Medallion Theatre Ticketing System

Justin Chung, Aigiun Guseinova, Jwalant Maheta, and Kevin Salger

Executive Summary

Our team has created a system to replace the outdated and prone to error ticket reservation system that Medallion theater had been using. Our established goal was the reduction of reservation errors to less than 0.5% and to create a new system that offered more means of reserving tickets. We followed the agile development methodology that allowed us enough time to analyze the previous system and to adapt a new one to function more efficiently. Use case, data flow, and entity-relationship diagrams were created to show the overall connections between the various actors, as well as the data. Additionally, we have created a Medallion Website that will allow patrons to access information about upcoming shows and to reserve tickets online. The website allows users to be informed about upcoming shows for the season, as well as the purchasing of tickets online to reserve their seats. The website is used in tandem with other options of reserving seats in person, or on the phone

Our team has also provided a timeline that shows the development cycle of the system we created. Implementing the system will require the installation of the server and having it connected to the public website. Training will need to be provided for workers in order to facilitate their familiarity with the systems, such as in person or phone reservations. Workers will also be needed to access the restricted portions of the website to provide updates of events and access patrons' data. We view that success can only be achieved with our new system if it reduces reservation errors, and functions reliably for users to successfully reserve tickets.

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Introduction

The upscale Medallion Theatre is known for high quality productions and performances, often staging four or five shows per season. Tickets for the shows often sell out quickly for the 602-seat facility. While a sold-out theatre is what every production wants, the demand for tickets has led to problems.

The ticket reservation system was outdated and prone to errors. Patrons called or visited the theatre in person and spoke with one of the staff to reserve seats for a particular show, date, and performance. Walk up purchases were delivered to the customer immediately while tickets purchased over the phone were held at Will Call. The staff used a series of large-format seating charts, one for each show, date, and performance time, printed on 11 x 17 paper. Patrons' information was kept in a simple database, but it was not linked to the purchase of tickets other than by manual entry. Season ticket holders were guaranteed seats for any shows and performances.

Ultimately, the demand for tickets increased to the point where the first week of ticket sales was a non-stop phone frenzy. All staff took reservations all week long. The constant calls combined with the manual seat selection resulted in double-booked seats and misplaced reservations. While most (roughly 90%) reservations were handled correctly, the remaining reservations issues threatened damage to the theatre's reputation and some patrons chose not to attend the theatre regardless of the quality productions.

Goal

As live theater lovers ourselves, the students of California State University, Long Beach's systems analysis and design program proposed to update the Medallion Theatre's ticketing system with the primary goal of reducing the reservation errors from about 10% to less than 0.5%. Using this metric, the target percentage range of correctly processed reservations is 99.5 to 100. (While we actually strove for 0.0% errors, we recognized that since the new system will still include human interaction, errors are, regrettably, possible.)

Approach

The team of Justin Chung, Aigiun Guseinova, Jwalant Maheta, and Kevin Salger were and are well versed in a variety of systems development methodologies, including the software development life cycle, agile, and object-oriented systems development. Each of these methodologies is useful in certain situations and the choice to use one or another is dependent on the situation.

In the case of the Medallion Theatre we chose to use the agile development methodology. Our reasoning for this choice relied on agile's core practices, resources, activities, and values. Additionally, the software development life cycle provides documentation for every step taken in the development process and is generally slower than agile or OOS. Since the theatre was in the middle of its season and could not afford to "go dark", our team was required to develop the system as the season progressed. Not only did this allow us ample opportunity to study the previous system, but user stories were easy to observe.

The components of the system also did not lend themselves well to an objects and classes framework, nor was reuse of the system's components a significant need. Thus, despite some similarities with agile in rapid system development, the object-oriented approach was rejected.

Finally, once created, we expected the completed system would not need frequent updates or changes after deployment. Instead, the primary system functions could be set up to run until a future feature requires significant change.

Development

Use Case

System analysis occurred first. For this project, we started with understanding the relationship between the various actors and the information passed between them or what tasks each actor performed. A Use Case diagram is often the first step in this process.

