I Homework 4: Packaging Specifications and Design

Due: Friday, February 10, at NOON

Team Code Name: Digital Real-time Networked Kegerator Group No. 4

Team Member Completing This Homework: Matthew Kocsis

NOTE: This is the first in a series of four "design component" homework assignments, each of which is to be completed by one team member. The completed homework will count for 10% of the team member's individual grade. It should be a minimum of five printed pages.

Evaluation:

Component/Criterion	Score	Multiplier	Points
Introduction	0 1 2 3 4 5 6 7 8 9 10	X 1	
Commercial Product Packaging	0 1 2 3 4 5 6 7 8 9 10	X 3	
Project Packaging Specifications	0 1 2 3 4 5 6 7 8 9 10	X 2	
PCB Footprint Layout	0 1 2 3 4 5 6 7 8 9 10	X 2	
List of References	0 1 2 3 4 5 6 7 8 9 10	X 1	
Technical Writing Style	0 1 2 3 4 5 6 7 8 9 10	X 1	
		TOTAL	

Comments:

1.0 Introduction

The Digital Real-time Intelligent Networked Kegerator is a modular addition to any existing beverage dispensing device. With the DRINK system, the owner is able to control, monitor, and record draft beverages on a per user basis via an LCD and an ethernet interface. The unit is designed to be modular so that it can be adapted to any consumer or commercial draft system.

2.0 Commercial Product Packaging

There are three commercial products that have very similar functions to our design: the Kegmeter by electro-pneumatics [1]; the Auper Harpagon by Bristol Business Machines [2]; and the Draft Sentinel by Berg Company [3].

2.1 Kegmeter

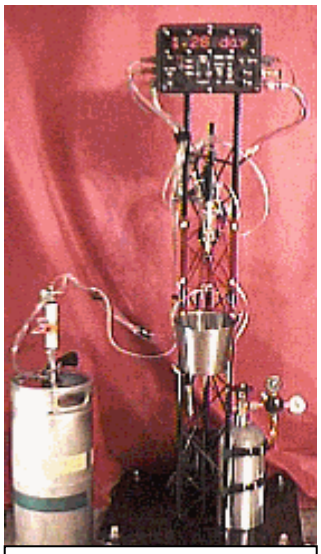

Figure 1 - Kegmeter

The Kegmeter is a complete portable draft dispensing unit. The system is designed as a five foot stand that has controls and a tap at the top. The unit is designed to automatically pour beer when a mug is placed under the tower. Battery power is used to power the Kegmeter if it is rigged for mobile operation. The control system sits in a metal box on the top of the stand. The system is designed for a single keg [1].

The Kegmeter is packaged as an entire system, which in some situations is very favorable. The interface of the unit is outdated and a bit sophisticated for an average user. The entire design of the unit is very functional but it is rather sloppy. No considerations were taken to minimize extraneous wires and complexity. The interface of the Kegmeter uses an 8 character dot matrix display which is unable to display much information. The system appears to resemble a hospital IV system rather than a draft beverage unit.

The only aspect of this design that will be similar to our system is the control unit. Most of the hardware of our design will be contained in a similar sized unit. The automatic pour feature of this system will also be implemented in our system but in a different way. Our unit will be different from the Kegmeter because our system is designed to be modular and scalable beyond one keg. Our design is also focused more on presenting user data than implementing a draft system, so our packaging will emphasize displaying data to the user.

2.2 Auper Harpagon

The Auper Harpagon is a commercial beverage monitoring system. The design is built in a modular fashion and is designed to monitor a maximum of sixteen kegs at the same time. It comes with a complete set flow meters and cables for 8 kegs. The system has a small user interface on the front of the control unit and also communicates with a custom PC software

bundle built for data collection and management. The software can connect to four separate units and report all 64 beverages. The unit has a separate turbine collector panel that connects to all of the flow meters [2].

The modular design of this system makes it very feasible, expandable and useful for commercial applications. The use of computer software helps present more data; however an external computer is required to run data analysis. The front of the control box is simple with only four buttons, but the single line LCD is small and would be difficult to use when the unit is in stand-alone operation (no PC connected). The only information presented from the control unit is the current meter rating for any individual beverage [2]. No user or overall statistics are available from the unit alone.

Figure 2 – Auper Harpagon

We plan to package our product very similar to the Harpagon. We plan to separate the system into various components and make them modular so that they can be connected as needed. Our product will focus more on specific users and displaying their data. Emphasis on real-time information will be included in our final package so that users do not have to go out of the way or spend much time to see current statistics and system information.

