**ALLDET**

**1. Problem**

**1.1 Historical Introduction**

When beer was first developed 4,000 years ago, it was stored in containers such as clay urns and pots. Over time, however, brewers found that storing beer in wooden casks allowed it to be carbonated and fermented more easily. These barrels were made by craftsmen known as “coopers”. Eventually, these wooden casks evolved into the stainless steel and aluminum containers we know today as kegs [1], [2].

Kegs were invented to allow pasteurization of liquids inside, such as beer [2]. With these metal beer containers, the way to determine the amount of beer inside without contaminating the beer is to physically roll the kegs onto a scale or purchase an interior redesign from high-priced companies.

Scales as a tool to weigh commodities dates back to ancient Egyptian and Babylonian times. Historically, scales were made using wood, a cord, and pans supported by cord. This “equal arm” balance was used for the next 2000 years until the Roman steelyard scale was developed [3]. Modern day scales use load cells, which transform pressure into current, and are the main technology used in the current competition for measuring keg levels [4]. In today’s market, keg scales are priced on an average of $200-$300 [5].

The ALLDET product will provide a way for keg owners to be able to accurately determine the amount of liquid in their containers without having to move it, weight it, or get the liquid sprayed on them. Our product will provide a non-invasive, hands-free method for level monitoring that provides no new taps or lines, all while maintaining a lower price point than our main competitors.

There are numerous companies that provide beer inventory tracking and monitoring. These solutions, however, require physical reconstruction of tap walls as they use proprietary beer taps to monitor flow control. Along with the cost of downtime due to reconstruction, these are large initial costs as well.

**1.2 Market and Competitive Product Analysis**

As mentioned above, one popular method currently available for determining the liquid level in a container uses scales to determine the weight of the keg and its contents. This method is not ideal because it requires the customers to lift their containers or take it off of the storage rack to place on the scale and manually calculate the amount of liquid remaining. Attaching the device to the side of the containers prevents heavy lifting, making our product more accessible than other options currently on the market. Manual entry of data increases the likelihood of incorrectly recording the liquid level as well as causing employees to spend more time on tedious inventory tracking. Our product automates the entry and analysis of data, allowing employees to spend their time on more important issues.

Another method available involves specialized bar taps and/or lines that have flow meters and sensors. This requires new construction of displaying taps to put the new product in place [6]. Our product differentiates itself in that it can be easily attached and removed from the container rather than modifying the keg or line.

The restaurant industry is our primary market. We aim to target bars, restaurants, alcoholic beverage vendors, and at-home breweries. Customers can include chain or locally owned businesses. Restaurants have a high enough usage rate that they could greatly benefit both from an automated method of determining the level of liquid in their containers as well as the data analytics associated with usage rates. There are several flow monitoring systems in use, and those businesses are outside of our market, as they already have expensive equipment in which we could not provide a competitive performance alternative.

**1.4 Concise Problem Statement**

The current methods that exist to measure the liquid level of a beer keg are either expensive, cumbersome, or both. Some solutions require heavy lifting while others are more invasive. We intend to solve this issue in an ergonomic and accurate way by attaching a small device to the exterior of a keg that will use the resonance of the keg to determine the level of liquid. We will display that level, along with consumption statistics, in an easy to use mobile application.

We intend for our solution to be affordable, quickly setup, and easily detached and moved to a different keg. Our product will utilize a vibration sensor for measuring the resonance that is created by a small mechanical arm that will strike the side of the container. The data from the sensor will be sent to a microprocessor to be analyzed and sent to the application. We will use a bluetooth connection from each module to the device running our application to send the data. Our application will have an easy-to-use interface to provide the user with many useful features including: estimated liquid level, alerts on when to reorder, and usage history. Our product is a simple, affordable, non-invasive solution to issues seen in the restaurant/bar industry.

**1.4 Implications of your Success**

ALLDET is pioneering the way beer keg level is monitored and tracked. Providing an innovative, long overdue solution to an entire industry will set a new standard on how inventory management is accomplished. Our device would help detect over pouring and theft due to free drinks. We aim to capture a large portion of the market, as we are the only product that attaches to the side of a container in an effort to determine liquid amount remaining inside. Upon further success, ALLDET devices could be used for chemical containers, oil drums, propane containers, or any other type of fluid stored in a metal container.

**References**

[1] “Evolution of the Beer Keg.” kegerators.com.<https://www.kegerators.com/blog/2009/03/04/evolution-of-the-beer-keg/> (accessed Sept. 3, 2019).

[2] “The Evolution of Beer Packaging.” beveragejournalinc.com. <https://www.beveragejournalinc.com/new/easyblog/entry/the-evolution-of-beer-packaging> (accessed Sept. 3, 2019).

[3] “Brief History of Weights and Measures.” cdfa.ca.gov. <https://www.cdfa.ca.gov/dms/trainingmodules/Module_07.pdf> (accessed Sept. 3, 2019).

[4] “Load Cell & Force Sensor: What Is It?” omega.com. <https://www.omega.com/en-us/resources/load-cells> (accessed Sept. 3, 2019).

[5] “Keg Scale.” alcoholcontrols.com. [https://alcoholcontrols.com/noname.html](https://alcoholcontrols.com/noname.html?gclid=EAIaIQobChMIh7zhrL215AIVFY_ICh2LvA2lEAAYASAAEgLGR_D_BwE) (accessed Sept. 3, 2019).

[6] “Draft Beer Monitoring System, Draft Beer Flow Meter, Beer Tap Control.” usbeersaver.com. <http://www.usbeersaver.com/> (accessed Sept. 3, 2019).