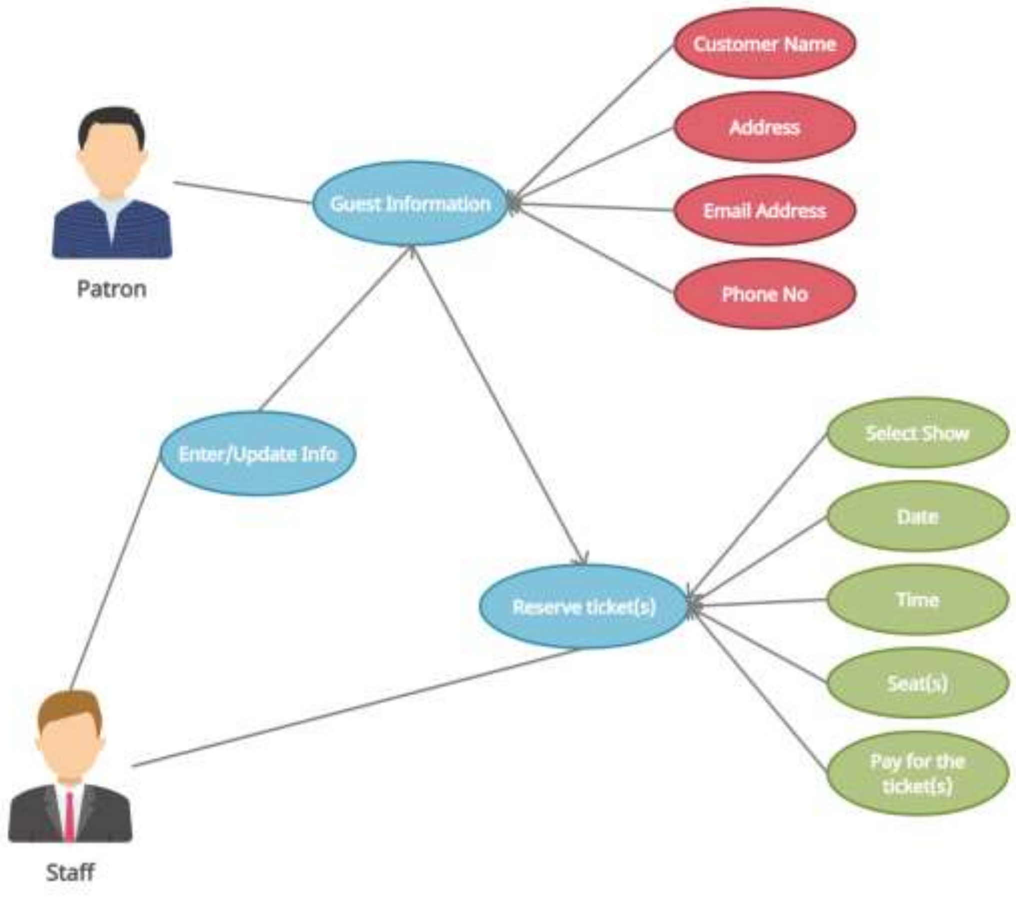


Figure 1 - Use Case diagram.

In Figure 1, two main actors have access to the system: patrons and theatre staff. (In this explanation, "actor" does not refer to the actors/performers on stage.) The patrons access the system through the Medallion Theatre website and are able to purchase tickets to any upcoming production in the current season. Patrons may also call the theatre staff, who use the same website access to purchase tickets. Both actors are able to enter or update their personal information in the system. Executive staff also have the ability to directly enter season, production, performance, and seating information, but since this activity is not part of the main data flow and is not included in the use case diagram.

After either entering new patron data or retrieving the patron data, the system allows the user (patron or staff) to select the production, performance date and time, and seats. Finally, a secured payment processing system is included. A summary page is displayed with the pertinent details following the payment.

Data Flow Diagram

The use case diagram is useful for seeing the "big picture" of the system and is fairly easy to understand how the major system components connect. However, to construct a replacement system, a deeper understanding of the data, its sources, and its destinations is needed. Enter the Data Flow Diagrams.

The first data flow diagram (DFD) is the simplest and contains the two actors providing information to the system, which in turn provides information (tickets) to the patron.

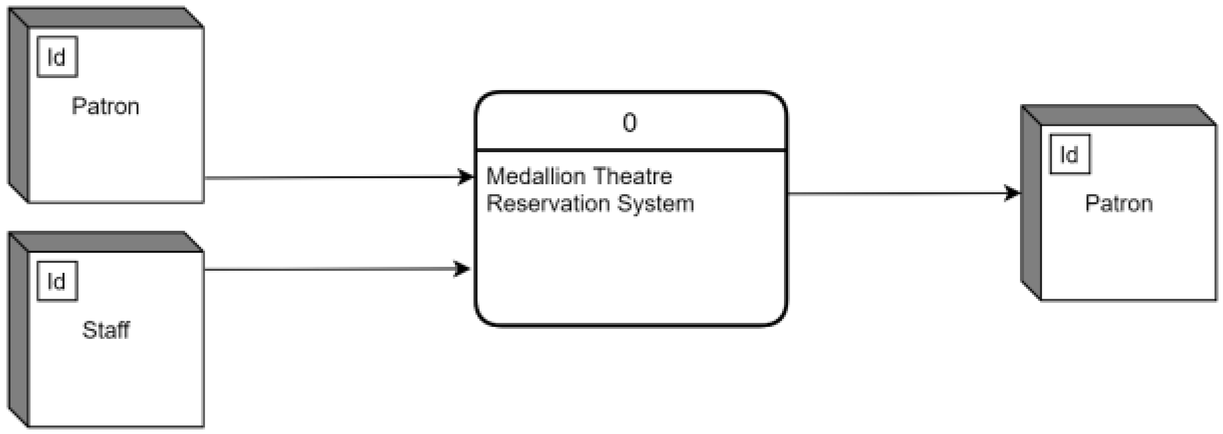


Figure 2 - The Level 0 data flow diagram.

