Report Number: WUCSE-2012-31

2012

Youpon

Authors: Garrison Prinslow

This project was motivated by two related ideas: what can be learned about the unique issues involved with developing cloud-based mobile applications; and, what application could be developed to evaluate these characteristics that would also be innovative and provide value to users. After vetting ideas for the latter objective, it was clear that a new digital coupon system could offer value and apply interesting technologies to computer science problems, such as shortest path calculation, position-aware authentication, game theory, and statistical reasoning. A brief summary of the motivation for developing the new digital coupon system follows.

Department of Computer Science & Engineering

Washington University in St. Louis
School of Engineering & Applied Science

2012-31

Youpon

Authors: Garrison Prinslow

Abstract: This project was motivated by two related ideas: what can be learned about the unique issues involved with developing cloud-based mobile applications; and, what application could be developed to evaluate these characteristics that would also be innovative and provide value to users. After vetting ideas for the latter objective, it was clear that a new digital coupon system could offer value and apply interesting technologies to computer science problems, such as shortest path calculation, position-aware authentication, game theory, and statistical reasoning. A brief summary of the motivation for developing the new digital coupon system follows.

Type of Report: MS Project Report

Student: Garrison Prinslow [gprinslow@wustl.edu]
Advisor: Ron K. Cytron [cytron@wustl.edu]

M.ENG.-CSE MASTERS PROJECT ABSTRACT: "YOUPON"

Motivation

This project was motivated by two related ideas: what can be learned about the unique issues involved with developing cloud-based mobile applications; and, what application could be developed to evaluate these characteristics that would also be innovative and provide value to users. After vetting ideas for the latter objective, it was clear that a new digital coupon system could offer value and apply interesting technologies to computer science problems, such as shortest path calculation, position-aware authentication, game theory, and statistical reasoning. A brief summary of the motivation for developing the new digital coupon system follows.

Consumers are always interested in saving money, and coupon sites such as Groupon or Living Social have been especially popular recently. Nevertheless, both consumers and merchants have voiced significant criticism of this coupon model. For example, merchants deeply discount their merchandise, and of the discounted revenue, they receive less than half after the coupon provider's take. The unpredictability and "lack of control" is risky for small businesses that cannot sustain a significant loss for the sake of advertising. Consumers have also criticized this model because the coupons available are often irrelevant to their immediate purchasing needs. Yowza has digital coupons that only work for merchants with a sophisticated Point-of-Sale computer system. Facebook, FourSquare, and Yelp have coupon offerings that are associated with "check-ins." Here, merchants are similarly concerned about the lack of control and analytical data, whereas consumers are concerned about lack of privacy. Traditional coupon mailings are expensive and wasteful, and paper loyalty punch cards are easily lost or forgotten; moreover, both offer little data to the merchant. Therefore, it is apparent that an opportunity exists in the marketplace for a digital coupon system that addresses the needs and concerns of both parties.

Problem Statement

In order to maximize value to consumers and merchants, the coupon system should: 1) Use the consumer's and merchant's location to search for relevant offers; 2) Use consumer preferences or past purchases to enhance relevancy; 3) Not require social networking participation, and address privacy concerns; 4) Not require retail infrastructure, to enable any business to participate; 5) Be affordable and efficient for the business; 6) Incorporate a loyalty concept, if desired; 7) Give the business control over the redemption of their offers; 8) Track valuable information for the business, such as coupon redemption data over time; and, potentially, 9) Dynamically tailor offers based on nearby competitors, customer loyalty, customer interest, and other potential factors.

Approach

Our approach to solving this problem involves three key components: 1) a mobile device application for use by consumers; 2) a website for use by merchants on either a mobile device or traditional computer; and, 3) web services and a central data store to support both user interfaces. The end goal is a system that addresses the high-level requirements listed above. Moreover, the system should incorporate all structural and functional aspects, and have usable interfaces. The third goal was to identify development issues and performance bottlenecks of this architecture.

We selected an iPhone application to serve customers; it is a popular platform with a wide user base, and it is technologically sufficient for our goals. We selected the Ruby-on-Rails platform to

serve the merchant website and shared web services, which employs a SQLite datastore. It is a solid platform with strict MVC architecture and up-to-date supporting components that is also conducive to writing RESTful web services. For both platforms, we focused our development efforts on the most recent stable release; at the beginning of development, this was iOS 4 and Rails 3.0.9. To stay current, the code base will be migrated to Rails 3.1 and iOS 5.

While the initial idea for the project was discussed in May 2010, substantive work began in May 2011, when requirements and design documents were written (Block Diagram, User Tasks, Use Cases, Object Description/Data Model). We established a project plan to address each component in successive prototypes, with an emphasis on short release cycles delivering incremental features. At a high level, a new prototype of each component would be released each month. This allowed for five prototypes from June to October 2011, with the final month of November reserved for performance testing and final documentation.

Results

The first iPhone prototype was developed in a short timeframe. It was intended to merely be a proof-of-concept for the iPhone interface. It incorporated a basic login and main menu interface, with a simulated login service. Due to difficulties with controller hierarchies in iOS and XCode workspace problems, development work transitioned to the second iPhone prototype.

The second iPhone prototype was intended to demonstrate all main functionalities: login; main menu; offer listing; offer creation, editing, and deleting; and, offer redemption and validation. It was built using Table View hierarchies and Core Data for local storage. After establishing this interface on the iPhone, the first and second Rails prototypes were developed, with an offer service allowing get/create/update/delete, and associated web pages for the same actions. The final component of the second iPhone prototype was to get data from the Rails service, then support creating/updating/deleting. Combining several references, refactoring, and experimentation led to successful asynchronous CRUD support between the iPhone and Rails service. Naturally, the iPhone customer interface would not allow creating or modifying offers, but it was useful to establish a working model that could support the necessary actions for other services.

Next, work began on the third iPhone prototype, which incorporates lessons learned from the prior prototypes, including removing Core Data local storage. Also, to create a uniform interface, Login and Registration were created using Table View hierarchies and custom cells for textfields, buttons, and switches. Work then transitioned to the third Rails prototype, which incorporates all essential services necessary to serve the merchant and customer: login, registration of users and merchants, offer listing, offer creation, offer validation, and redemption data analysis, as well as user profile updates, role hierarchies, password encryption, and HTTPS. To date, the third Rails prototype is functionally complete. Current work is focused on satisfying the end-to-end flows for customers and merchants, which involves connecting additional services to the iPhone, and improving interfaces on both components; this will be completed by the end of October 2011.

Conclusion

There are several preliminary observations that may be made at this point. First, the hypothesis about the need in the market was confirmed by the entry of “Punchd!” in December 2010. Nevertheless, this system targets only one component of our system, the loyalty punch card, and is still in a private beta. Second, the platforms chosen for development have proved to be well suited to rapid prototyping. Third, the performance characteristics of this system will be dictated by the Rails server, as the iPhone client has a lightweight interface that depends on remote persistence. Testing the server with typical request patterns will uncover scaling bottlenecks.