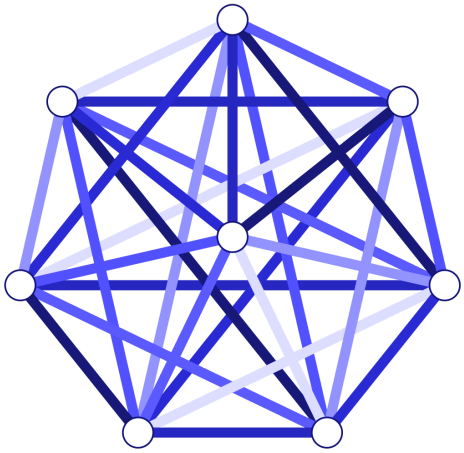
Clik



CSCI 6600
Database Management Systems

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Section 1: Introduction

Purpose

The purpose of this document is to serve as a resource outlining the life cycle of the application Clik. Important notes from the phases of development are included in the sections that follow from the conception, stakeholder identification, user and use case exploration, requirements analysis, implementation and testing of the project. All code and documentation are available at the GitHub https://github.com/KelleClark/database_project

Intended Audience

This report is intended to be used by Dr. Ding and the members of the team as part of the conceptualization phase for the Database Management Team Project.

Section 2: Project Proposal

Section 2.1 Promoting Real Social Connections

An objective of social media platforms is to connect members with individuals and groups who share similar interests or connections. While FB, Twitter, LI, Reddit and Instagram provide users with an enjoyable and useful service, many believe that these social media sites make users less social. Current social applications available indirectly promote more time behind the screen, encourage individuals to make large and superficial connections, and enable the consumption of curated information that does not reflect reality. This project aims to provide users with some of the functionality of benchmark social media applications but with a focus on a design that improves real interaction between users. The proposed system would include a three tier design implemented as a locally hosted web application for the scope of this semester-long project.

The overarching goal for the system, as viewed by the team, is to bring people together in authentic ways that foster real relationships off screen. The application's use cases will be constructed in early stages of development as the team explores the personas of typical users and the tasks and goals of those users. Possible use cases are to enable the user to create small social circles and to enable the user to engage in face-to-face interactions in real-time.

Section 2.2 The Plan

The development of the application will follow the Agile methodology with frequent and brief updates regarding the project as a whole and the use of sprints with deliverables aimed to generate momentum toward the project's completion. The team will communicate through Microsoft Teams and have set up both a GitHub and Overleaf shared repositories for version control and collaboration.

As the team members have worked well together on a previous project in a Software Engineering course in the Fall of 2020, the team has already established good communication and mutual trust. Kelle and Greg are also currently taking Web Application and this course, Database Management, providing them with the skills necessary to develop every component of this project.

The team will devise a timeline for the phases and sprints for the project that allows for iterative development and testing with a presentation preferred on April 15th. The first sprint has already begun for the team and entails the choice of DDL/DML and developing environment. Other sprints will involve identifying the users of the system, outlining the functional requirements and use cases, developing context diagrams, workflow diagrams and use case diagram, creating the schema of the required databases, building prototypes of the website, construction of test cases and logging changes for the system, implementing the front-end using html, CSS and bootstrap, jQuery and JavaScript.

Section 2.3 The Deliverables

1. A database to capture members, messages, events, and interactions. This database will also capture relationships between entities.

2. A web based platform that recommends activities to friends and groups of friends including: group chats, events, and the introduction of new friends to existing groups that share similar interests.

3. The documentation for the application that describes the relational schema, a user's guide and the testing performed on the system's functionality.

Section 3 The Stakeholders

This system is being constructed to assist users who desire to connect with local friends by attending events: getting a coffee or playing in a pick-up game of soccer, hiking a trail or browsing a gardening outlet for great deals. Loneliness and isolation are the problem, and this application aims to help a person connect with others by offering the person a way to create

small groups of “local” people they know (knowds and pronounced “nodes”), offer up and show interest in activities (events) and get out from behind the screen ...wearing a mask...and get out from behind the devices that isolate people.

