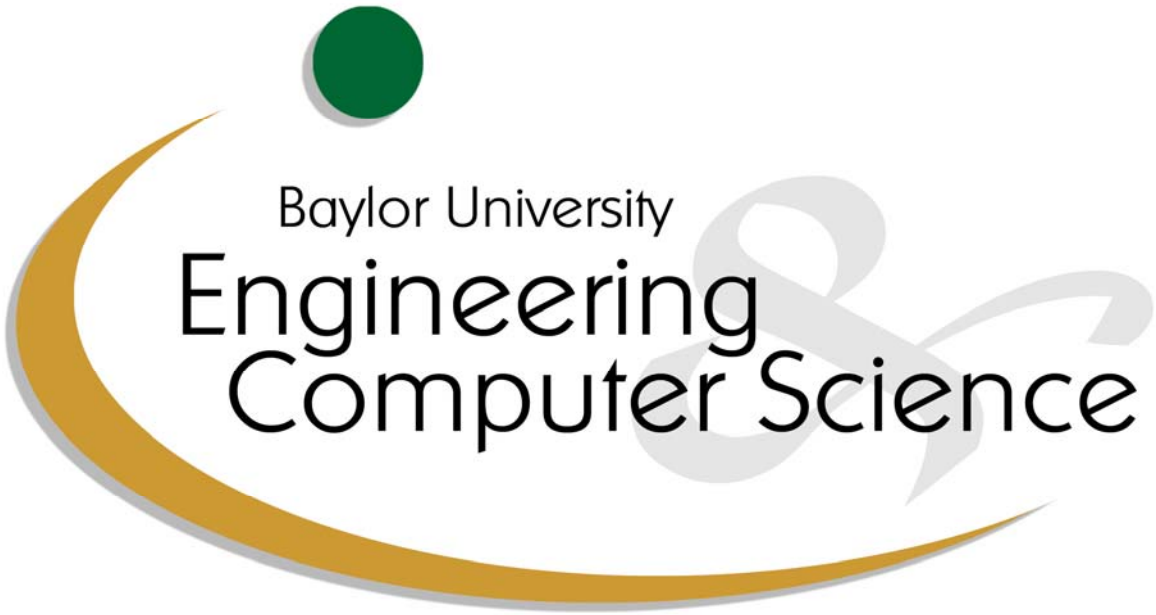
EGR 3380
Engineering Design I

REQUEST FOR PROPOSAL

FOR THE DESIGN OF AN

BRAILLE TEXTING DEVICE



Baylor University
Department of Electrical and Computer Engineering
Department of Mechanical Engineering

Spring 2009

1 STATEMENT OF WORK

Qualified engineering design teams are invited to submit technical proposals for the design of an *Braille Texting Device*, hereinafter referred to as the *BTD*. Proposals are to be submitted to the instructors of EGR 3380, hereinafter referred to as the *client*. Upon client approval of a conceptual design, each engineering design team, hereinafter referred to as the *team*, shall build, test, and evaluate a prototype device, and shall provide the client with engineering documentation of the prototype design.

Additional instructions and schedules not included in this RFP for completing design, presentation, construction, testing, and documentation milestones will be found in the course calendar, milestone assignment documents, and other specific documents to be distributed by the client at appropriate times during the project. The design, construction, testing, and reporting of the BTD is a requirement for completion of Engineering 3380 - Engineering Design I at Baylor University for the spring semester 2009.

2 DESIGN SPECIFICATION

2.1 General Description

Short Message Service, SMS, or "texting" describes a telecommunications protocol that uses cellular telephone infrastructure to send short (fewer than 160 characters) text messages to mobile devices. Its popularity has been increasing rapidly in recent years. Americans sent approximately 75 billion messages in June 2008, according to the Cellular Telephone and Internet Association in Washington DC.

SMS is changing the way people communicate and is affecting culture in numerous ways from the way we correspond with family to the way we watch television. However, texting options for the visually impaired are quite limited.

There are several products on the market that enable the visually impaired to send and receive electronic messages, but most utilize computers and internet connectivity, not the cellular network. These devices range from voice synthesis software to Braille keyboards with electronically rewritable Braille displays. Voice synthesis does not provide the privacy of a Braille, or visual, display, and neither option is portable. Only a few portable devices are on the market as of 2009, such as Samsung's Touch Messenger, and these seem to have been brought to market in Asia. Samsung's device uses Braille input and output.