The reservation system can be detailed in a second DFD. This second diagram provides a visual description of the data sources, destinations, and types in greater detail. Each rectangle with rounded corners is a process that was broken down into constituent parts, although they are not all shown in this document.

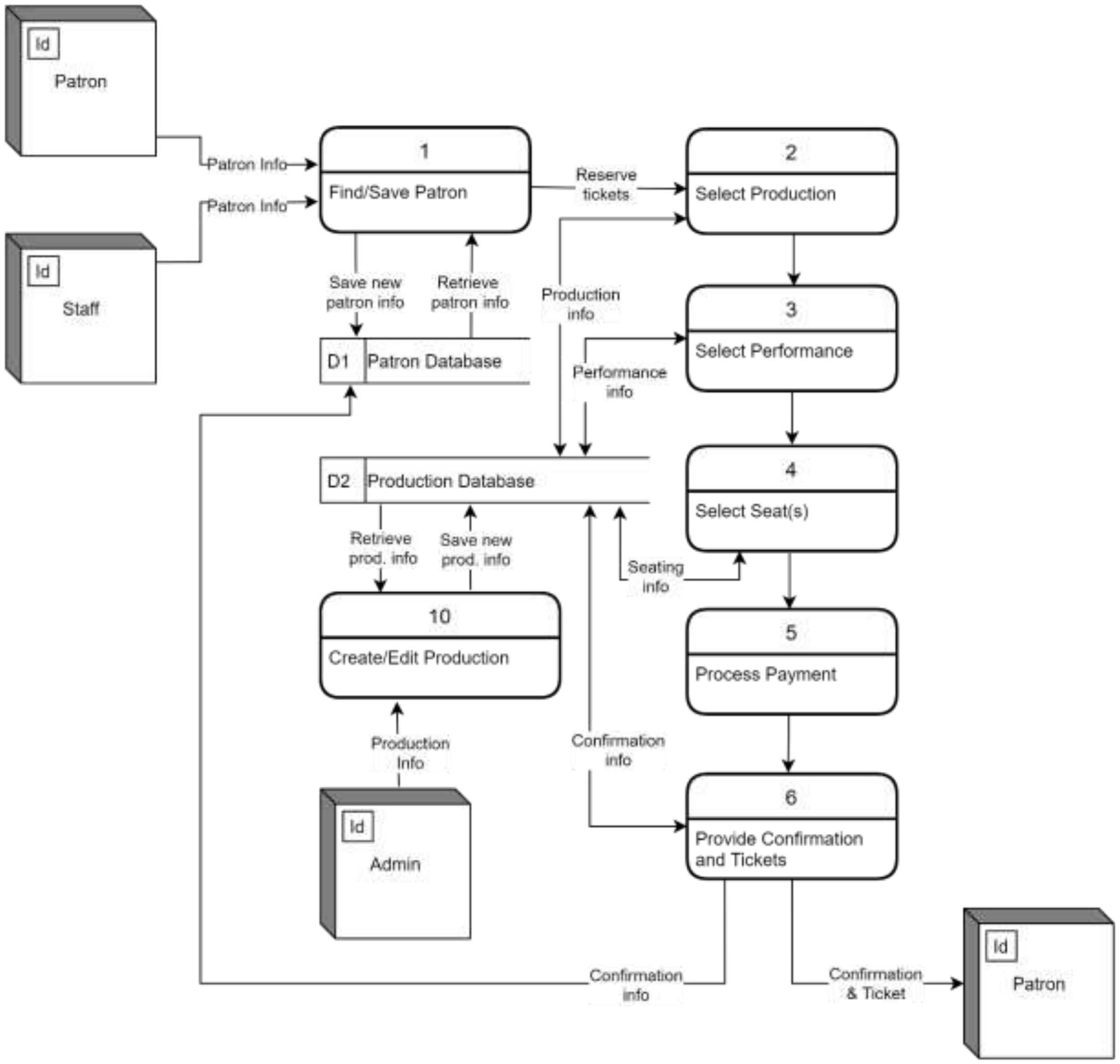


Figure 3 - The Level 1 data flow diagram.

The data flow diagrams gave us a clearer picture of the disparate parts of code to write. Put another way, after creating the DFDs, we knew that the process 1, “Find/Save Patron”, would send and retrieve information to and from a data storage database, “Production Database”. Similarly, the Medallion administrators had direct access to the Production Database to enter production information that the remainder of the staff and patrons would later use when reserving seats for a performance.

Entity-Relationship Diagram

We chose to enhance our understanding of the data storage by creating and implementing an entity-relationship diagram. As with any ER diagram, there are rules. The displayed diagram was derived from the following rules in addition to the system requirements.