It follows that the primary stakeholder of this system is a user who can benefit from broadening their circle of friends. These friends can enjoy simple acts together like a walk in the park, browsing a nursery for plants, throwing a frisbee, or maybe hitting some range balls. The secondary stakeholders are the team members who will learn a whole lot about the design of a database that serves as the backend of a simple application and the life cycle of the application’s development. Other stakeholders include Professor Ding and the other students in CSCI6600 that the team will share the project with.

Section 4 Users and Use Cases

The users of this system will include those individuals who will interact with the system as described in the previous section as well as the components within the three layers of the system’s architecture: the frontend (browser), the business layer (server) and the backend (graphical database management system). hosting the application and the system used to manage the database. We summarize these users in an Actor-Use Case Description Table, Table 4.1.

Table 4.1 Actor-Use Case Description Table for Clik

User/Actor	Description
Friend	Wishes to interact with a system through a web-browser on different devices and receive value from the system by posting activities, adding friends to their network and finding events/friends that align with their interest.
Developer	Wishes to design, implement and test the system including a database that holds tables of records that satisfies all relevant requirements of the system.
Dr Ding	Wishes to inspect the collection of deliverables of the project and judge the package based on a set rubric.
Classmates	Wish to be presented with an interesting database concept and application of concepts learned in the course
server	The system will be hosted on a local server using bolt type protocol (bolt://localhost:7687) and neo4j-driver to consume transactions during a react session.
database	Neo4j Desktop will manage and allow for queries on the

	collection of nodes, friends and events,and edges (relationships connecting a record in the friends table with a record in the events table) as a graphical database.
browser	The browser will render chosen views of the model and relay communications between a Friend and the server in order for the Friend to complete tasks.

The use cases for the actors are presented in Table 4.2, and the team used these use cases to explore the requirements for the system in Section 6.

