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/*
 * helloworld.c: simple test application
 *
 * This application configures UART 16550 to baud rate 9600.
 * PS7 UART (Zynq) is not initialized by this application, since
 * bootrom/bsp configures it to baud rate 115200
 *
 * -----
 * | UART TYPE    BAUD RATE
 * -----
 * | uartns550   9600
 * | uartlite    Configurable only in HW design
 * | ps7_uart    115200 (configured by bootrom/bsp)
 */
/* Include Files */
#include <stdio.h>      /* Contains the standard input and output functions */
#include "platform.h"    /* Defines init and tidy up routines for MicroBlaze */
#include "xil_printf.h"
#include "xparameters.h" /* Contains address & configurations system needs */
#include "xtmrctr.h"
#include "xgpio.h"        /* General Purpose I/O */
#include "xstatus.h"     /* Contains the status definitions used */
#include "xintc.h"        /* Contains API for using the AI interrupt controller */
#include "xil_exception.h" /* Contains the API for MicroBlaze exceptions */

/* Definitions */
#define GPIO_DEVICE0_ID XPAR_AXI_GPIO_0_DEVICE_ID /* GPIO dev for LEDs & btns */

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#define GPIO_DEVICE1_ID XPAR_AXI_GPIO_1_DEVICE_ID /* GPIO dev for 7-seg disp */
#define LED 0x0000      /* Initial LED value */
#define CAT 0x00        /* Initial 7-segment display cathode value */
#define DELAY_7SEG 100 /* Delay between anodes of 7-segment display */
#define DELAY_DISP 1000 /* Delay between updates to displays */
#define BTN_CHANNEL 1  /* GPIO port for pushbuttons */
#define LED_CHANNEL 2  /* GPIO port for LEDs */
#define ANODE_CHANNEL 1 /* GPIO port for 7-segment display anodes */
#define CATHODE_CHANNEL 2 /* GPIO port for 7-segment display cathodes */
#define printf xil_printf /* A smaller, optimized printf */
#define TMRCTR_DEVICE_ID XPAR_TMRCTR_0_DEVICE_ID
#define TMRCTR_INTERRUPT_ID XPAR_INTC_0_TMRCTR_0_VEC_ID
#define INTC_DEVICE_ID XPAR_INTC_0_DEVICE_ID
#define TIMER_CNTR_0 0
#define INTc XIntc
#define INTc_HANDLER XIntc_InterruptHandler
#define RESET_VALUE 0xFFFFE795F

/* Global Variables */
XGpio Gpio0;          /* GPIO Device driver instance 1 */
XGpio Gpio1;          /* GPIO Device driver instance 2 */
INTC InterruptController; /* The instance of the Interrupt Controller */
XTmrCtr TimerCounterInst; /* The instance of the Timer Counter */
volatile int numMillisec = 0;
volatile int whichDigit = 0;
volatile int led = LED; /* Hold current LED value. */
volatile int cath[4]; /* Hold current cathode value. */
volatile int Freeze = 0;

/* Function Declarations */
void lookup7Seg(void);
int Lab4Timer(INTC* IntcInstancePtr,XTmrCtr* TmrCtrInstancePtr,
              u16 DeviceId,u16 IntrId,u8 TmrCtrNumber);
void TimerCounterHandler(void *CallBackRef, u8 TmrCtrNumber);
static int TmrCtrSetupIntrSystem(INTC* IntcInstancePtr,
                                  XTmrCtr* TmrCtrInstancePtr,u16 DeviceId,u16 IntrId,u8 TmrCtrNumber);
void TmrCtrDisableIntr(INTC* IntcInstancePtr, u16 IntrId);

int main() {
    init_platform();
    int Status;
    Status = Lab4Timer(&InterruptController, &TimerCounterInst, TMRCTR_DEVICE_ID,
                      TMRCTR_INTERRUPT_ID, TIMER_CNTR_0);
    if (Status != XST_SUCCESS) {
        xil_printf("Timer Interrupt Counter Failed!\r\n");
        return XST_FAILURE;
    }
    return XST_SUCCESS;
}

void lookup7Seg(void) {
    int i, digit, num;
    num = led;
    for (i=0; i<4; i++) {
        digit = num % 10;
        if (digit==0) { cath[i] = 63; } /* 0x3F = 0b00111111 */
        else if (digit==1) { cath[i] = 6; } /* 0x =0b00000000 */

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        else if (digit==2) { cath[i] = 91; } /* 0x =0b00000000 */
        else if (digit==3) { cath[i] = 79; } /* 0x =0b00000000 */
        else if (digit==4) { cath[i] = 102; } /* 0x =0b00000000 */
        else if (digit==5) { cath[i] = 109; } /* 0x =0b00000000 */
        else if (digit==6) { cath[i] = 125; } /* 0x =0b00000000 */
        else if (digit==7) { cath[i] = 7; } /* 0x =0b00000000 */
        else if (digit==8) { cath[i] = 127; } /* 0x =0b00000000 */
        else if (digit==9) { cath[i] = 111; } /* 0x =0b00000000 */
        else { cath[i] = 0; } /* 0x00=0b00000000 */
        num /= 10;
    }
    return;
}