2.3 Draft Sentinel

The Sentinel is by far the most intelligent and sophisticated of the commercial draft beverage dispensers. Its modular design is capable of connecting up to twenty-four beverages with a small number of exterior cables. The Sentinel is also able to connect to a PC over a RS232 connection. Proprietary PC software can be used to configure the device specifically for each beverage dispensed. The device also has the ability to set a price per unit for each beverage individually [3].

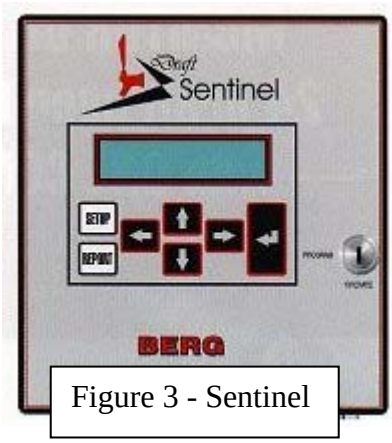

Figure 3 - Sentinel

The Sentinel's packaging is very professional because of the simplicity of the user interface and cabling. The flow meter packaging is very compact and modular allowing easy connection to kegs that might be in tight spaces. The LCD is somewhat limiting with only two lines of text, but the menu operations are rather simple because of easy navigation buttons. The system does not have users, so it only tracks total amount or cost of poured beverages.

Our design will use many principles from this design. Again, the modularity will be an important feature for our design. Our solenoid and flow meter units are designed to be small and unobtrusive, similar to those used in the Sentinel package, so that they can be easily added to existing beer lines. We will be using a similar menu concept; direction

inputs and an enter button. Our unit will be different from the sentinel because we are removing any setup or management control from the external unit leaving just a rotary knob and a large graphical LCD. This will help keep the focus on displaying user and system information. Our unit will also have an external dollar bill accepter to facilitate collecting money for dispensed beverages. As another module, our design has an external RFID antenna that can be placed close to the taps. This allows the unit to be placed farther away, reducing the chance of a beverage being spilled on the control unit. Unlike the Sentinel, our system will not require a computer for advanced continuous operation.

2.4 Product Comparison

Feature	Kegmeter	Harpagon	Sentinel	DRINK
System	Complete	Monitoring	Monitoring	Monitoring
Cost	$4,999.99	$2,845		$1,500
Kegs	1	16	24	8 (exp to 64)
Display	8 characters	Single line LCD	2 line LCD	240x160 color LCD
Interface	switches	Buttons	Buttons	RPG
Data Storage	none	Meter Ratings Only	Meter and price	meter, user statistics
Management	Front Panel	PC Software	Front Panel, PC	web interafce
Users	1	1	1	256+
Additional Features	Alarm Clock	MS-DOS software	Windows Software	Bill Accepter
	Auto Pour	Key lock	Key lock	User Statistics
			Keg Price	Temperature Controller
				Keg Shutoff
				RFID login

Figure 4 – Product Comparison Matrix

3.0 Project Packaging Specifications

Our product will consist of several components all connected to a central controller. The controller will house the LCD, the user inputs, all PCBs (main, rabbit, LCD, RFID), and the bill accepter. Connected externally will be the RFID antenna, solenoid/flow meter units, DC power supply, and the AC contactor. Each external unit will connect to the central controller via plugs so the system can be completely modular. Due to the importance and complexity of the controller, it will be the focus for much of our packaging constraints.

The controller housing, seen in Appendix A, will be the main interface unit for any user, therefore it needs to be simple and unobtrusive. This unit will be mounted on top of a chest freezer that currently has a single draft tower, so size constraints reduce it to something that could be easily attached. The largest component of the control unit is the bill accepter, so that became the start of the constraint placed on the physical enclosure. We also want the focus of the enclosure to be the LCD screen and user interface, so they need to be up front and easy to read and use. Behind the bill accepter, the enclosure will house all of the PCBs.

We expect to make this enclosure out of metal or very durable plastic. Since it will operate in wet conditions periodically, it is very important to be able to make it reasonably impenetrable to liquid. The enclosure will need to be machined out of solid components or cut and bent out of sheet metal and then sealed together. The estimated weight of the enclosure including parts will be 4.5 pounds, and the cost of making the enclosure will be between $40 and $65.

