

Transforming Open Source Brewery Software to Open Brewing: The Case of Indebrau

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Abstract. Craft beer is currently experiencing an explosive growth in popularity. However, knowledge about the actual brewing process for most consumers still falls short in comparison to the appreciation of the final product. In this contribution we introduce a concept called *Open Brewing*. It engages end users into the brewing process and thereby conveys both knowledge about it, as well as it also bears the potential to raise acceptance for the final product.

Keywords: Brewing, Open Source, Automation, End User Involvement.

1 Introduction

The craft beer industry has experienced an explosive growth during the last three decades. Starting in the US already as early as in the 1980s, this trend has spread throughout Europe with the start of the new millennium and is still expected to continue to grow during the next years. The trend is closely related to the rise of the Web 2.0 [6], and with it the rise of social media [4]. It allowed small breweries with nearly no budget spend on marketing to connect and engage with their customers in ways not possible before [7]. This form of viral marketing is more or less reserved to craft breweries, leveraging on the concept of hyper-differentiation to position themselves between other craft breweries and strongly differentiate themselves from corporate brewing companies [3].

The rise of craft beer heavily influenced the rise of another trend: *homebrewing*. Also originating from the US and only very slowly transitioning across Europe during the last decade, it has established itself as a shaping of the *Do It Yourself* (DIY) movement. The close relation between the two (and also the related *Maker* community) can be observed by the fair share of open source brewing support software (Malt.io⁴, BeerXML⁵ or CraftBeerPi⁶, to name only a few). There is no shortage in mash automation (measuring and adjusting the temperature of the mashing process) software or recipe calculators in the homebrewing community.

⁴ <http://www.malt.io>

⁵ <http://www.beerxml.com>

⁶ <http://www.craftbeerpi.com>

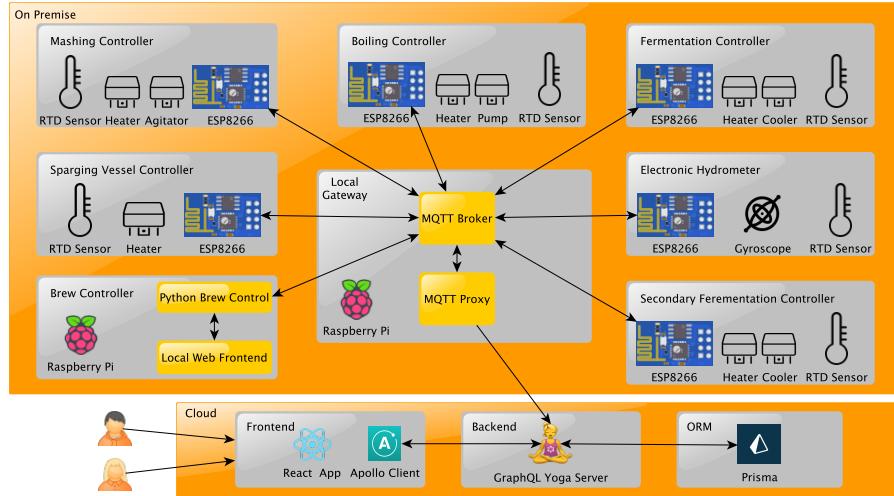


Fig. 1. The Open Brewery Architecture

However, this support ends when it comes to involving end users (in a sense of not home-brewers, but consumers) into the brewing process. The usual learning curve in the domain of (home-)brewing involves reading blog entries, forum threads or introductory books and then starting with manual brewing. Software and hardware support is usually provided for more advanced brewers. In this contribution, we want to describe a concept we call *Open Brewing*. It goes one step further than existing solutions, by not (only) providing open source brewery software⁷, but also opening up the brewing process itself. To achieve this, we set-up a *Web of Things* (WoT) brewery that sends real-time data of a brewing process (in form of different sensor data and multimedia content) to a Web application, targeted at and tailored for end users without any prior brewing experience. With this, we hope to raise trust in the final product and also to lower the entry barrier into the world of (home-)brewing.

2 The Open Brewery

To realize our concept of open brewing, we created *Indebrau*, an *Open Brewery*. It consists of both a digitally controlled brewing process, made possible by the heavy use of WoT technology, as well as the cloud infrastructure that realizes the Web application for end users to engage with the brewing process (cf. Fig. 1). We use the ESP8266 microcontroller chip for controlling and recording the brewing process. For each step of the brewing process, we constructed a *MQTT Controller Box* that can control heating, cooling, pumps and agitators, depending on the current task. Fig. 2 shows a picture of such a device. As all components of the

⁷ <https://github.com/indebrau>



Fig. 2. MQTT Fermentation Controller Box

open brewery, the PCB layouts, as well as the 3D printing designs and the source code are available on GitHub. The software we use as a basis for each controller is called *MQTT Device*⁸. It enables communication via the request/response pattern using the MQTT protocol [5]. To measure the tilt level of a floating device in the fermenting beer (and thereby the advancement of the fermentation process), we use an electronic hydrometer called *iSpindel*⁹.