● A season has multiple productions.	● A production is in only one season.
● A production can have multiple performances.	● A performance is only one production.
● A performance has multiple seats.	● A seat is only in one performance.
● A patron can attend one performance at a time.	● A performance can be attended by multiple patrons.

The requirements included that the new system maintain records of the following information and that certain reports, like those of which seats were sold for each performance or revenue for each production, could be generated at any time by the administrators.

● Seasons ○ Shows ● Productions (Shows) ○ Show Type ○ Production Dates ○ Performance Dates ● Performances ○ Performance Date ○ Curtain Time ○ Attendance ● Seats ○ Sold	● Patron Data ○ Name ○ Address ○ Phone ○ Email ○ Season Ticket Holder ○ Supporter Level ○ Previous Shows ○ Notification Preference

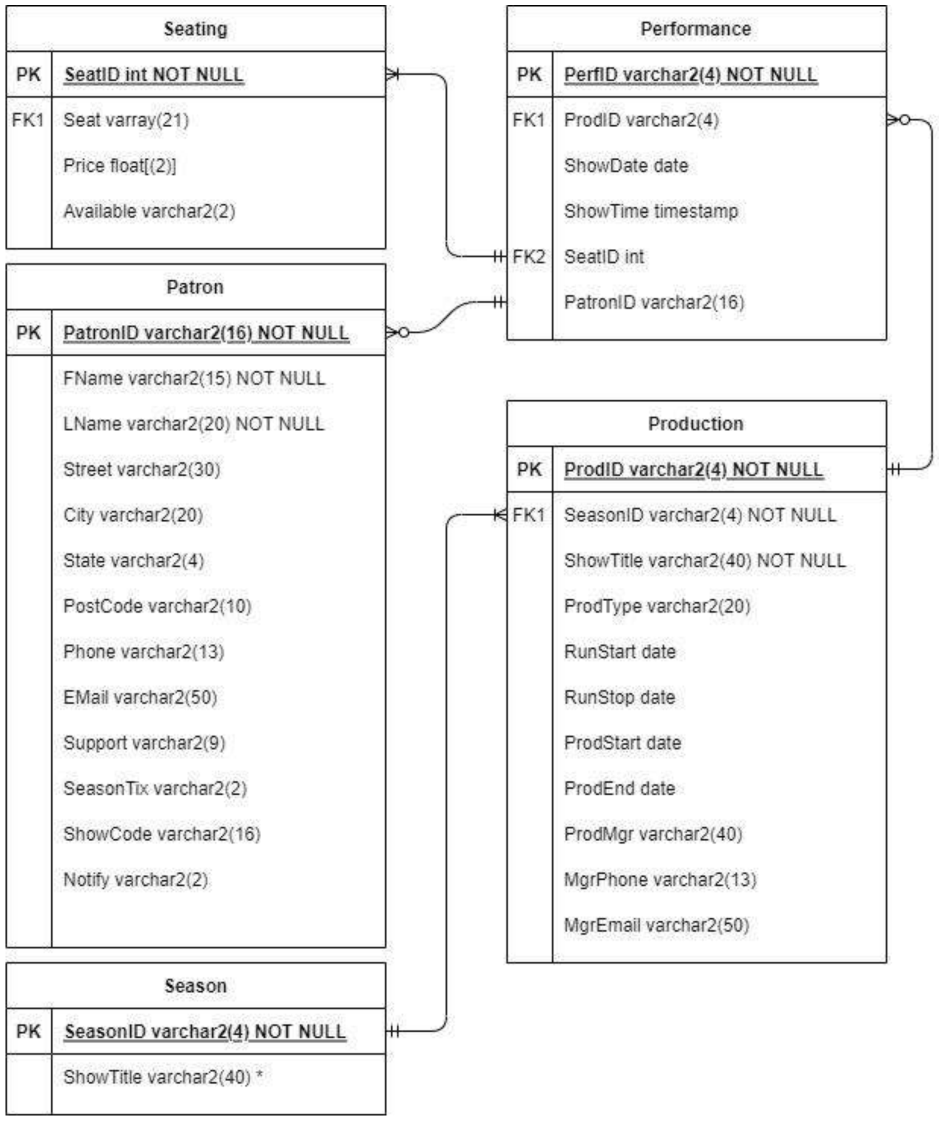


Figure 4 - The data storage E-R Diagram.

We also developed a cascading identification code based on the E-R diagram fields. By borrowing the internet protocol (IP) addressing format (192.168.1.100, e.g.), each season, production, performance, and seat could be uniquely identified and associated with a particular patron using the correct search query: SeasonID.ProdID.PerfID.SeatID

For example, the 199th seat in the 4th performance of the 5th production in the 15th season is coded: 15.5.4.209 Using a simple lookup table, the 199th seat is determined to be Row G, Seat 19. Printed tickets reflect the more familiar Row & Seat Number format for patrons.

