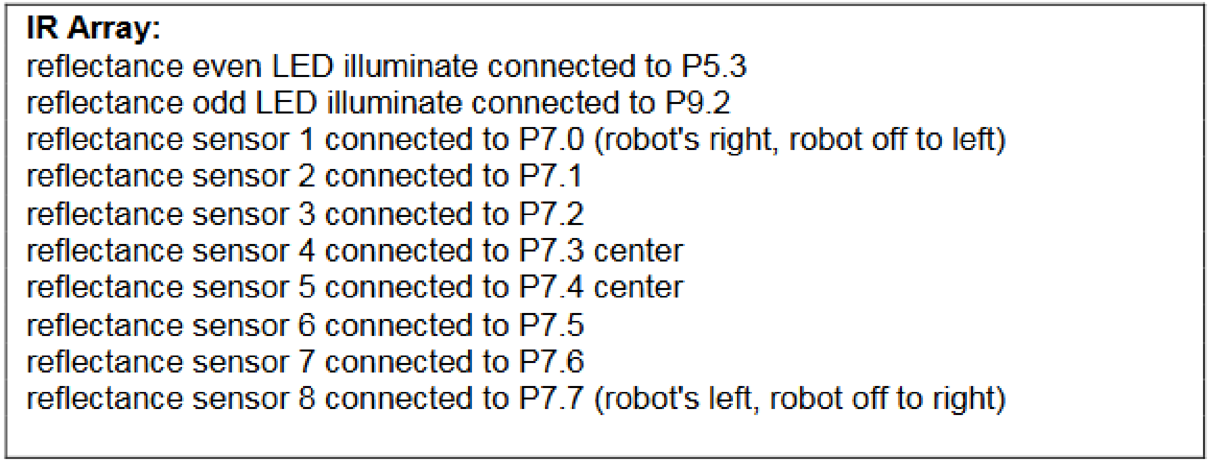
```
/* TI_RSLK_bumper
 * T. Lorenzen
 * 08/17/20
 * Code for TI RSLK using 6 bumper switches
 * v1.4 08/17/20 Thorsten
 */

#include "msp.h"
unsigned long cycles;
unsigned long direction;
unsigned long drive;

int main(void) {                        // this code uses its bumper switches to walk around obstacles while moving around.
    volatile uint32_t i;

    WDT_A->CTL = WDT_A_CTL_PW |              // Stop WDT
             WDT_A_CTL_HOLD;

    P5->DIR = 0x30;                     // P5.4 and P5.5 as output -> set direction to forward for left (P5.4) and right (5.5) motor
    P2->DIR = 0xC0;                     // P2.6 and P3.7 as output -> no signal for left (P2.7) and right (2.6) motor
    P3->DIR = 0xC0;                     // P3.6 and P3.7 as output -> disable sleep mode for left (P3.7) and right (3.6) motor
    P4->DIR = 0x00;                     // P4.0 to P4.7 as input -> Interrupt setup for bumper switches
    P4->OUT = 0xED;                      // set pull-up function on P4.0 to P4.7 without P4.1 and P4.4
    P4->REN = 0xFF;                      // enable pull-up/pull-down on P4.0 to P4.7
    P4->IES = 0xFF;                     // Input edge select 1->0
    P4->IFG = 0x00;                     // clear pending interrupt flags

    P5->OUT = 0x00;                      // P5.4 and P5.5 set to low -> set output to forward for left (P5.4) and right (5.5) motor
    P3->OUT = 0xC0;                      // P3.6 and P3.7 set to high -> disable sleep mode for left (P3.7) and right (3.6) motor
    P2->OUT = 0x00;                      // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor

    NVIC->ISER[1] = 1 << ((PORT4_IRQn) & 31);   // Enable Port 4 interrupt on the NVIC
    P4->IE = 0xED;                      // Set Port 4 interrupt enable bits

    while(1)                          // in this loop the forward moving is realized with a PWM signal
    {                               // it looks like: l lllll h l l -> 6 cycles low and 1 cycle high
        P5->OUT = 0;                    // P5.4 and P5.5 set to low -> reset output to forward for left (P5.4) and right (5.5) motor
        P2->OUT = 0;                    // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(5);               // wait 5 cycles
        P2->OUT = 0xC0;                   // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0;                    // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
    }
}

int drive_back(void){
    while(cycles > 0)                    // cycles defined in ISR
    {
        P2->OUT = 0;                    // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(5);               // wait 5 cycles
        P5->OUT = direction;              // change direction of left/right motor to backwards
        P2->OUT = drive;                                     // set left/right motor signal (P2.6/7) to high
        P2->OUT = 0;                    // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        cycles--;                     // decrement cycle counter
    }
    return;
}

void PORT4_IRQHandler(void)                 // Port4 ISR //
{
    if(P4->IFG){                        // check if one bumpers switch high
        cycles = 70000;                      // Turn 70000 cycles ~ 90 degrees
        direction = 0x20;                 // Used for turn bit of one motor P5 to make a turn
        drive = 0xC0;                    // Motor drive bit P2
        drive_back();                    // call function for driving backward
        P4->IFG =0;                      // clear all interrupt flags
    }
}
```