Therefore, the client believes there is a significant market opportunity for a BTD and is seeking qualified engineering design teams to design, prototype, and develop BTD concepts.

2.2 Design Requirements

The design team shall design the device to meet or exceed all of the criteria listed below.

2.2.1 Character Input Device:

The BTD will receive input from a keypad entry device with alphanumeric mapping as illustrated in Figure 1. The depression of any key on the keypad will result in the output device responding within one second. Successive keystrokes made on the same key within the read-time interval will cause the BTD to display next character corresponding to that key. If the key is depressed within the read time interval while the displayed character is the last of the sequence, the BTD shall display the first character again.

Non-alphanumeric characters will be read according to the following mapping:

- "1" will cause the BTD to display the punctuation symbols period (.), comma (,), and question mark (?), in that order.
- "*" will cause the BTD to display the capital letter sign. The next keystroke, will , therefore, be interpreted as a letter.
- "0" will cause the BTD to display a blank output (no raised points) indicating an empty space ( ).
- "#"will cause the BTD to display a number sign. The next keystroke will, therefore, be interpreted as a numeral.
- Other sequences of keystrokes not specified here may be selected at the liberty of the design team. Illustrated examples of keystroke combinations and the corresponding required display are given in the 2.2.4 Input/Output Examples Section.
- Other key sequences not described here will be ignored: for example, "*" followed by "1".

Figure 1: Alphanumeric Mapping of Character Input Device

2.2.2 Read-Time Interval:

The Read-Time Interval is the time between successive keystrokes in which the BTD will display the next character of a particular key. The default value of the Read-Time Interval is one second, but this value should be adjustable by a simple software change.

2.2.3 Braille Alphabet:

The Braille alphabet codes characters using a 3x2 (row x column) grid of dots. The code for the basic alphabet, punctuation, and numerals is shown in Figure 2.

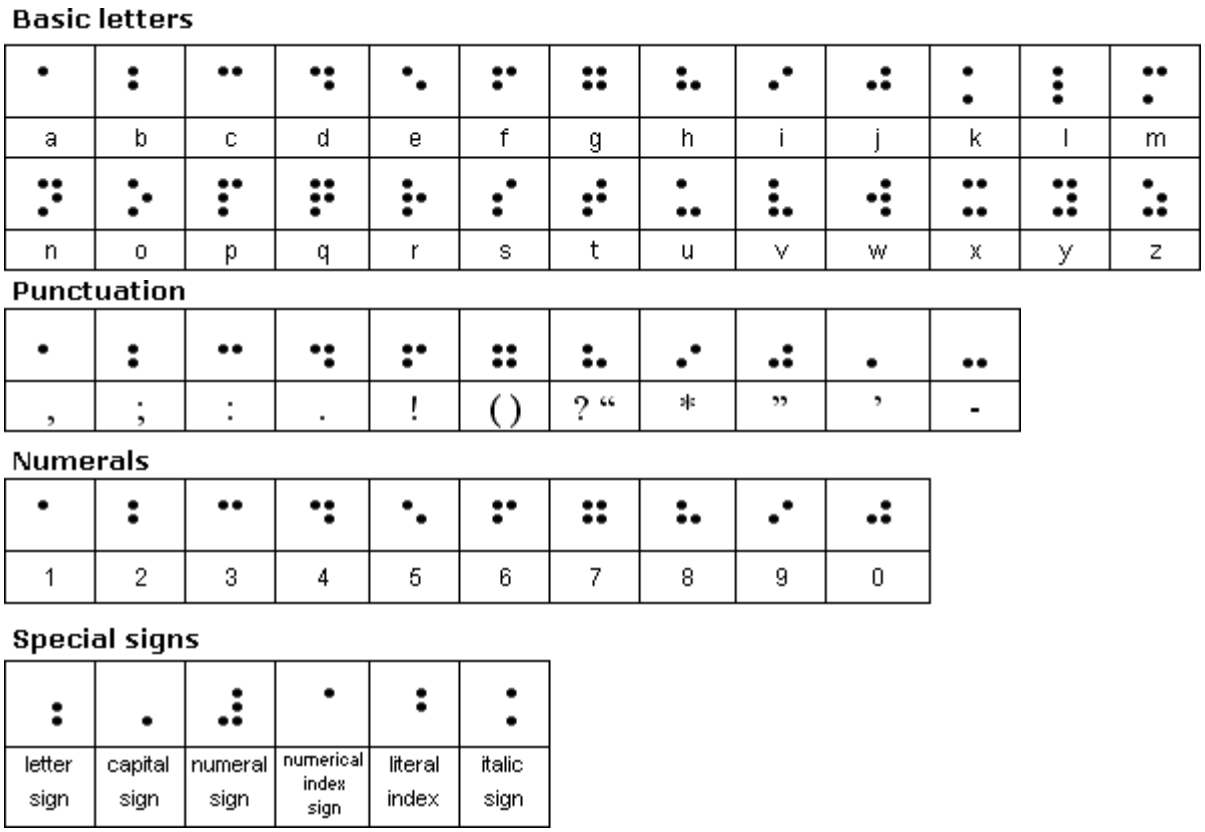
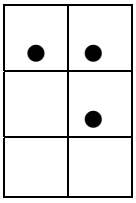
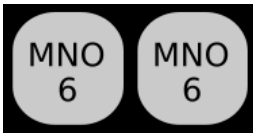
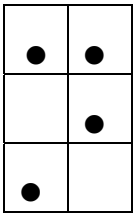
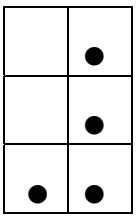
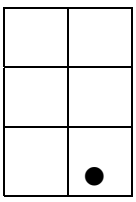