int Lab4Timer(INTC* IntcInstancePtr,XTmrCtr* TmrCtrInstancePtr,u16 DeviceId,u16
IntrId,u8 TmrCtrNumber) {
    int Status, Mode = 0, Pressed = 0;
    uint8_t btn, last_btn=0x00; /* Hold current & last pushbutton values */
    Status = XTmrCtr_Initialize(TmrCtrInstancePtr, DeviceId);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    Status = XTmrCtr_SelfTest(TmrCtrInstancePtr, TmrCtrNumber);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    Status = TmrCtrSetupIntrSystem(IntcInstancePtr,TmrCtrInstancePtr,DeviceId,
IntrId,TmrCtrNumber);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    XTmrCtr_SetHandler(TmrCtrInstancePtr,TimerCounterHandler,
TmrCtrInstancePtr);
    XTmrCtr_SetOptions(TmrCtrInstancePtr,TmrCtrNumber,
XTC_INT_MODE_OPTION | XTC_AUTO_RELOAD_OPTION);
    XTmrCtr_SetResetValue(TmrCtrInstancePtr, TmrCtrNumber, RESET_VALUE);
    XTmrCtr_Start(TmrCtrInstancePtr, TmrCtrNumber);
    /* GPIO driver initialization */
    Status = XGpio.Initialize(&Gpio0, GPIO_DEVICE0_ID);
    Status = XGpio.Initialize(&Gpio1, GPIO_DEVICE1_ID);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    /* Set the direction for the LEDs to output */
    XGpio_SetDataDirection(&Gpio0, BTN_CHANNEL, 0xFF);
    XGpio_SetDataDirection(&Gpio0, LED_CHANNEL, 0x00);
    XGpio_SetDataDirection(&Gpio1, ANODE_CHANNEL, 0x00);
    XGpio_SetDataDirection(&Gpio1, CATHODE_CHANNEL, 0x00);
    xil_printf("Entering while(1).\r\n");
    while (1) {
        btn = XGpio_DiscreteRead(&Gpio0, BTN_CHANNEL);
        if (btn == 4 && Mode == 1 && Pressed == 0){
            Mode = 0;
            Pressed = 1;
            XTmrCtr_Start(TmrCtrInstancePtr, TmrCtrNumber);
        }
        else if (btn==4 && Mode == 0 && Pressed == 0){
            Mode = 1;
            Pressed = 1;
            XTmrCtr_Stop(TmrCtrInstancePtr, TmrCtrNumber);
        }
        if (btn != 4){
            Pressed = 0;
        }
        xil_printf("Button: %2d Mode = %2d Pressed = %2d
\r\n",btn,Mode,Pressed);
    }
}

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xil_printf("Exiting while(1).\r\n");
TmrCtrDisableIntr(IntcInstancePtr, DeviceId);
return XST_SUCCESS;
}

void TimerCounterHandler(void *CallBackRef, u8 TmrCtrNumber) {
    XTmrCtr *InstancePtr = (XTmrCtr *)CallBackRef;
    if (XTmrCtr_IsExpired(InstancePtr, TmrCtrNumber)) {
        if (numMillisec == 0) {
            XGpio_DiscreteWrite(&Gpio0, LED_CHANNEL, led);
            lookup7Seg();
            led++;
        }
        numMillisec = (numMillisec+1) % 100;
        if (whichDigit==0) {
            XGpio_DiscreteWrite(&Gpio1, ANODE_CHANNEL, ~(0x1));
            XGpio_DiscreteWrite(&Gpio1, CATHODE_CHANNEL, ~(cath[0]));
        } else if (whichDigit==1) {
            XGpio_DiscreteWrite(&Gpio1, ANODE_CHANNEL, ~(0x2));
            XGpio_DiscreteWrite(&Gpio1, CATHODE_CHANNEL, ~(cath[1]|0x80));
        } else if (whichDigit==2) {
            XGpio_DiscreteWrite(&Gpio1, ANODE_CHANNEL, ~(0x4));
            XGpio_DiscreteWrite(&Gpio1, CATHODE_CHANNEL, ~(cath[2]));
        } else if (whichDigit==3) {
            XGpio_DiscreteWrite(&Gpio1, ANODE_CHANNEL, ~(0x8));
            XGpio_DiscreteWrite(&Gpio1, CATHODE_CHANNEL, ~(cath[3]));
        }
        whichDigit = (whichDigit+1) % 4;
    }
}

static int TmrCtrSetupIntrSystem(INTC* IntcInstancePtr,
XTmrCtr* TmrCtrInstancePtr,u16 DeviceId,u16 IntrId,u8 TmrCtrNumber) {
    int Status;
    Status = XIntc_Initialize(IntcInstancePtr, INTC_DEVICE_ID);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    Status = XIntc_Connect(IntcInstancePtr, IntrId,
                           (XInterruptHandler)XTmrCtr_InterruptHandler,
                           (void *)TmrCtrInstancePtr);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    Status = XIntc_Start(IntcInstancePtr, XIN_REAL_MODE);
    if (Status != XST_SUCCESS) { return XST_FAILURE; }
    XIntc_Enable(IntcInstancePtr, IntrId); /* Enable interrupt for timer ctr */
    Xil_ExceptionInit(); /* Initialize the exception table. */
    Xil_ExceptionRegisterHandler(XIL_EXCEPTION_ID_INT,
                                (Xil_ExceptionHandler) INTC_HANDLER, IntcInstancePtr);
    Xil_ExceptionEnable(); /* Enable non-critical exceptions. */
    return XST_SUCCESS;
}
void TmrCtrDisableIntr(INTC* IntcInstancePtr, u16 IntrId) {
    /* Disable the interrupt for the timer counter */
    XIntc_Disable(IntcInstancePtr, IntrId);
    return;
}

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