TI-RSLK MAX Build the Line Follower

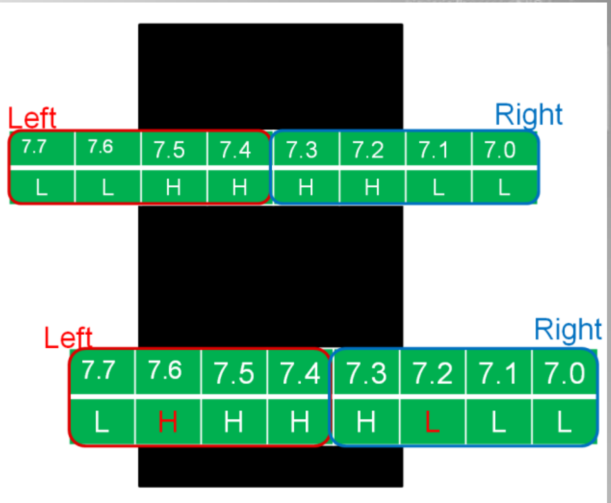
Line follower implementation

- TI-RSLK MAX contains an IR sensor connected to P7
- The sensor detects bright/dark surface on each of the 8 photo transistors.
- Based on this detection the TI-RSLK is moving along a black line




IR Array:

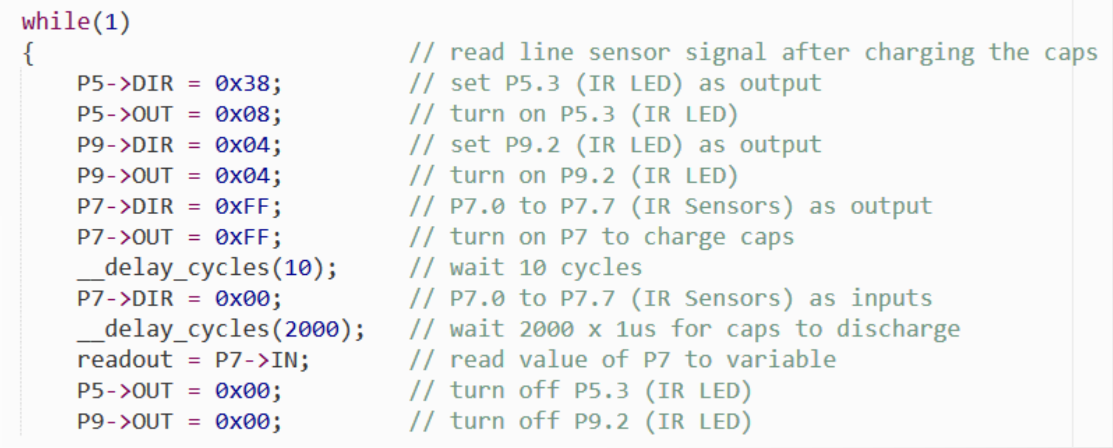
reflectance even LED illuminate connected to P5.3
reflectance odd LED illuminate connected to P9.2
reflectance sensor 1 connected to P7.0 (robot's right, robot off to left)
reflectance sensor 2 connected to P7.1
reflectance sensor 3 connected to P7.2
reflectance sensor 4 connected to P7.3 center
reflectance sensor 5 connected to P7.4 center
reflectance sensor 6 connected to P7.5
reflectance sensor 7 connected to P7.6
reflectance sensor 8 connected to P7.7 (robot's left, robot off to right)