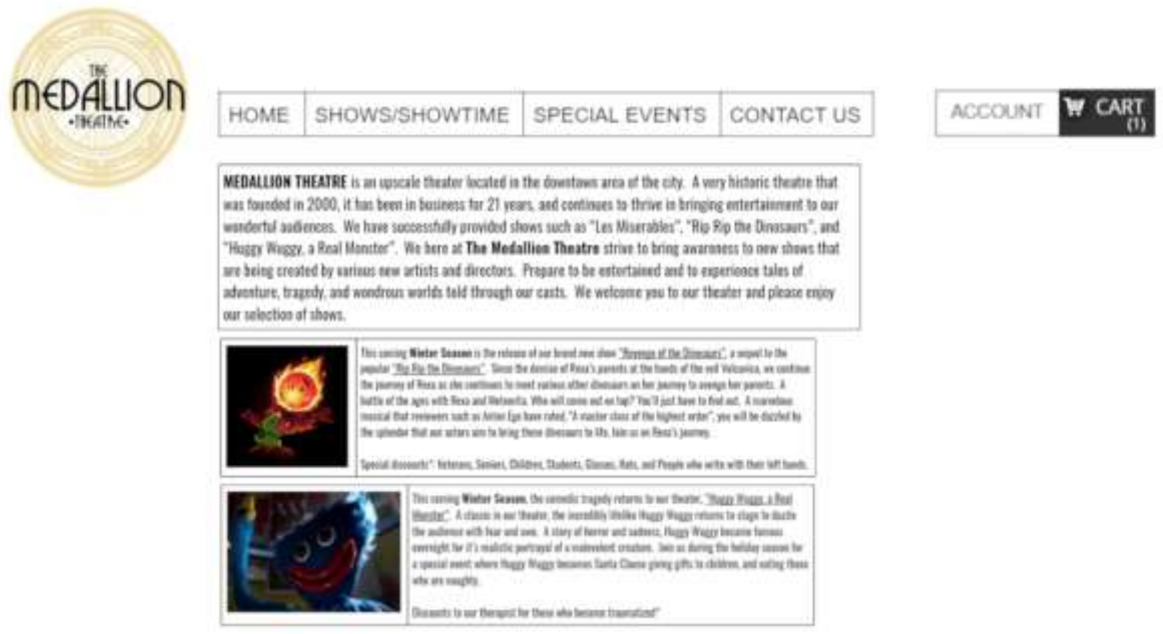
User Interfaces

Patrons and staff access the reservation system through a series of webpages on the Medallion Theatre website. (Particular staff, for example the executives, will have access to the database directly, to enter season, production, performance, and seating data. Those pages are not shown here.)

In Figure 4 an example of the main page (www.medalliontheatre.com) a user sees. From this page, a user clicks on the production or show of interest, either from the drop-down menus along the top or directly on the show summaries in the body of the page.

Other features of the website are also visible, including the Special Events and Contact tabs, along with the Account tab. Clicking on Account allows a patron or staff to adjust any component of the patron's information (name, address, email, phone, notification settings, and so on). New patron's can create their account on that page as well.

Finally, the patron's Cart is available from this page. Should the patron wish to purchase tickets for more than one performance or show, the cart will keep track of the various tickets.



MEDALLION THEATRE is an upscale theater located in the downtown area of the city. A very historic theatre that was founded in 2000, it has been in business for 21 years, and continues to thrive in bringing entertainment to our wonderful audiences. We have successfully provided shows such as "Les Miserables", "Rip Rip the Dinosaurs", and "Huggy Wuggy, a Real Monster". We here at **The Medallion Theatre** strive to bring awareness to new shows that are being created by various new artists and directors. Prepare to be entertained and to experience tales of adventure, tragedy, and wondrous worlds told through our casts. We welcome you to our theater and please enjoy our selection of shows.

This coming **Winter Season** is the release of our brand new show "Revenge of the Dinosaurs", a sequel to the popular "Rip Rip the Dinosaurs". Since the demise of Rexa's parents at the hands of the evil Volcanica, we continue the journey of Rexa as she continues to meet various other dinosaurs on her journey to avenge her parents. A battle of the ages with Rexa and Volcanica. Who will come out on top? You'll just have to find out. A marvelous musical that reviewers such as Anton Ego have rated, "A master class of the highest order", you will be dazzled by the splendor that our actors aim to bring these dinosaurs to life. Join us on Rexa's journey.

Special discounts*: Veterans, Seniors, Children, Students, Classes, Rats, and People who write with their left hands.

This coming **Winter Season**, the comedic tragedy returns to our theater, "Huggy Wuggy, a Real Monster". A classic in our theater, the incredibly lifelike Huggy Wuggy returns to stage to dazzle the audience with fear and awe. A story of horror and sadness, Huggy Wuggy became famous overnight for it's realistic portrayal of a malevolent creature. Join us during the holiday season for a special event where Huggy Wuggy becomes Santa Claus giving gifts to children, and eating those who are naughty.

Discounts to our therapist for those who became traumatized*

Figure 5 - Medallion Theatre home page.