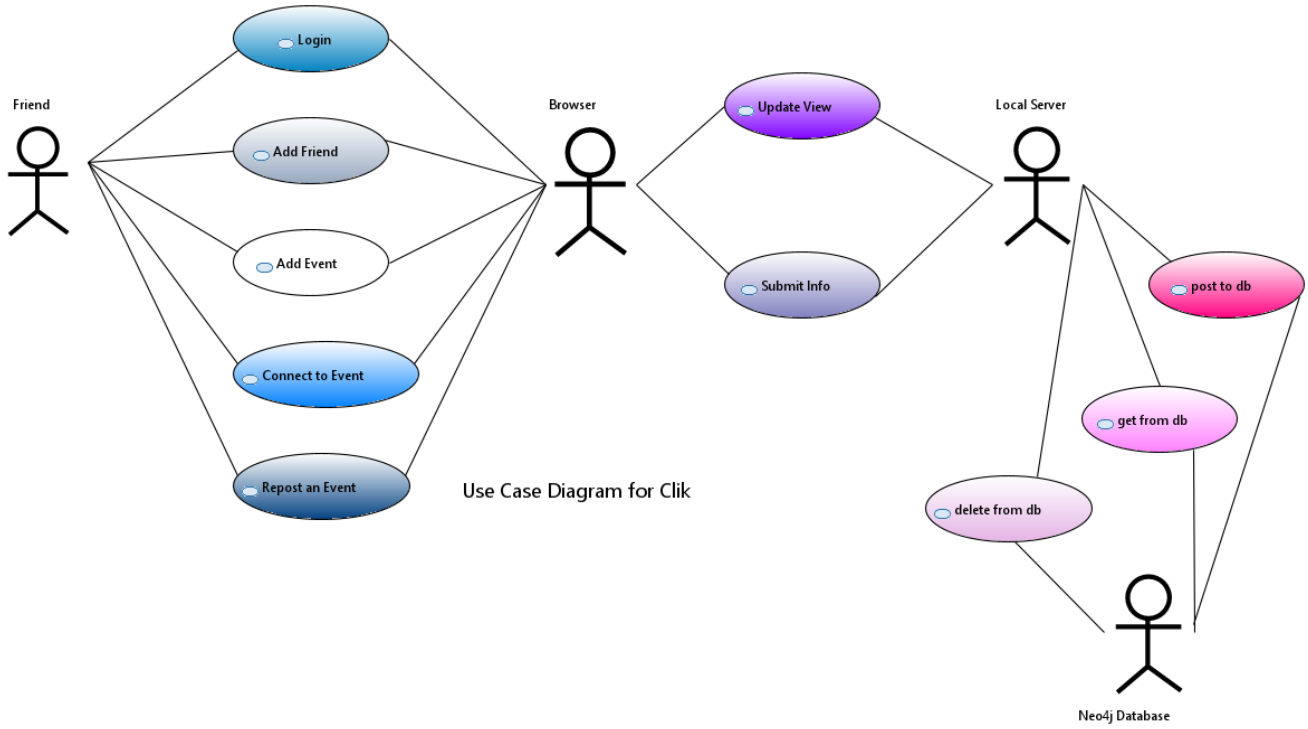
Table 4.2 Use Cases

Use Case	Description
1. Login	A Friend wants to log into the system.
2. Add Friend	A Friend wants to add another Friend user to their network of Friends.
3. Add Event	A Friend wants to add an Event to their network of Events.
4. Connect to an Event	A Friend wants to demonstrate interest in an Event posted by another Friend.
5. Repost an Event	A Friend wants to repost an Event that will increase the network of that Event.
6. Update View	The server will communicate when it is appropriate to update the view based on communication from the database or communication from the Friend.
7. Submit Information	An action has been completed by a Friend through the Browser, information will be communicated to the Server.
8. Post to Database	The Server requests that a new node Friend Event or a new relationship interestIn or rePost be added to the database.
9. Get from Database	The Server will query and manage the database.
10. Delete from Database	The Server will ask for a record to be deleted from the database.

Section 5 Use Case Diagram

After identifying the Use Cases and the Actors for Clik, the team put together a Use Case Diagram Figure 5.1 to illustrate the associations between these two identities using the Papyrus extension within the Eclipse IDE.

Figurer 5.1 Use Case Diagram



Section 6 Requirements Analysis

The functional requirements, to date, as identified by the development team are listed in the following two sections. In List 6.1 the functional requirements for the system Clik where the focus is on what the system should be able to do. The requirement on the measurable performance features of the system is a relatively short list in that the development team and stakeholders in general have not hashed out the details of necessarily metrics in performance.

List 6.1 Functional Requirements to date:

1. The system should allow a Friend to sign up and log in to the system with a username and password
2. The system should keep the username and password information of all Friends in a secure database

3. The system should allow a Friend to view their Clik network of Friends and Events with connection between Friends and Events.
4. The system should allow a Friend to add a Friend to their Clik network.
5. The system should allow a Friend to delete a Friend from their Clik network.
6. The system should allow a Friend to add an Event to their Clik network.
7. The system should allow a Friend to delete an Event from their Clik network.
8. The system should allow a Friend to demonstrate interest in an Event in their Clik network.
9. The system should allow a Friend to rePost an Event of a Friend in their Clik network so that Friends not in a shared network can demonstrate interest in the Event.
10. The system should maintain a database with a node for each Friend, each Event and relationships between Friends and Events as a common edge between a Friend and Event.
11. The system should be documented with all code available, a requirements.txt file and README.md file that assists Dr. Ding and classmates to follow the production of the system.
12. The system should be able to run within Microsoft Edge, Google Chrome or FireFox browsers.
13. The system should be able to run on a Window, Mac or Linux operating system.

