SYSTEM DESIGN SPECIFICATIONS
RFID ADVANCED SYSTEM

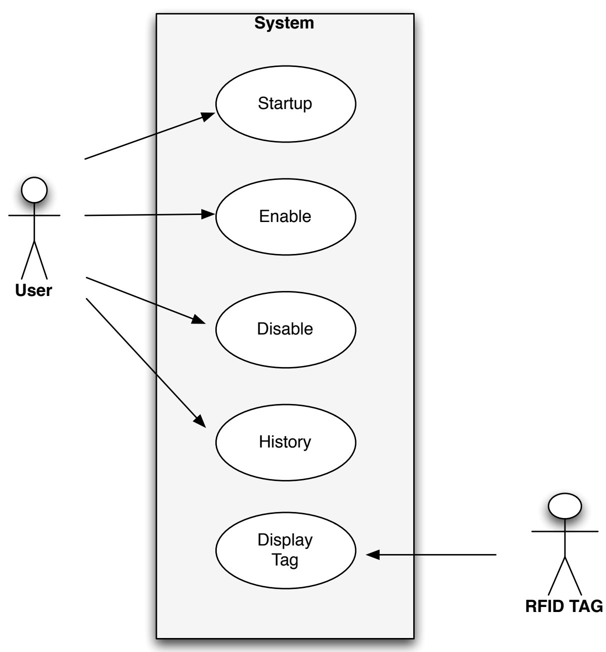
SYSTEM DESCRIPTION

This specification describes and defines the advanced requirements of the CE3200 RFID sensor mote. The RFID sensor mote responds to user panel control events, records passive RFID transponder tags, performs statistical calculations, and displays user feedback on an LCD panel. These behaviors will be implemented over a three week project timeline. The remainder of this document outlines the requirements, use cases, and system design specifications for the second project week.

REQUIREMENTS

1. The system must be powered from standard U.S. 60Hz AC line power.
2. The system does not need power-failure or system failure recovery.
3. The system must operate in standard room temperature.
4. The system must accept user panel requests.
5. The system must respond to user panel requests.
6. The system must display RFID transponder tag IDs on an LCD panel.
7. The system must display tag history on an LCD panel.
8. The system must display a power-on heartbeat on the LCD panel.
9. The system must display antenna status on the LCD panel.

USE CASE DIAGRAM



USE CASE EVENTS

1. Startup

    A. The user starts up the system.
    B. The system initializes.

2. Enable

    A. The user requests that the system enable the RFID antenna.
    B. The system identifies the request.
    C. The system responds by enabling the RFID antenna.
    D. The system displays an antenna enabled icon on the LCD panel.

3. Disable

    A. The user requests that the system disables the RFID antenna.
    B. The system identifies the request.
    C. The system responds by disabling the RFID antenna.
    D. The system displays an antenna disabled icon on the LCD panel.

4. History

    A. The user requests that the system display tag history.
    B. The system identifies the request.
    C. The system responds by showing tag history on the LCD panel. Tag history is a list of each tag followed by the total number of times that tag has been seen since startup. The tag history is retrieve from EEPROM storage.

5. Display Tag

    A. The system identifies RFID transponder tags when enabled.
    B. The system displays the new RFID transponder tag ID on the LCD.
    C. The system updates RFID transponder tag history in EEPROM storage.

SPECIFICATION OF SYSTEM INPUTS AND OUTPUTS

1. System Inputs

   A. The system uses a Parallax RFID Reader to read RFID transponder tags.

      i. Power is supplied through the Atmega32 power supply rails.
      ii. The active-low **enable** signal is controlled by an Atmega32 port pin.
      iii. The serial **sout** signal connects to the Atmega32 USART **RXD** pin.

   B. The system uses a digital pushbutton to allow users to enable and disable the RFID antenna.

      i. The pushbutton uses a hardware debouncer.
      ii. The pushbutton produces logic 0 or logic 1.
      iii. The pushbutton toggles between enabled and disabled.
      iv. The pushbutton connects to Atmega32 external interrupt pin INT0.

