Visualization and Analysis of UNL Game Development Club Membership Data

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Abstract

The UNL Game Development Club, founded in Fall 2018 by a group of Computer Science students, has been steadily growing in both size and student background. The group hosts a variety of activities such as game development demos, hosting guest speakers, and competing in game development competitions. The club also manages its own mailing list of 150 people. However, the current club officers have noticed a disparity between the amount of interested students on the mailing list and the average weekly meeting attendance rate. Moreover, the club still lacked an efficient means of tracking member information and demographics, attendance records, meeting information, and other logistical records. This project targets these organizational concerns by building a scalable relational database to assist the club officers with record keeping. Further, we implemented four different types of graphics for analyzing the relationship between attendance data and member background. Through this analysis, we identified the consistently interested under-represented majors to assist in guiding future recruiting efforts.

Index Terms

game development, database, MySQL, D3JS

I. Introduction

The University of Nebraska-Lincoln Game Development Club (UNL GDC) was founded in the Fall 2018 semester by a group of Computer Science students who are all passionate about the video game industry. With genuine hope of providing a platform for other students who share similar interests, the original members decided to run the club first as an unofficial group in the Fall 2018 semester and registered to be an official Registered Student Organization for the Spring 2019 semester. In its first three semesters, the club has hosted around 30 regular meetings and activities and around 10 events both on-campus and off-campus. These activities include game development instructional demos, game development competitions, industry guest speakers, and university-related recruiting events. Gradually, the club's mailing list has grown from 6 recipients in September 2018 to 150 recipients as of November 2019, which shows a steady growth in popularity and campus presence.

Through recruiting and expanding the club, the club officers became aware of the disparity between the number of email recipients and the average meeting attendance. Moreover, the club has only tracked member information, attendance records, and other logistics through document files, which implies a need for an alternative approach. Therefore, this project targets these organizational concerns by building a scalable relational database using MySQL [7] to assist the club officers with maintaining records. MySQL was chosen as the database language due to its performance capabilities, vast documentation, and ease of use. The authors also used Java programs to import and format data from previous club records to the MySQL database. For purposes of this project, the data was scrubbed of any personally identifiable information and replaced with fake names, usernames, and other data to protect the members' privacy. Any information that did not qualify as personally identifiable information, such as majors, school year, and attendance records, was not replaced as that was the target of the project's analysis.

The remainder of this report will detail the development, visualization, analysis, and future recommendations. Section II uses an ER Diagram to illustrate the database design. Section III describes the implementation process for visualizing the data and explains the findings. Sections IV and V will explain the authors' conclusions and recommendations for future work.

II. Database Design

Prior to this project, the previous method of record keeping included maintaining attendance records, notes, and more in shared Word documents. The primary downfall to this setup was that not all documents were complete or maintained a consistent format. As this is not an effective method, this project aimed to provide the UNL GDC club officers with a scalable, easily searchable manner of maintaining records. The authors determined that each of the shared documents included a set of key information: active member names, meeting types, basic meeting notes, dates, relative event information, and other minor details. In collaboration with the club officers, the authors elaborated on this information to compile a complete set of meeting