4.0 PCB Footprint Layout

The requirements of the Digital Real-time Intelligent Networked Kegerator system have led to the choice of several key components. These components include: the RCM3315 RabbitCore™, the ezLCD-001, and the Series 2000 Micro Reader. The footprints available for these components were extremely limited. For the microprocessor module, the RCM3315, the only footprint available was a 2mm pitch double header. The entire chip dimensions were 47mm by 69mm. It is estimated that few components will be able to fit under this device due to the header height. The ezLCD-001 is a component that will be mounted external to the PCB, but this device will require a two header interfaces for the layout. The last major component, the Series 2000 Micro Reader, was available in only one variant, a 30 pin Dual-in-line package. The dimensions of this package were found to be 38.3mm by 29.3mm. In addition to these major components, several smaller components were added including three RS-232 components, two DC to DC converters, and 5 external connectors. These components were added only to provide a better estimate of the PCB layout dimensions. Attached in Appendix C is the Preliminary Layout. The layout of the PCB was constrained by the size of the enclosure. The PCB layout was measured to be 105mm by 130mm. This layout can be found in Appendix C. One thing to note in the preliminary design is that passive devices have not been considered. However, this layout is designed so there will be margin for growth.

5.0 Summary

Because of its modular design, the Digital Real-time Intelligent Networked Kegerator requires special packaging considerations. There are a few similar devices on the market that have a similar modularity; however our design includes many features that are far beyond commercial counterparts. The modular design also influences both the packaging and PCB layouts so the product is an easy addition to a keg system.

List of References

[1] Electro-pneumatics, **"**Kegmeter Overview," [Online Document], 2003 Jun 13, [cited 2006 Feb 7], Available HTTP: http://www.kegmeter.com/keg1.htm

[2] Bistrol Business Machines Ltd., "Draft Beer Control System, The Auper Harpagon Draught Beer system from Bristol Business Machines Ltd.," [Online Document], unknown publication date, [cited 2006 Feb 7], Available HTTP: http://bristolnf.com/har.htm

[3] Berg Company, "Draft Sentinel Beer Monitoring Equipment inexpensively monitors a large number of taps," [Online Document], 1999 Sep. [cited 2006 Feb 7], Available HTTP: http://www.berg-controls.com/draft.htm

IMPORTANT: Use standard IEEE format for references, and CITE ALL REFERENCES listed in the body of your report.