   C. The system uses a digital pushbutton to allow users to request tag history.

      i. The pushbutton uses a hardware debouncer.
      ii. The pushbutton produces logic 0 or logic 1.
      iii. The pushbutton connects to Atmega32 external interrupt pin INT1.

2. System Outputs

   A. The system uses a standard Hitachi 14-pin LCD panel as a status display.

SYSTEM FUNCTIONAL SPECIFICATION

The system uses control software written in either Atmega32 assembly language or C.

1. The system initializes at power-on reset.

   A. System variables are initialized.
   B. A half-second timer interrupt is initialized for the power-on heartbeat.
   C. A welcome message is displayed on the LCD panel.
   D. The RFID antenna is disabled.
   E. An antenna disabled icon is displayed on the LCD panel.
   F. USART receive interrupts are enabled.
   G. CPU interrupt processing is enabled.
   H. The main program enters an infinite loop monitoring volatile variables set by interrupts.
   I. The main program makes appropriate responses when volatile variables are set.

2. The power-on heartbeat timer interrupt event occurs.

   A. The global volatile **heartbeat** variable is set.
   B. The interrupt service routine exits.

3. The USART receive interrupt event occurs.

   A. The interrupt service routine retrieves the data byte.
   B. The global volatile **data-byte-ready** variable is set.
   C. The interrupt service routine exits.

4. The enable/disable pushbutton interrupt event occurs.

   A. The global volatile **enable** variable is set.
   B. The interrupt service routine exits.

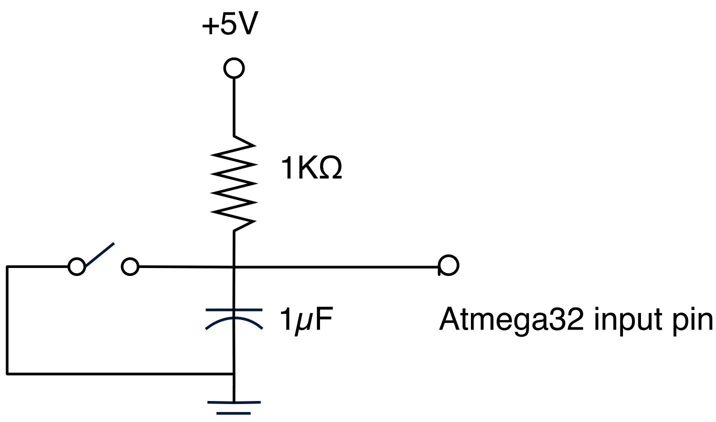
5. The tag history pushbutton interrupt event occurs.

   A. The global volatile **history** variable is set.
   B. The interrupt service routine exits.

6. The main program identifies a set volatile variable.

   A. Appropriate updates are made based on the set volatile variable.
   B. The volatile variable is cleared.
   C. The main program returns to variable checking.

SUPPORTING DIAGRAMS



Pushbutton switches act like mechanical springs. This causes the switch output to oscillate until the spring action settles. The addition of an RC time constant prevents the bounce because the capacitor cannot change voltage rapidly. Thus, the switch output becomes a more gradual capacitive charge-discharge shaped waveform. The RC time constant determines how rapidly the charge-discharge occurs. Standard values of 1KΩ and 1μF work well in most applications. On microcontrollers with built-in port pullup resistors, the pullup resistor can be enabled in place of the 1KΩ external resistor. Note on the diagram that the port pin, resistor, capacitor, and switch all join at a common node.

DELIVERABLES

1. Laboratory testing and demonstration must be completed within one academic week. **Demonstrate** during the regularly scheduled laboratory period, the instructor's office hours, or visit the instructor during any of his Fall quarter laboratory periods. This will successfully clear the RFID Project Week 3 demo from the incomplete laboratories listed for you in the grading spreadsheet.
2. **Email** well-commented source code in PDF format to the instructor after you successfully demonstrate your system.