Figure 5 shows the page from which a patron can choose shows, performances, and seats. For a given show, the dates and times available are

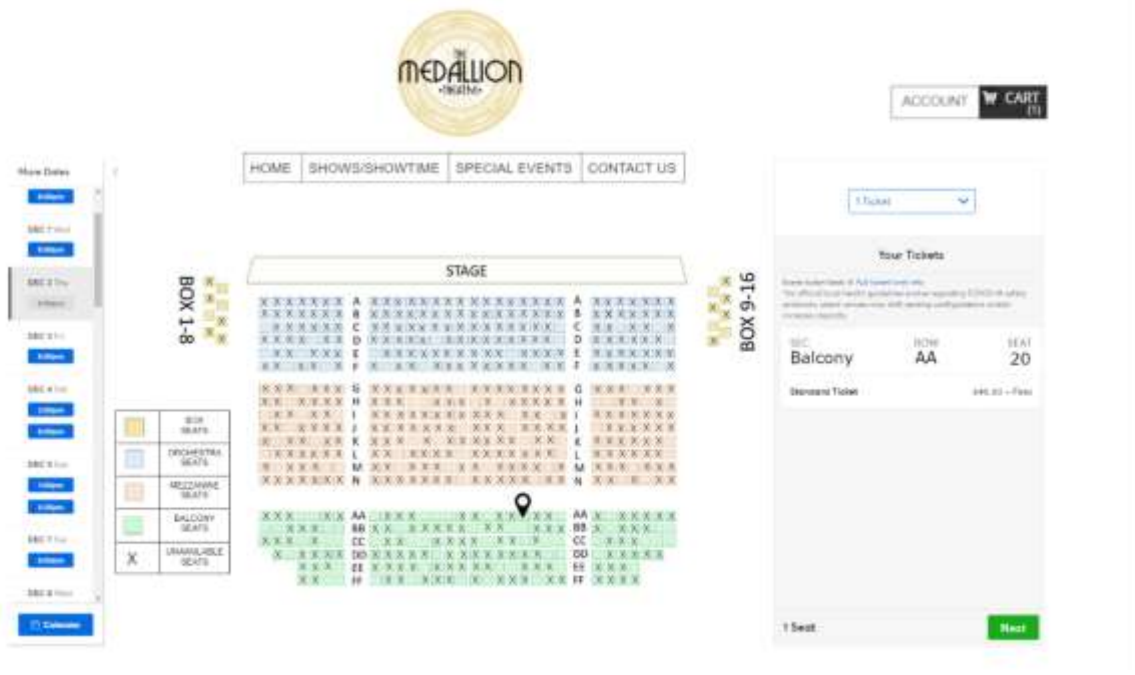
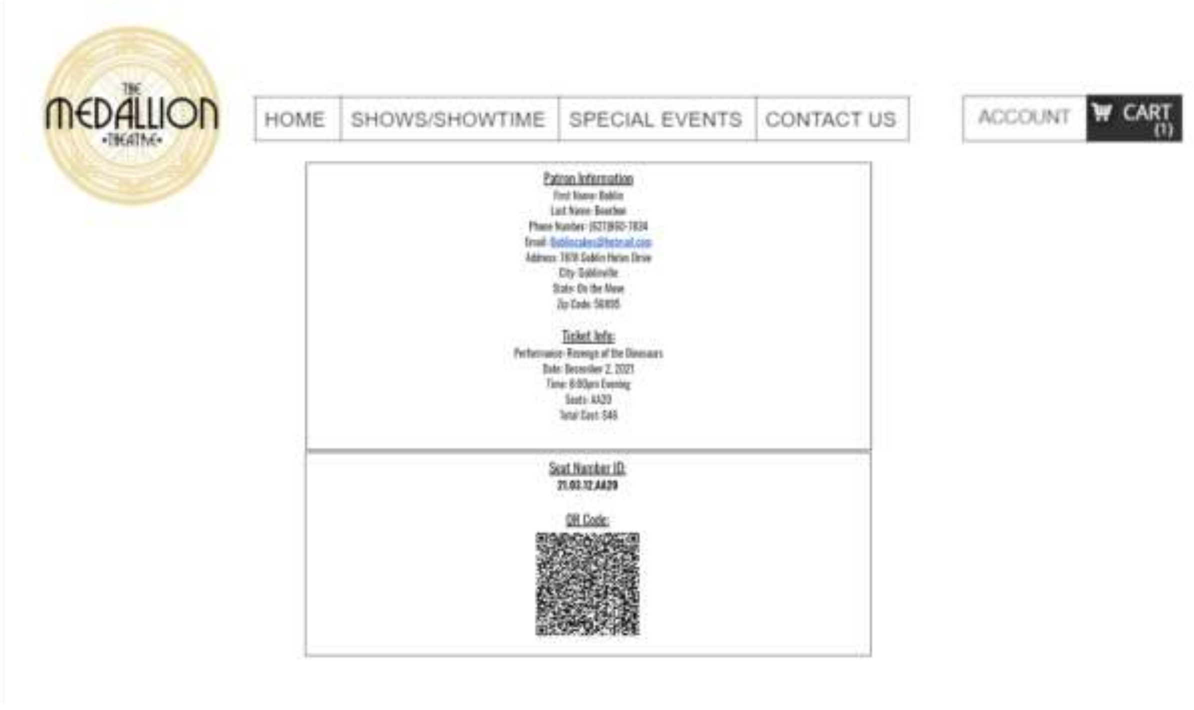


Figure 6 - Medallion Theatre reservation page.



