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MINI-028

M.Tech. IN ADVANCED INFORMATION TECHNOLOGY – EMBEDDED SYSTEM DESIGN (MTECHSD)

00264

Term-End Examination

December, 2014

MINI-028 : MICROCONTROLLER SYSTEMS DESIGN-I

Time : 3 hours *Maximum Marks : 100*

Note :

(i) *Section I is* ***compulsory****.*

(ii) *In Section II, answer any* ***five*** *questions.*

(iii) *Assume suitable data wherever required.*

(iv) *Draw suitable circuits wherever required.*

(v) *Italicized figures to the right indicate maximum marks.*

(vi) *Use of calculators is allowed.*

(vii) *See end of the question paper for reference data.*

SECTION I

1. An environmental surveillance bot has to do the following tasks in the monsoon season and has to be fail safe :

(a) Take rainfall readings at different locations.

(b) Locations are specified to the bot as GPS coordinates.

(c) It should be able to move on uneven terrains.

(d) In the worst case scenario, where it gets stuck on a difficult terrain, it should intimate the base station with enough information so that it can be retrieved.

Give a detailed design description with pseudo-codes, schematic, important considerations, desired sensor characteristics and assumptions, if any. *30*

SECTION II

2. (a) Describe the process of compiling programs and flashing the AVR using a makefile. *7*

(b) A car manufacturing company is deciding on a motor to be used for the car wiper. Which motor will you suggest ? How can you use a controller to drive this motor ? *7*

3. Write short notes on any ***two*** of the following : *2×7=14*

(a) Intel HEX file

(b) Pulse Width Modulation

(c) Global Positioning System

4. (a) What are the different ways to pull up a pin on the controller ? *6*

(b) Describe an application where pull up is used in controllers. Draw the circuit diagram and explain the working. *8*

5. An embedded system takes an analog sine wave input of 5Vp-p with a + 2·5V DC shift. It has to sample the signal at 2,000 samples/second. Convert the samples' values into integer and display it on the terminal. Write the embedded C code for the system. *14*

6. (a) What is the advantage of using an interrupt in embedded systems and how are these implemented ? *7*

(b) Write a function in embedded C for initializing and starting the 8-bit timer of the Mega8, which toggles an LED at a delay of 0·5 sec. *7*

7. Atmega8 has an on board ADC for doing analog-to-digital conversion. *2×7=14*

(a) Which ADC is there on board ? Explain its working.

(b) Define sampling rate and prescaling.

8. From the controller's point of view, justify the following statements. Draw proper circuit diagrams as and when needed. *2×7=14*

(a) Sinking current into a controller is better than sourcing current from a controller.

(b) A free wheeling diode should be used with a DC motor.

Following data is available for reference :

Register UCSRB has bits RXEN, TXEN

Register UCSRC has bits URSEL, UCSZ0, UCSZ1

Other Registers Available : UBRRL, UBRRH

Conditions applicable :

while ((UCSRA & (1 << UDRE)) == 0)

while ((UCSRA & (1 << RXC)) == 0)

Register ADCSRA has bits ADPS2, ADPS1, ADPS0 for setting prescaler (assume 111 as the required prescaler).

Register ADMUX has bit REFS0 which when **SET**, makes ADC reference to AVCC.

Register ADMUX has bit ADLAR which when **SET**, Left adjust ADC result to allow easy 8-bit reading.

Register ADCSRA has bit ADFR, which when **SET**, puts ADC to Free-Running Mode.

Register ADCSRA has bit ADEN, To enable ADC when **SET**.

Register ADCSRA has bit ADSC, To start ADC conversions when **SET**.

Register ADMUX (Lower 3 Bits) are used to select ADC channel.

Conditions applicable :

while(bit_is_set(ADCSRA,ADSC));

Register TIMSK has bit TOIE0, when **SET**, enable timer overflow interrupt for Timer0.

Register TCNT0, for setting timer 0 initial 1 value.

Register TCCR0 has bits CS01 and CS00, when SET, starts the timer with 64-bit prescaler

TIMER0_OVF_vect, is the timer0 overflow vector.