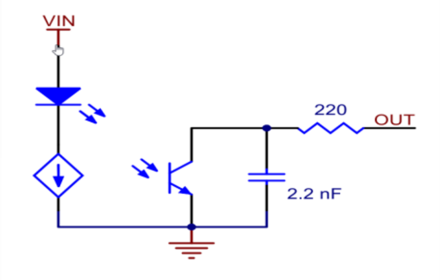
7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0
L	L	H	H	H	H	L	L

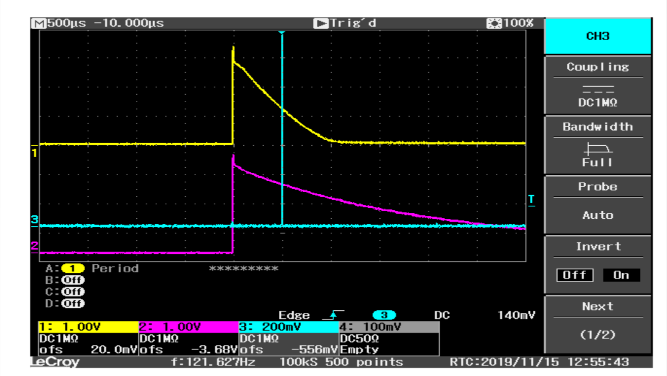
7.7	7.6	7.5	7.4	7.3	7.2	7.1	7.0
L	H	H	H	H	L	L	L

Line follower implementation



```
while(1)
{                                   // read line sensor signal after charging the caps
    P5->DIR = 0x38;                 // set P5.3 (IR LED) as output
    P5->OUT = 0x08;                 // turn on P5.3 (IR LED)
    P9->DIR = 0x04;                 // set P9.2 (IR LED) as output
    P9->OUT = 0x04;                 // turn on P9.2 (IR LED)
    P7->DIR = 0xFF;                 // P7.0 to P7.7 (IR Sensors) as output
    P7->OUT = 0xFF;                 // turn on P7 to charge caps
    __delay_cycles(10);             // wait 10 cycles
    P7->DIR = 0x00;                 // P7.0 to P7.7 (IR Sensors) as inputs
    __delay_cycles(2000);           // wait 2000 x 1us for caps to discharge
    readout = P7->IN;               // read value of P7 to variable
    P5->OUT = 0x00;                 // turn off P5.3 (IR LED)
    P9->OUT = 0x00;                 // turn off P9.2 (IR LED)
```