We installed two Raspberry Pis in our architecture. One is responsible for hosting the brew control software, for which we choose *CraftBeerPi 3.0*. From an architectural perspective, it is just another MQTT device that subscribes to the sensor topics of the *MQTT Controller Boxes*, evaluates them and on that basis sends steering information (e.g. “turn on heater”) on actor channels back to the boxes. The second Raspberry Pi hosts the MQTT Broker, as well as a software we call MQTT proxy, that translates MQTT messages into GraphQL requests and sends them to the cloud. To create multimedia content of the single brewing steps, we currently rely on manual image/video taking, but we are in the process of installing ESP32-based AI Tinker Cam modules to automate that process as well.

In the cloud, we use the a GraphQL Yoga-based backend¹⁰ for processing the incoming sensor data. The ORM system is a Prisma¹¹ server. The frontend, based on the React framework NEXT.js¹², uses the Apollo Client¹³ to access the backend via GraphQL requests. Our application features a user management system and allows users to subscribe to brewing processes, tailoring the sensor data to specific users [1]. The visualizations are end user friendly and contain as much information as necessary to actually follow the process, without overloading the user. Fig. 3 shows a screenshot of the visualization of an active brewing process.

⁸ <https://github.com/MQTTDevice/MQTTDevice>

⁹ <https://github.com/universam1/iSpindel>

¹⁰ <https://github.com/prisma/graphql-yoga>

¹¹ <https://github.com/prisma/prisma>

¹² <https://github.com/zeit/next.js>

¹³ <https://github.com/apollographql/apollo-client>

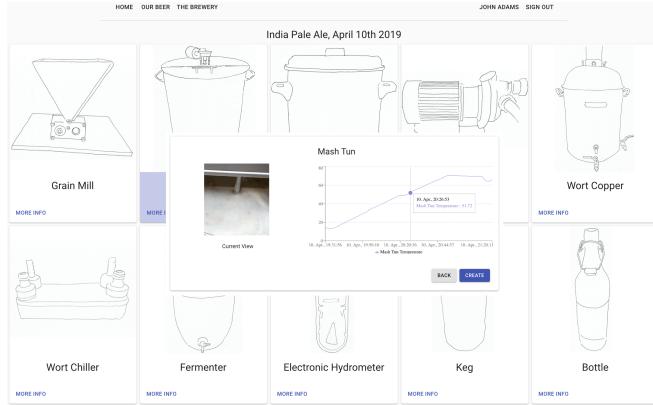


Fig. 3. Screenshot of an Active Brewing Process

3 Conclusion

In this contribution, we have introduced the *Open Brewing* concept. It engages end users with the final product in a way traditional advertisement is not capable of, while at the same time it also transfers knowledge of the creation process, which has been proven to raise acceptance for the final product [2]. While we still have to evaluate our prototype, we are convinced that this approach also bears the potential to serve as an example for end user engagement in other domains.

Acknowledgments. We thank the whole open source brewery software community, especially the authors of CraftBeerPi and iSpindel. Also, we thank the GitHub users “matschie1”, who started the MQTT device project and “InnuendoPi”, who made major contributions to it. Last but not least we thank Magnus Szemeit for designing the cases of our controllers.

References

1. Bruni, F., Pomo, C., Murgolo, G.: Four Key Factors to Design a Web of Things Architecture. In: ICWE 2017 Workshops. pp. 87–91. Springer (2017)
2. Caporale, G., Monteleone, E.: Influence of Information About Manufacturing Process on Beer Acceptability. Food Quality and Preference **15**(3), 271–278 (2004)
3. Clemons, E.K., Gao, G.G., Hitt, L.M.: When Online Reviews Meet Hyperdifferentiation: A Study of the Craft Beer Industry. Journal of Management Information Systems **23**(2), 149–171 (2006)
4. Foster, D., Kirman, B., Linehan, C., Lawson, S.: The Role of Social Media in Artisanal Production: A Case of Craft Beer. In: Proceedings of the 21st International Academic Mindtrek Conference. pp. 184–193. ACM (2017)
5. Luoto, A., Systä, K.: IoT Application Deployment Using Request-Response Pattern with MQTT. In: ICWE 2017 Workshops. pp. 48–60. Springer (2017)
6. O’reilly, T.: What is Web 2.0: Design Patterns and Business Models for the Next Generation of Software. Communications & Strategies (1), 17 (2007)
7. Rice, J.: Craft Obsession: The Social Rhetorics of Beer. SIU Press (2016)