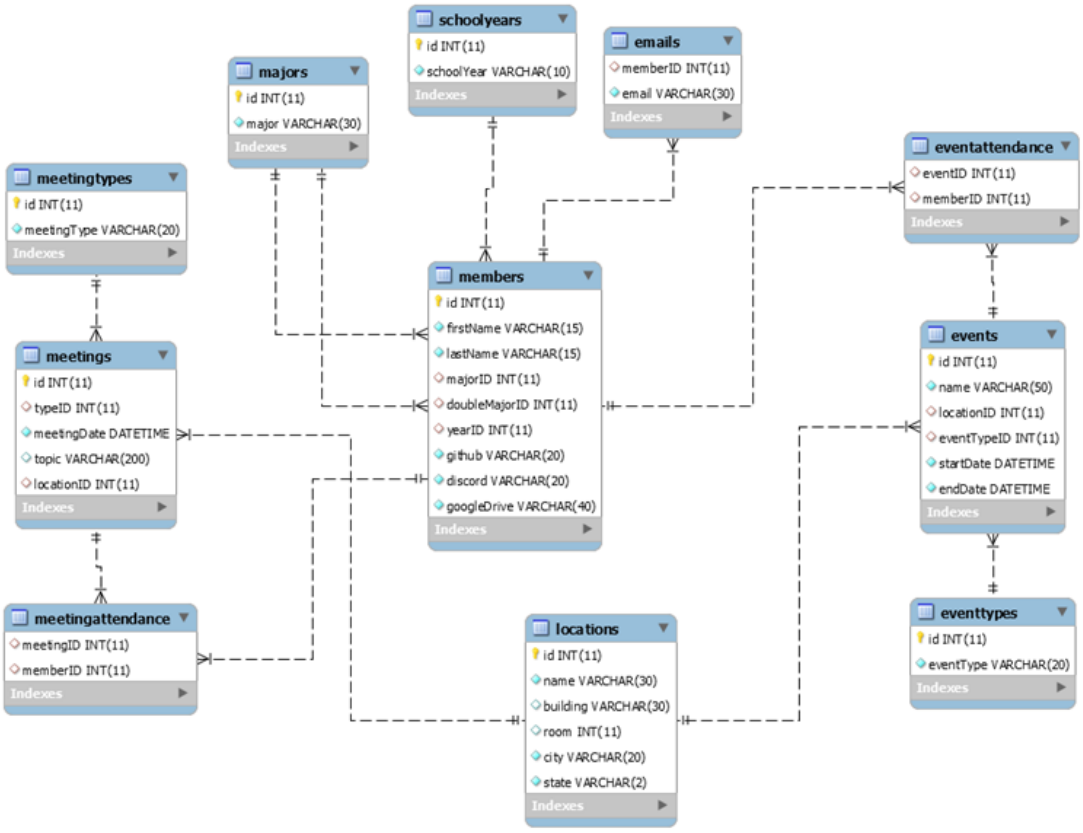

Fig. 1. ER Diagram of the UNL Game Dev Club member database.

entries, event entries, member information (both past and present), and a list of emails that can be used in a custom email script.

As shown in Figure 1, the database is structured in a relational schema and is centered around the members table, which tracks the members' names, school year, major, and information for club-related resources. From the members table, the database can track which meetings each member has attended, which events they have attended, and which emails the member has on file with the club. For each meeting, the database tracks the main topic of the meeting, the date, the location, and what type of meeting was held. The meeting types include, but are not limited to, demos, elections, and work days. For each event, the database tracks the name of the event, the location, the type of event, the start date, and the end date. The start date and end date are significant for tracking multiple-day events such as competitions. The types of events include, but are not limited to, competitions, recruiting events, and talks with guest speakers.

Ultimately, the purpose of this database is to maintain data in a scalable, searchable manner. One major use case to consider is determining which members maintained voting member attendance requirements. This structure easily allows for querying the database to determine which members attended during which months. Another use case to consider is determining which students come from which majors. Further, prior to the creation of this database, the member demographic was not previously well-documented so the authors had to collaborate with club officers to complete the database entries for all members. With this relational data structure, the officers can now query the database and determine which majors are well-represented, which majors are under-represented, and other useful demographic information to facilitate recruitment. In addition to current records, the club officers are also free to create new record categories in the future and can map that to existing member information without effort. A potential extension could be appending finances and fundraising records, including tracking dues, member "accounts", and more. Considering these use cases, the authors have determined that the goal of a scalable, easily searchable record keeping medium has been satisfied.