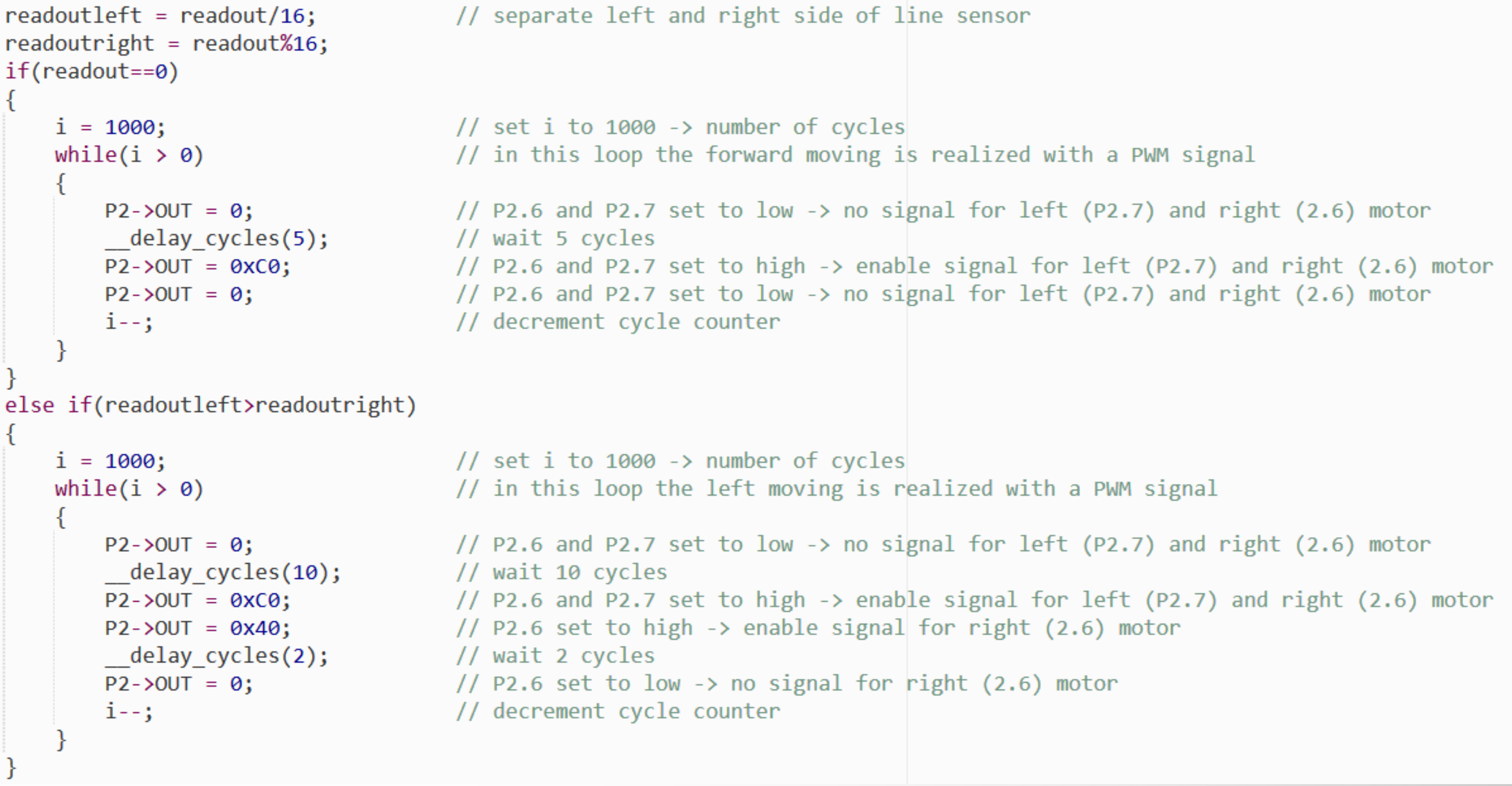


Reading the sensors

The typical sequence for reading a sensor is:

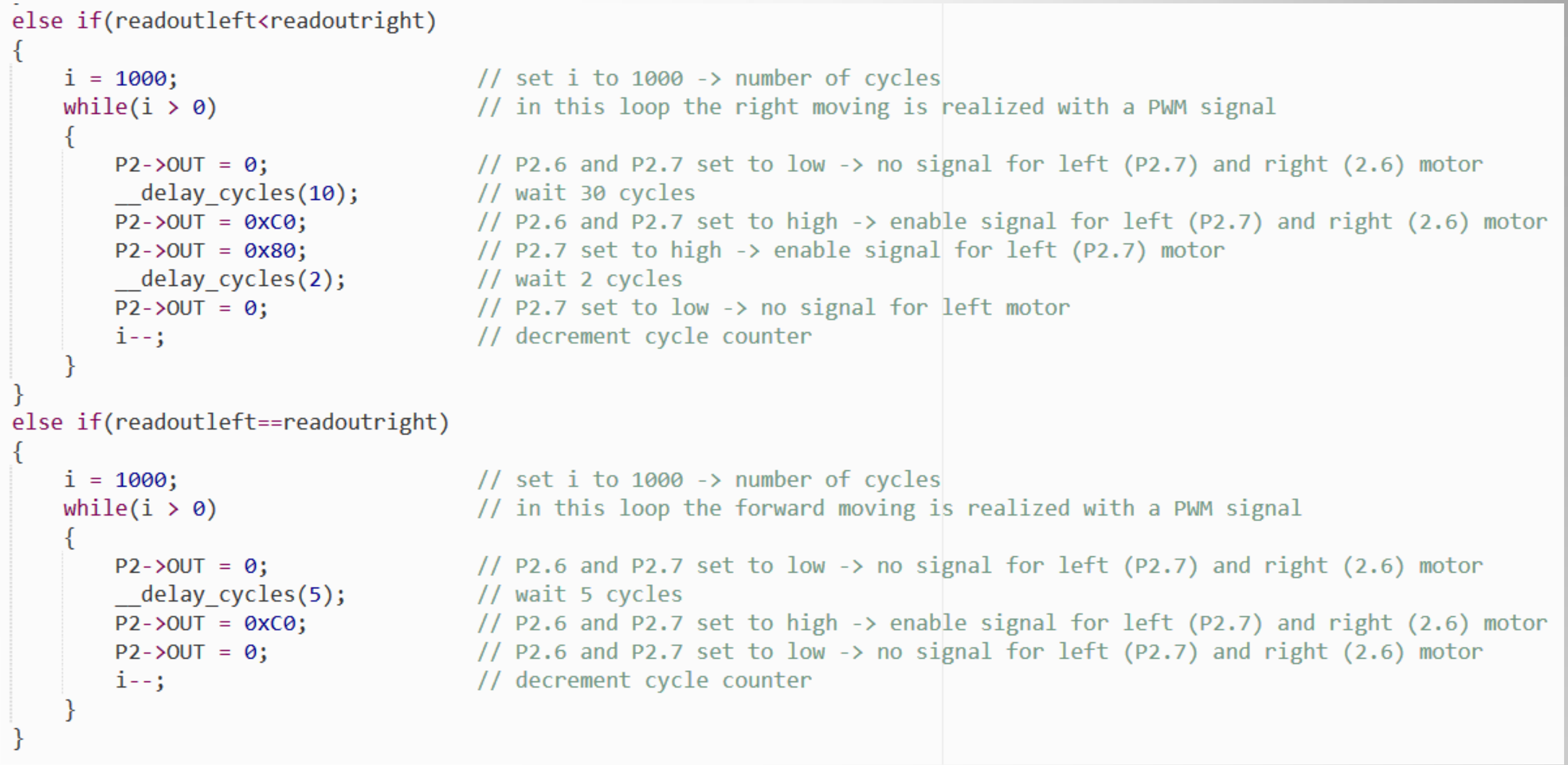
1. Turn on IR LEDs (optional).
2. Set the I/O line to an output and drive it high.
3. Allow at least 10 µs for the sensor output to rise.
4. Make the I/O line an input (high impedance).
5. Measure the time for the voltage to decay by waiting for the I/O line to go low.
6. Turn off IR LEDs (optional).
7. These steps can typically be executed in parallel on multiple I/O lines.

Line follower implementation



```
readoutleft = readout/16;           // separate left and right side of line sensor
readoutright = readout%16;
if(readout==0)
{
    i = 1000;                       // set i to 1000 -> number of cycles
    while(i > 0)                    // in this loop the forward moving is realized with a PWM signal
    {
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(5);          // wait 5 cycles
        P2->OUT = 0xC0;             // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        i--;                        // decrement cycle counter
    }
}
else if(readoutleft>readoutright)
{
    i = 1000;                       // set i to 1000 -> number of cycles
    while(i > 0)                    // in this loop the left moving is realized with a PWM signal
    {
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(10);         // wait 10 cycles
        P2->OUT = 0xC0;             // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0x40;             // P2.6 set to high -> enable signal for right (2.6) motor
        __delay_cycles(2);          // wait 2 cycles
        P2->OUT = 0;                // P2.6 set to low -> no signal for right (2.6) motor
        i--;                        // decrement cycle counter
    }
}
```