Appendix A: Project Packaging Illustrations

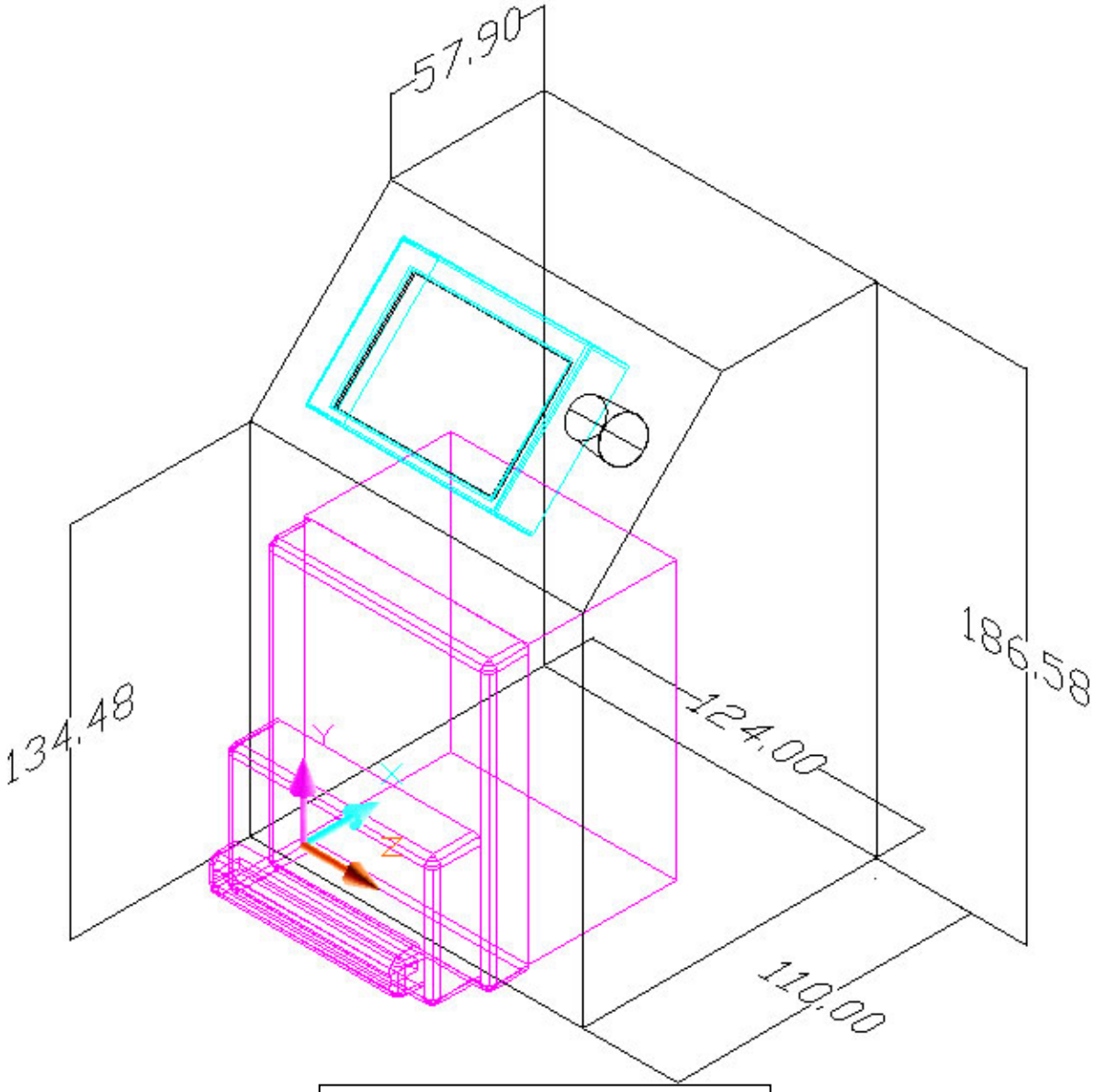

Figure 5 – Control Unit 3D View

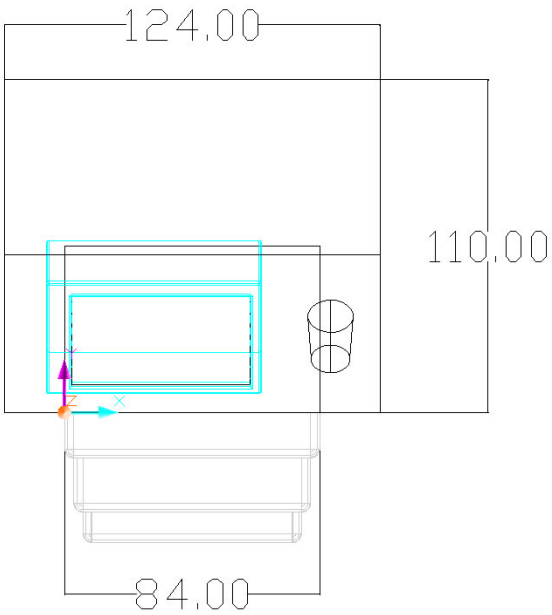

Figure 6 – Controller Top View

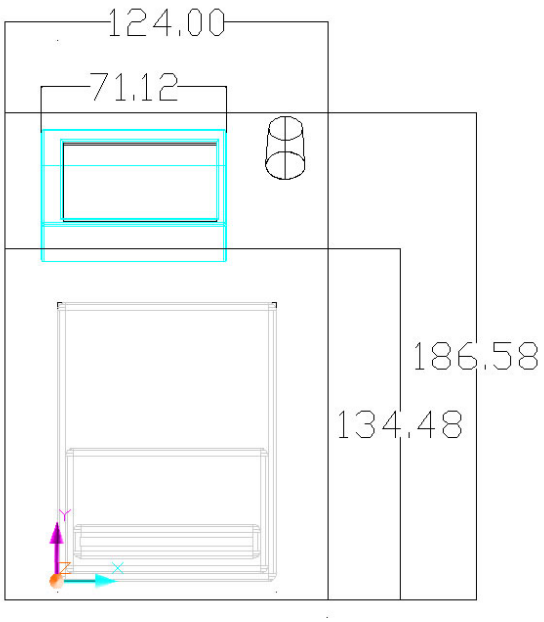

Figure 7 – Controller Front View

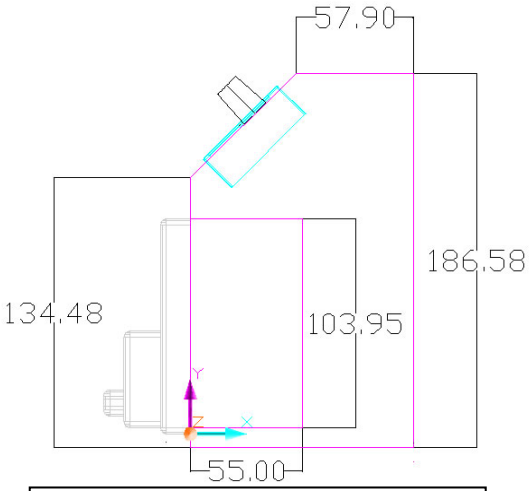

Figure 8 – Controller Side View

Figure 9 – Controller 3D Rendered View

Appendix B: Project Packaging Specifications

Part	Cost (USD)	Weight (lb)
eZ-001 LCD Module	$150.00	0.25
ICT A6 Bill Accepter	$0.00	1.5
62S Optical Encoder	$41.80	0.1
TI S200 Micro RFID	$284.29	0.15
Rabbit RCM3315 Module	$99.00	0.15
PCB	$0.00	0.3
Custom Enclosure	$50.00	2
TOTAL	$625.09	4.45