III. Visualization and Analysis

To assist in the analysis of the member background and attendance records, the data was exported from MySQL to various file formats to be used in D3JS-based web graphic templates [4]. This project used four templates from ObservableHQ.com [5] and bl.ocks.org [6] that best fit the data and visualized it in an intuitive manner for new officers to maintain. The four main

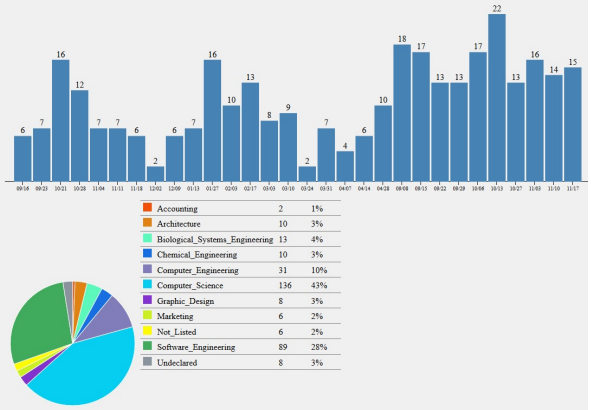

Fig. 2. Attendance trends with major distribution in the form of Pie and Bar charts.

Fig. 3. Sunburst chart showing membership demographics for all three semesters.

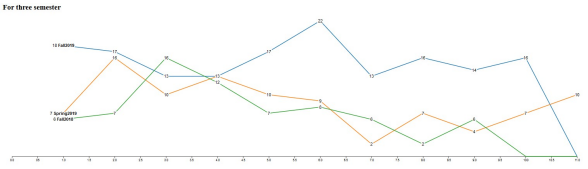

Fig. 4. Comparison of general attendance performance across each semester with Line graph.

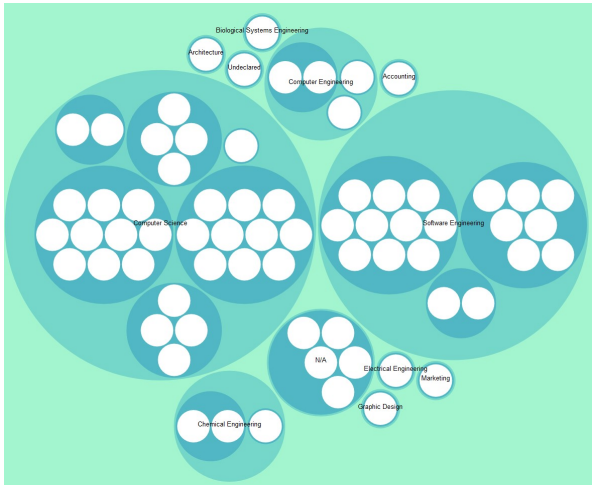

Fig. 5. Circle Packing diagram showing membership demographics for all three semesters.

templates we picked are simple dashboard with pie and bar [8], line graphs [1], zoomable sunburst [3], and circle packing [2]. The pie and bar chart and the line graphs delineate attendance trends from different perspectives, the other two graphics present member background information i.e. major, schoolyear. Whereas some diagrams are similar to each other, each portrays the target information in a different manner.

As shown in Figure 2, the pie and bar chart is an interactable visualization of the club's attendance records. The bar chart shows the general attendance performance for meetings across entire three semesters. The pie chart uses a number of distinct colors to represent different majors, and then partition into pieces based on the total attendance of students from each major. When the user hovers over the bars representing each meeting, the pie chart likewise shifts to reflect the distribution of the students in attendance for that selected meeting. Then if the user hovers over the pie chart, the bar chart likewise shifts to show the attendance at each meeting of students from the corresponding major. Likewise, the line graph helps analyze these trends but with the added view of overlaying all three semesters. As shown in Figure 4, the user can see trends that may apply to all semesters, such as if attendance swells in the middle of the semester or dips at the end of the semester. The sunburst graphic helps show member background information across all three semesters in a pie chart type of graphic, including the major and school year for each student. Likewise, the circle packing graphic shows similar information but in a unique manner by having the size of each bubble reflect the number of students in each category. For instance, as there are more students majored in Computer Science than those from Software Engineering enrolling our club, the bubble representing Computer

Science is larger. The different types of graphics will likely allow future officers to gather different types of information to assist in recruiting and event planning.