Line follower implementation



```
else if(readoutleft<readoutright)
{
    i = 1000;                       // set i to 1000 -> number of cycles
    while(i > 0)                    // in this loop the right moving is realized with a PWM signal
    {
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(10);         // wait 30 cycles
        P2->OUT = 0xC0;             // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0x80;             // P2.7 set to high -> enable signal for left (P2.7) motor
        __delay_cycles(2);          // wait 2 cycles
        P2->OUT = 0;                // P2.7 set to low -> no signal for left motor
        i--;                        // decrement cycle counter
    }
}
else if(readoutleft==readoutright)
{
    i = 1000;                       // set i to 1000 -> number of cycles
    while(i > 0)                    // in this loop the forward moving is realized with a PWM signal
    {
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        __delay_cycles(5);          // wait 5 cycles
        P2->OUT = 0xC0;             // P2.6 and P2.7 set to high -> enable signal for left (P2.7) and right (2.6) motor
        P2->OUT = 0;                // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
        i--;                        // decrement cycle counter
    }
}
```

Final code for following a line on the ground

Source code robot line follower

- You can copy and paste the code to your CCS Cloud project and hit “Run”

```
/* TI_RSLK_LineFollwer
 * T. Lorenzen
 * 08/17/20
 * Code for TI RSLK follwing the black line on the ground
 * with its 8 photo transistors it can distinquish bright/dark surfaces
 * v1.0 08/17/20 Thorsten
 */

#include "msp.h"
#include <stdint.h>
unsigned long i;
unsigned int time=1000;
unsigned long readout=0;
unsigned long readoutleft=0;
unsigned long readoutright=0;

int main(void) {                    // this code checks the line sensor signal and decides to activate the left
motor, the right motor, or both
   volatile uint32_t i;             // It should move forward turn left, turn right and go back to start position

   WDT_A->CTL = WDT_A_CTL_PW |               // Stop WDT
            WDT_A_CTL_HOLD;

   P5->DIR = 0x38;                     // P5.4 and P4.5 motor drive as output and set P5.3 IR LED output driver
   P2->DIR = 0xC0;                     // P2.6 and P3.7 as output set to output driving the motor
   P3->DIR = 0xC0;                     // P3.6 and P3.7 as output to control motor deriver sleep mode
   P5->OUT = 0x00;                      // P5.4 and P5.5 set to low -> set direction to forward for left (P5.4) and
right (5.5) motor
   P3->OUT = 0xC0;                      // P3.6 and P3.7 set to high -> disable sleep mode for left (P3.7) and right
(3.6) motor
   P2->OUT = 0x00;                      // P2.6 and P2.7 set to low -> no signal for left (P2.7) and right (2.6) motor
   P9->DIR = 0x04;                     // P9.2 LED driver control set to output driver
   P9->OUT = 0x00;                      // P9.2 clear LED driver control

   while(1)
   {                                // read line sensor signal after charging the caps and waiting for 1ms.
      P5->DIR = 0x38;                  // set P5.3 (IR LED) as output
      P5->OUT = 0x08;                   // turn on P5.3 (IR LED)
      P9->OUT = 0x04;                   // turn on P9.2 (IR LED)
      P7->DIR = 0xFF;                  // P7.0 to P7.7 (IR Sensors) as output
      P7->OUT = 0xFF;                   // turn on P7 to charge caps
```

Useful links

Order your TI-RSLK MAX
http://www.ti.com/tool/TIRSLK-EVM

Publish your TI-RSLK MAX project
https://texasinstruments.hackster.io/

Use the curriculum for further learning
https://university.ti.com/en/faculty/ti-robotics-system-learning-kit/ti-rslk-max-edition-curriculum

Programming with CCS cloud:
https://dev.ti.com/

Support for TI-RSLK MAX
http://e2e.ti.com/

Follow us on social media
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http://www.ti.com/facebook
http://www.ti.com/linkedin
https://www.instagram.com/txinstruments/
https://www.youtube.com/texasinstruments