Figure 10 – Controller Price and Weight Table

Appendix C: PCB Footprint Layout

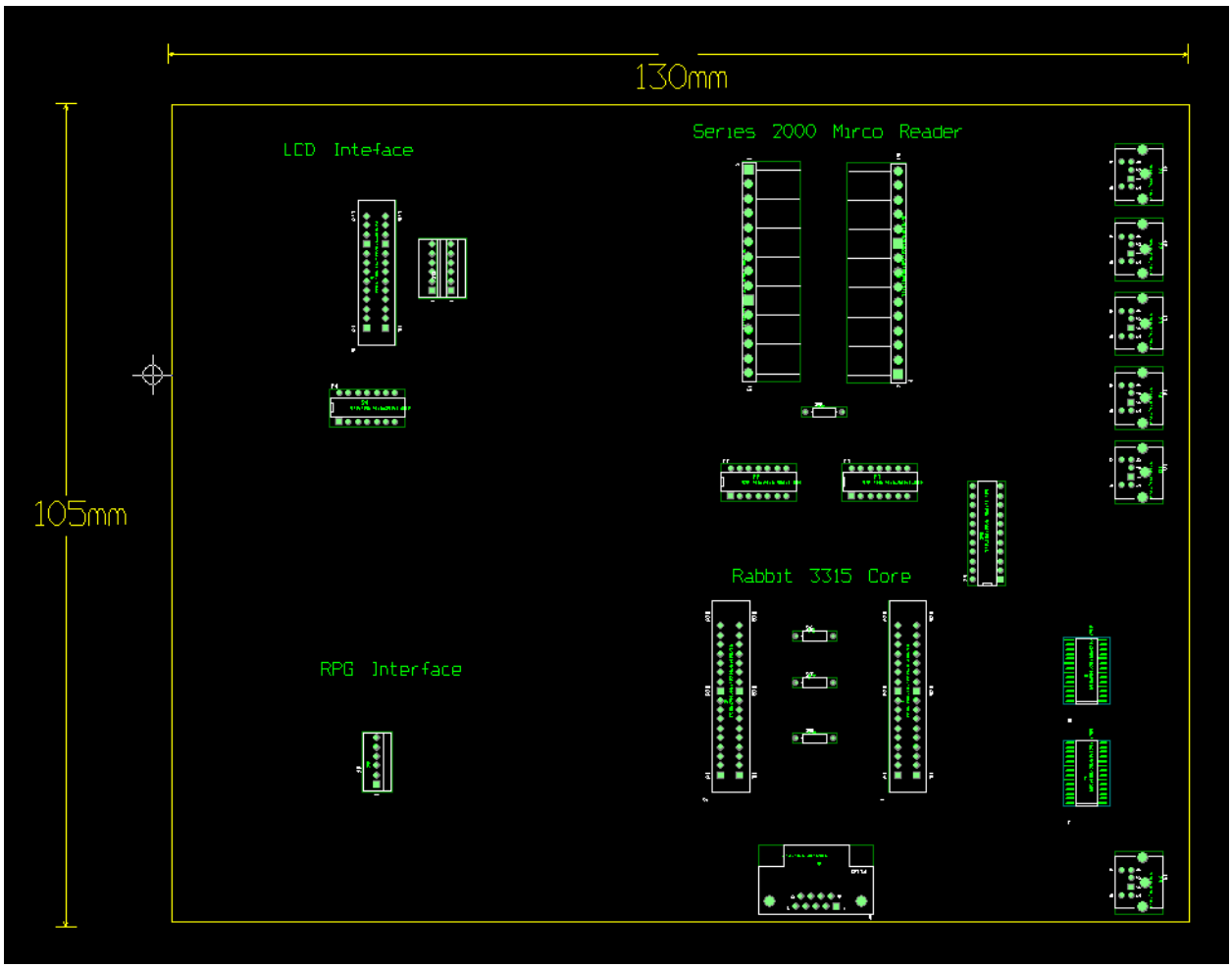

Figure 11 – Initial PCB Layout