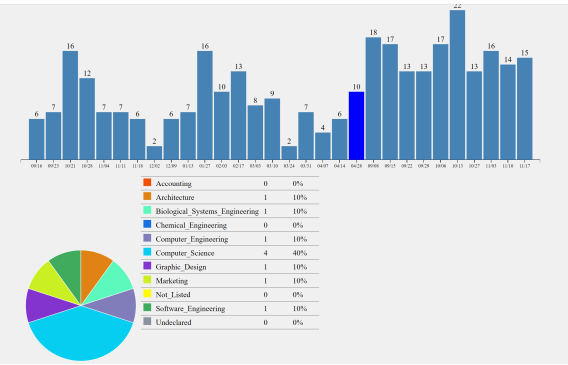

Fig. 6. An example of selecting specific meeting (04/28/2019) on bar chart.

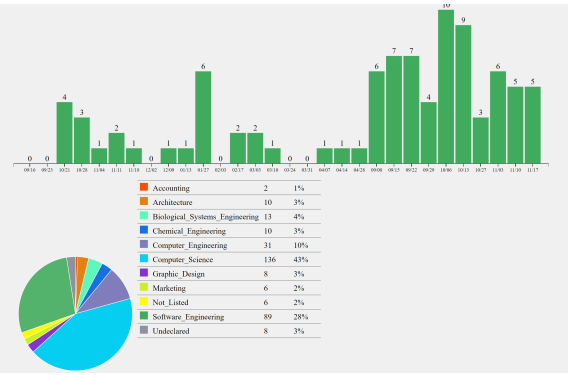

Fig. 7. An example of selecting specific department (Software Engineering) on pie chart.

Using the charts, the authors identified three main patterns in the data as follows: (1) The overall member attendance has increased steadily throughout the following three semesters. (2) The majority of club members, including past and present students, are Computer Science students but Software Engineering students make up a recent majority of active members. (3) There are several under-represented majors that consistently and actively participate in the club activities. The authors also identified minor findings as follows: (1) Some club members have only participated for one semester before leaving the club. (2) The overall member retention rate is low. In general, the analysis results provide a strong foundation for the club officers to improve both recruiting efforts and event planning. The authors have publicly posted the visual graphics via the UNL CSE servers at [9].

IV. Conclusions

This project was designed to assist in managing and maintaining records for the UNL Game Development Club. This database supports searchable and scalable mechanisms that facilitate for maintaining club records and enforcing policies such as attendance requirements. Further, by applying various templates, the authors visualized the member data and attendance trends to assist the UNL GDC officers in focusing their recruiting and event planning efforts. The analysis concluded that the club shows a trend of continuous growth but has under-represented majors that consistently and actively participate in the club activities. In addition, the analysis also shows issues with retention that the officers should address in the future.

V. Future Work

There are some records associated with club management that do not currently exist, including financial records. However, when it comes time to maintain these types of records, they can easily be added to the database and mapped to keep track of member ”accounts”, member dues, and more. In addition to this, it would be beneficial to provide a graphical front-end application to facilitate maintaining these records. Lastly, the analysis of the data did not consider any relation between attendance and school year, which might prove to be an interesting comparison and useful in improving retention. We plan to implement it in the near future.

Acknowledgment

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References

[1] M. Bostock. Inline lables/d3/observable. https://observablehq.com/@d3/inline-labels, October 2011. [Online].
[2] M. Bostock. Zoomable circle packing/d3/observable. https://observablehq.com/@d3/zoomable-circle-packing, November 2018. [Online].
[3] M. Bostock. Zoomable sunburst/d3/observable. https://observablehq.com/@d3/zoomable-sunburst, April 2018. [Online].
[4] M. Bostock. D3.js-data driven documents. https://d3js.org/, 2019. [Online].
[5] M. Bostock, M. Meckfessel, et al. The magic notbook for exploring data /observable. https://observablehq.com/, 2019. [Online].
[6] M. Bostock, M. Meckfessel, et al. Popular blocks - bl.ocks.org. https://bl.ocks.org/, 2019. [Online].
[7] Oracle Corporation. Mysql. https://www.mysql.com/, 2019. [Online].
[8] Pasha. Dashboard - bl.ocks.org. http://bl.ocks.org/NPashaP/96447623ef4d342ee09b, June 2018. [Online].
[9] R. Lafferty, J. Wang. Visualization of unl member data. https://cse.unl.edu/~rlafferty/Vis, December 2019. [Online].