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| /\*  \* stepper\_motor\_lab.c  \*  \* Created: 10/24/18 7:13:18 PM  \* Author : juanruelas  \*/ #include <avr/io.h> #include <avr/interrupt.h> #include <stdbool.h> #include <stdlib.h> #include "keypad.h"  #define true 1 #define false 0 unsigned char btn; int pressed = false; unsigned char key; int num\_steps = 0; unsigned char input [4] = { '\*', '\*', '\*' }; int phase; int execute = false;  /\* USED FOR CREATING A SYNCRONOUS STATE MACHINE\*/ volatile unsigned char TimerFlag = 0; // TimerISR() sets this to 1. C programmer should clear to 0. // Internal variables for mapping AVR's ISR to our cleaner TimerISR model. unsigned long \_avr\_timer\_M = 1; // Start count from here, down to 0. Default 1 ms. unsigned long \_avr\_timer\_cntcurr = 0; // Current internal count of 1ms ticks void **TimerOn**() {  // AVR timer/counter controller register TCCR1  TCCR1B = 0x0B;// bit3 = 0: CTC mode (clear timer on compare)  // bit2bit1bit0=011: pre-scaler /64  // 00001011: 0x0B  // SO, 8 MHz clock or 8,000,000 /64 = 125,000 ticks/s  // Thus, TCNT1 register will count at 125,000 ticks/s  // AVR output compare register OCR1A.  OCR1A = 125; // Timer interrupt will be generated when TCNT1==OCR1A  // We want a 1 ms tick. 0.001 s \* 125,000 ticks/s = 125  // So when TCNT1 register equals 125,  // 1 ms has passed. Thus, we compare to 125.  // AVR timer interrupt mask register  TIMSK1 = 0x02; // bit1: OCIE1A -- enables compare match interrupt  //Initialize avr counter  TCNT1=0;  \_avr\_timer\_cntcurr = \_avr\_timer\_M;  // TimerISR will be called every \_avr\_timer\_cntcurr milliseconds  //Enable global interrupts  SREG |= 0x80; // 0x80: 1000000 } void **TimerOff**() {  TCCR1B = 0x00; // bit3bit1bit0=000: timer off } void **TimerISR**() {  TimerFlag = 1; } // In our approach, the C programmer does not touch this ISR, but rather TimerISR() ISR(TIMER1\_COMPA\_vect) {  // CPU automatically calls when TCNT1 == OCR1 (every 1 ms per TimerOn settings)  \_avr\_timer\_cntcurr--; // Count down to 0 rather than up to TOP  if (\_avr\_timer\_cntcurr == 0) { // results in a more efficient compare  TimerISR(); // Call the ISR that the user uses  \_avr\_timer\_cntcurr = \_avr\_timer\_M;  } } // Set TimerISR() to tick every M ms void **TimerSet**(unsigned long M) {  \_avr\_timer\_M = M/10;  \_avr\_timer\_cntcurr = \_avr\_timer\_M; }  enum CLOCKWISE { A, AB, B, BC, C, CD, D, DA } CLOCKWISE; enum COUNTER\_CLOCKWISE { D1, DC, C1, CB, B1, BA, A1, AD } COUNTER\_CLOCKWISE;  // state machine for going clockwise void **tick\_clkwise**(){  // transitions  switch(CLOCKWISE){  case A:  CLOCKWISE = AB; break;  case AB:  CLOCKWISE = B; break;  case B:  CLOCKWISE = BC; break;  case BC:  CLOCKWISE = C; break;  case C:  CLOCKWISE = CD; break;  case CD:  CLOCKWISE = D; break;  case D:  CLOCKWISE = DA; break;  case DA:  CLOCKWISE = A; break;    }  // actions    switch(CLOCKWISE){  case A:  PORTA = 0b00000001; break;  case AB:  PORTA = 0b00000011; break;  case B:  PORTA = 0b00000010; break;  case BC:  PORTA = 0b00000110; break;  case C:  PORTA = 0b00000100; break;  case CD:  PORTA = 0b00001100; break;  case D:  PORTA = 0b00001000; break;  case DA:  PORTA = 0b00001001; break;  } } // state machine for going counter clockwise void **tick\_cnt\_clkwise**(){  // transitions  switch(COUNTER\_CLOCKWISE){  case A1:  COUNTER\_CLOCKWISE = DA; break;  case AB:  COUNTER\_CLOCKWISE = A1; break;  case B1:  COUNTER\_CLOCKWISE = AB; break;  case BC:  COUNTER\_CLOCKWISE = B1; break;  case C1:  COUNTER\_CLOCKWISE = BC; break;  case CD:  COUNTER\_CLOCKWISE = C1; break;  case D1:  COUNTER\_CLOCKWISE = CD; break;  case DA:  COUNTER\_CLOCKWISE = D1; break;    }  // actions    switch(COUNTER\_CLOCKWISE){  case A1:  PORTA = 0b00000001; break;  case AB:  PORTA = 0b00000011; break;  case B1:  PORTA = 0b00000010; break;  case BC:  PORTA = 0b00000110; break;  case C1:  PORTA = 0b00000100; break;  case CD:  PORTA = 0b00001100; break;  case D1:  PORTA = 0b00001000; break;  case DA:  PORTA = 0b00001001; break;  } } void **setPhase**(){  int angle = atoi(input);  phase = (angle / 5.625) \* 64;   }  void **tick\_sm**(){  if(execute){  PORTC = 0xFF;  if( phase > 0){  tick\_clkwise();  phase -= 1;  }  else if( phase <= 0 ){  execute = false;  }  } else {  resetArray();  PORTC = 0x00;  } }  void **resetArray**(){  for (int i = 0; i < 4; i++){  input[i] = '\*';  } } void **doStuffWith**(unsigned char k){  // iterator for the for loop  int i = 0;    switch (k){  case '\*':  // error out, reset array  resetArray();  case 'A':  // error out, reset array  resetArray();  case 'B':  // error out, reset array  resetArray();  case 'C':  // error out, reset array  resetArray();  case 'D':  // error out, reset array  resetArray();  case '#':  // if they press pound  execute = true;  setPhase();      }    for (; i < 3; i++){  if(input[i] == '\*'){  input[i] = k;  break;  }  }     } int **main**(void) {  DDRB = 0x00; PORTB = 0xFF; // Configure port B's 8 pins as inputs    DDRA = 0xFF; PORTA = 0x00; // Configure port A's 8 pins at outputs  DDRC = 0xFF; PORTA = 0x00; // Configure port A's 8 pins at outputs    DDRD = 0xF0; PORTD = 0x0F; // Configure port D's 8 pins as inputs  TimerSet(30);  TimerOn();    int t;  int phases360 = (360 / 5.625) \* 64; //64 \* 64  int phases180 = (180 / 5.625) \* 64;  int phases90 = (90 / 5.625) \* 64; //64 \* 16    while (1) {      while (!TimerFlag);  TimerFlag = 0;    key = GetKeypadKey();  doStuffWith(key);    tick\_sm();      } } |