Figure 2. Braille Alphabet
(http://www.omniglot.com/writing/braille.htm)

2.2.4 Input/Output Examples:

Table 1 provides examples of the Braille character displayed by the Character Output Device and the corresponding input keystrokes.

Table 1: Input/Output Examples

Input Key	**Character Indicated**	**Braille Output**
	d	
 (entered within the Read Time Interval)	n	
	(number sign)	
	(capital character)	

2.2.5 Character Output Device

The output of the BTD will represent Braille characters and, therefore, consist of an array of six “dots” in accordance with Section 2.2.3. The dots must fall uniformly on a square grid. The area of the 3x2 array should be as close as possible to standard Braille spacing (0.1 inch between adjacent dot centers). The dimensions of the dots, when activated, should be as close as possible to standard Braille dot dimensions (0.02 inches height, .06 inches at base). Unactivated dots will be flush to the reading surface.

Braille characters will be formed by the Character Output Device within 1 second of the last keystroke associated with a character. The characters will remain formed indefinitely until the next keystroke (or power is disconnected).

2.2.6 Automation:

The BTD shall utilize the Atmega 168 microcontroller and the Bare-Bones Board manufactured by Modern Device Company in an Arduino coding environment. All inputs shall be read by the microcontroller and may not be used to directly engage actuators or other devices in the Character Output Device.

2.2.7 Power:

The BTD shall be powered by a voltage source of less than or equal to 9 VDC. This voltage may be achieved either through the use of “9 volt” batteries or via a transformer that converts 120 VAC.

2.2.8 Size & weight:

The client does not specify the maximum size of the device, however, the end use of the device should inform the design. The weight limit is 10 pounds, excluding power supply.

2.2.9 Ease of Use:

An important design objective is for the device to be operator-friendly. This means that the set-up and operation should be as clear and intuitive as possible.

3 SAFETY REQUIREMENTS

The team shall conduct all construction and testing with safety as the paramount consideration. Failure to observe workplace safety rules will lead to penalties in performance evaluation. Egregious or repeated safety violations, or disregard for Safety Officers, can result in dismissal from the course.

Cleanliness in the workplace is expected at all times and in all work areas. Failure to observe workplace rules will lead to penalties in performance evaluation. The design team shall clean all work areas with each use.

4 REPORTING & DOCUMENTATION REQUIREMENTS

The team shall document the design by use of manuscripts, calculations, schematics, flowcharts, computer code, and design models/drawings. Specifications for required documentation and due dates not otherwise contained herein will be contained in the course calendar and/or will be distributed by the client at appropriate points during the project.