Patron Information
First Name: Bobbin
Last Name: Bourbon
Phone Number: (621)960-1834
Email: bobbincakes@hotmail.com
Address: 1878 Goblin Helen Drive
City: Gobbinville
State: On the Move
Zip Code: 56895

Ticket Info:
Performance: Revenge of the Dinosaurs
Date: December 2, 2021
Time: 6:00pm Evening
Seats: AA20
Total Cost: $46

Seat Number ID:
21.03.12.AA20

QR Code:

Figure 7 - Medallion Theatre summary confirmation page.

Timeline

Any project requires some amount of time to develop and complete. This ticketing system was no exception. In the following Gantt chart is our projected schedule from the initial project analysis. As can be seen, we estimated the project could be completed in eight weeks, or two months. The project coincided approximately with the Cal State Long Beach spring semester's start on January 24. (The project began February 1, eight days later.) Our goal was not only to finish the project before the end of the Theatre's season, but also to finish well before the end of the semester and final exams. The eight-week, two-month mark was March 1. See Figure 7.

While the exact breakdown did not fall along the dates projected (some segments took less time than expected, some took more), overall the project was finished only about one day later than projected. The result of this slight slippage was one day less of evaluation, where the system is installed and operating at the theatre. However, one less day did not greatly affect the results and subsequent error rate calculations.

We attempted to meet regularly to discuss the project, much like a scrum meeting might be held. Our class schedules did not permit daily meetings, but the team did meet or communicate two to three times in most weeks. Other class homework, projects, or exams hindered communication many times.

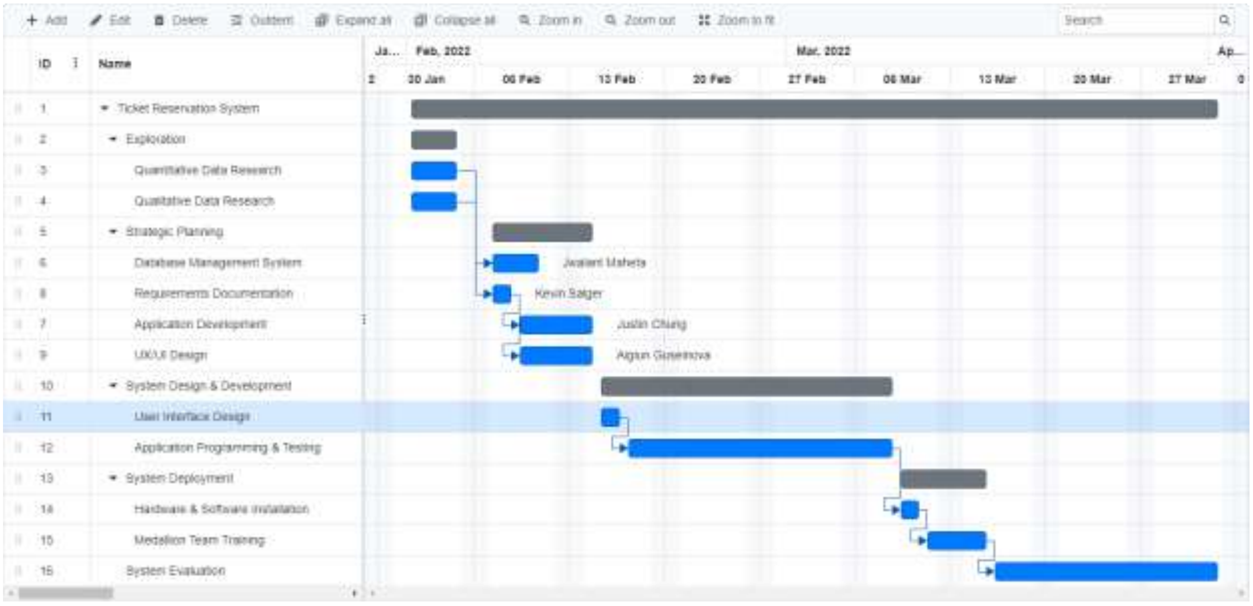


Figure 8 - System development timeline.

Deployment

Installing the new system into the Theatre involved largely installing the server for the database and connecting it to the public-facing website. While test connections were completed off-site and verified to work, there was a bit of trepidation the system would find some previously undiscovered reason not to function when installed physically at the Theatre.