4.1 Conceptual Design Review

4.1.1 Date

February 12, 2009

4.1.2 Objective

The CDR is a *top-down* presentation to the client of the design concept. The client should understand how your proposed design will meet the specifications in this RFP. The client should gain a clear picture of the major components/systems and their overall arrangement/function. Furthermore, the client should understand your team's implementation plan for completing the project.

4.1.3 Format

- <10 minute duration
- Given by two team members, with approximately equivalent contributions.
- Professional quality visual aids (PowerPoint as primary platform); other visual aids as appropriate
- Business casual dress.

4.2 Preliminary Design Review 1 (PDR 1)

4.2.1 Date

February 19, 2009

4.2.2 Objective

PDR 1 is for the purpose of communicating the detailed design of a major *subsystem* through a presentation and drawings.

4.2.3 Presentation Format

- < 8 minute duration
- Given by one team member
- Professional quality visual aids (PowerPoint as primary platform); other visual aids as appropriate
- Business casual dress

4.2.4 Drawing Format

- Subsystem Drawings
    - Assembly drawing(s) of subsystem including *bill(s) of materials*.

- Circuit schematic(s) for subsystem.
- Detailed drawings of subsystem parts that must be manufactured

4.3 Subsystem Test

4.3.1 Date

February 26, 2009

4.3.2 Objective

The subsystem test is a hardware demonstration of the performance of the subsystem described in the PDR 1.

4.4 PDR 2

4.4.1 Date

March 5, 2009

4.4.2 Objective

PDR 2 is for the purpose of communicating the detailed design and integration of two major *subsystems* through a presentation and drawings.

4.4.3 Presentation Format

- < 8 minute duration
- Given by one team member
- Professional quality visual aids (PowerPoint as primary platform); other visual aids as appropriate
- Business casual dress

4.4.4 Drawing Format

- Subsystem Drawings
  - Assembly drawing(s) of both subsystems including *bill(s) of materials*.
  - Circuit schematic(s) for subsystems.
  - Detailed drawings of subsystem parts that must be manufactured

4.5 System Integration Test

4.5.1 Date

March 19, 2009

4.5.2 Objective

The system integration test is a hardware demonstration of the integrated performance of the two subsystem described in the PDR 2.

4.6 PDR 3

4.6.1 Date

March 26, 2009

4.6.2 Objective

PDR 3 is for the purpose of communicating the detailed design of the entire device through a presentation and drawings.

4.6.3 Presentation Format

- < 8 minute duration
- Given by one team member
- Professional quality visual aids (PowerPoint as primary platform); other visual aids as appropriate
- Business casual dress

4.6.4 Drawing Format

- Subsystem Drawings
    - Assembly drawing(s) of entire system and all subsystems including *bill(s) of materials*.
    - Circuit schematic(s) for entire system.
    - Detailed drawings of parts that must be manufactured

4.7 Preliminary System Test

4.7.1 Date

April 2, 2009

4.7.2 Objective

The preliminary system test is a preliminary hardware demonstration of the performance of the entire system as described in the PDR 3.

4.8 Compliance Test

4.8.1 Date

April 9, 2009

4.8.2 Objective

The compliance test is the final and critical hardware evaluation. System performance will be evaluated against all specifications. Data will be collected and analyzed.

4.9 Final Design Review (FDR)

4.9.1 Date

April 16, 2009

4.9.2 Objective

The FDR is a public presentation of the design to a general audience including the client, other design teams, invited faculty, students, and guests.

4.9.3 Presentation Format

- < 4 minute duration
- Given by one team member
- Professional quality visual aids (PowerPoint as primary platform); other visual aids as appropriate
- Professional dress

4.10 Final Report and Drawings

4.10.1 Date

April 20, 2009

4.10.2 Objective

The Final Report and Drawings are archival documents that provide a complete and permanent record of the design.

4.10.3 Report Format

The format for the final report will be communicated to the design teams by the client by April 6, 2009.

4.10.4 Drawing Format

- Subsystem Drawings
    - Assembly drawing(s) of entire system and all subsystems including *bill(s) of materials*.
    - Circuit schematic(s) for entire system.
    - Detailed drawings of parts that must be manufactured