Much of the installation involved finding a suitable location for the server to live in the office, connecting it to the nearest network switch, and establishing the internet connections required for the website. Clearing off desk space in the Ticketing and Will Call booths took more time than the actual installation of the system. Once connected, the system provided only token resistance to full functionality.

Documentation and Training

Any new system involves a learning curve. While the website interface did not require a significant curve, it was still important to make sure the staff knew how to access not only the public website, but the restricted access version of the site. Familiarity with the website was predicted to increase the speed a reservation could be made with customers purchasing tickets in person or on the phone. Administrators also needed training on accessing the database directly to enter new shows, update upcoming shows, or create reports on each production or performance.

Because of differing schedules of the staff, training sessions occurred on three different days, but the typical employee learned the essentials of the system within about two hours.

We wrote a manual regarding the system: how to access, how to perform database updates for patrons, how to create new seasons, productions, and performances in the database, and most critically for the Medallion Theatre's bruised reputation, how to create ticket and seat reservations.

Printed copies of the manual were delivered with the installation and a softcopy is available inside the restricted access area of the website.

System Success

To be considered a success, apart from improving the error rate, the system had to be capable of performing certain tasks. These tasks were derived directly from the direct and indirect observation of the manual system. Automating the majority of these tasks intended to provide the bulk of the error rate improvement.

Additional success measurement was meeting the projected project schedule. While some days saw longer than the recommended eight hours of development, the number of these days were few and far between. This outcome is consistent with the agile development's concept not to "burn out" employees by expecting 60 to 80 hour workweeks.

Admittedly, the later weeks in March are not the most trying times for the new system, since the Medallion Theatre's schedule generally runs from September through May, with only one show remaining in the season before the summer stock shows and children's summer day camps begin. The real test will happen in August, when tickets for next year's season become available.

However, the late March rollout could be considered a beta test of the system, with time now available to find and fix any errors before the rush for tickets in August. This time between the initial rollout and the August rush is also good for the Theatre staff.

After monitoring the system for two weeks (thus completing the eight week project timeline), we found that the error rate initially rose to just under 12%, it then dropped to about 2.2%. While this did not meet the goal of less than 0.5%, the overall reduction of 7.8 percentage points is a significant improvement.

Potential explanations for the initial rise and subsequent drop is likely due to unfamiliarity with the new system, followed by increasing familiarity by both patrons and Theatre staff. We hypothesize the error rate could still drop further from the 2.2% as the staff and patrons gain confidence with the system. A significantly longer evaluation period would be needed to ascertain if the hypothesis is proven.

Conclusion

Overall, the administrators and staff at the Medallion Theatre are grateful for the new system, despite the error rate not dropping as much as was hoped. The development team plans to visit the theatre in a few weeks to determine if any errors have crept into the system, but there are no formal maintenance plans at this time. The team has learned a great deal about not only the analysis, design, and implementation of a system that can help each of them as they begin their systems analyst careers.

1. Patron
    a. Patron ID Code
    b. Name (First & Last)
    c. Address
    d. City, State, Zip
    e. Phone
    f. Email
    g. Supporter Level (Platinum, Gold, Silver, Copper, Aluminum) *<enumerated list>*
    h. Season Tickets (Yes/No)
    i. Shows/Tickets Purchased: SeasonID.ProdID.PerfID.SeatID e.g. 45.03.12.342
    j. Notify of upcoming shows (Yes/No)
2. Productions
    a. ProdID Code: SeasonID.ProdID: e.g. 45.03 = 45th season, 3rd show
    b. Related Performance ID Codes: 45.03.1-24 Twenty-four performances.
    c. Show Name
    d. Type (Concert, Recital, Play, Musical, Lecture, Dance, Competition, Commencement/Awards,) *<enumerated list>*
    e. Production Date Start/End
    f. Show Date Start/End
3. Performances
    a. Performance ID Code: Season.Show.Performance: e.g. 45.03.12 = 45th season, 3rd show, 12th performance
    b. Show Date
    c. Show Time
4. Seats
    a. Array of seats: 21 Rows, Seat. Will need new array for each show date & time combination. Alternatively, simply number each seat 1-602 as the SeatID & reference a specific cell in the seat array. The SeatID becomes the final number in the code: 45.03.12.438, 45.03.12.439 (Season.Show.Performance.Seat) = 45th season, 3rd show, 12th performance, seat 438 and seat 439.
    b. Ticket Price
    c. Available?

1. Theatre Reservation System
    a. Explore
        i. Interview
        ii. Research similar systems
        iii. Trial purchase
    b. Plan
        i. Jwalant develops database
        ii. Justin develops webpage
        iii. Kevin writes documentation/training
        iv. Aigiun manages team/interfaces with client

c. System Design & Coding
    i. Reserve ticket
        1. Name
        2. Address
        3. Phone
        4. Email
        5. Show
        6. Date
        7. Time
        8. Seat(s)
        9. Pay
    ii. Update information
    iii. Enter show information
d. Implement
    i. Deploy system into theatre
    ii. Train staff
e. Maintain