List 6.2 Non-Functional Requirements to date:

1. The system should take no more than 1 minute to reload with a new graph of Friends and Events.

Section 7 The Creation of the Database

The Database is the primary focus of this project. The team chose to first explore the attributes and tables that would be needed for Clik using a familiar relational database model approach and also to investigate other types of database designs such as a graphical database system. For this graphical interface we used a Microsoft SQL Server database instance with SQL Server Management Studio GUI tool to render the entity relationship diagram.

Section 7.1 A Relational Database Approach

Figure 7.1 The Beginnings of a Relational Database for Clik

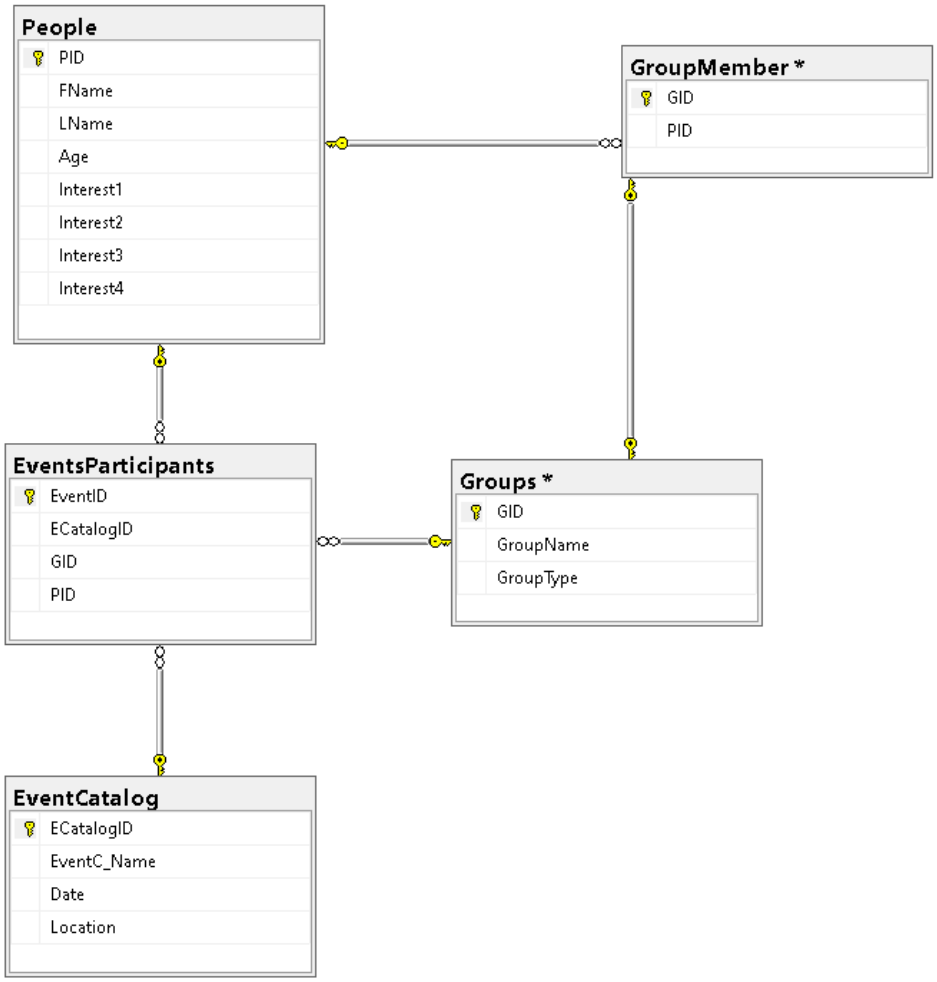


Figure 7.2 the DDL used to create a Relational Database for Clik

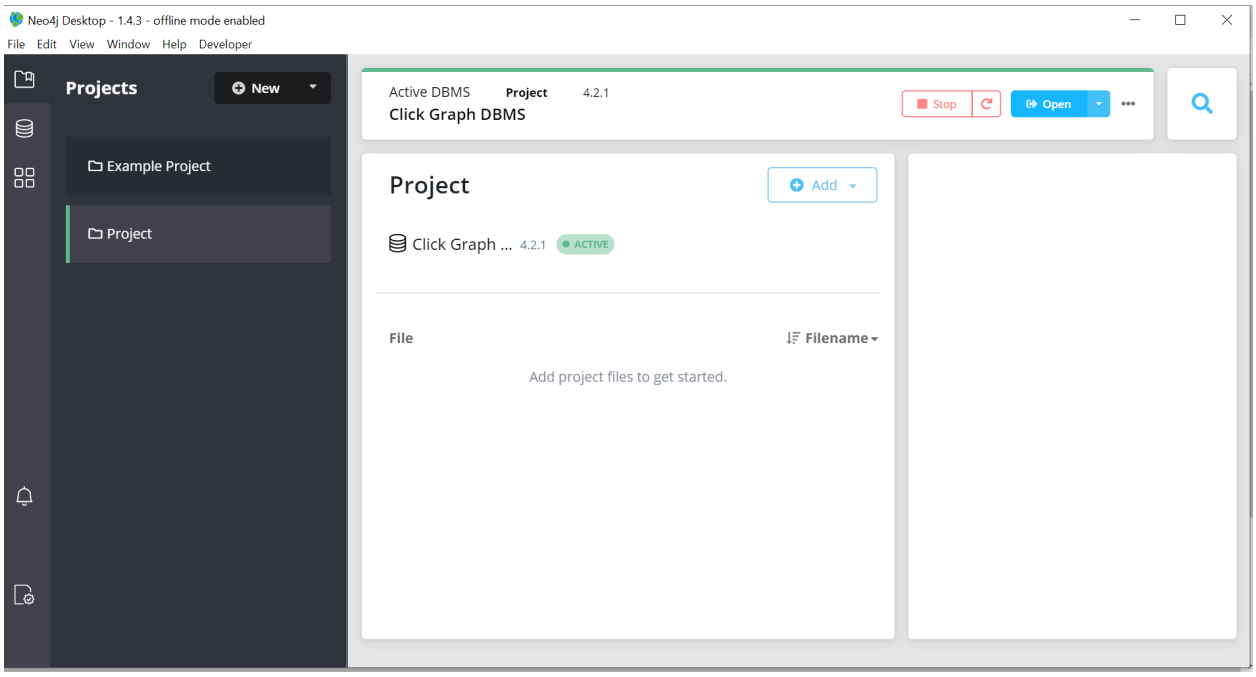
```
Create Table People
(
 PID INT Primary Key
,FName NVarchar(255) Not NULL
,LName NVarchar(255) NOT NULL
,Age INT NOT NULL
,Interest1 Nvarchar(255)
,Interest2 Nvarchar(255)
,Interest3 Nvarchar(255)
,Interest4 NVarchar(255)
)


Create Table Groups
(
GID INT Primary Key
,GroupName NVarchar(255) Not NULL
,GroupType Nvarchar(255) NOT NULL

)

Create Table GroupMember
(
GID INT Primary Key
,PID INT FOREIGN KEY REFERENCES People(PID)
)


Create Table EventCatalog
(
ECatalogID INT Primary Key
,EventC_Name NVarchar(255) Not NULL
,Date DateTime NOT NULL
,Location Nvarchar(255) NOT NULL
)


Create Table [EventsParticipants]
(
EventID INT PRIMARY KEY
,ECatalogID INT NOT NULL FOREIGN KEY REFERENCES EventCatalog(ECatalogID)
,GID INT FOREIGN KEY REFERENCES Groups(GID)
,PID INT FOREIGN KEY REFERENCES People(PID)
)
```

Section 7.2 A Graphical Database Approach

The team decided to explore the possibilities of other types of databases for this application, in particular the team created a graph database for Clik. The concept of allowing each Friend and each Event to be represented as a node within a graph, the relationships between the two records to be embedded and stored within these nodes and to capitalize on the rendering of the database as a graph in the browser was of great interest to the team. Using a graph database allows some queries on the database to run very quickly and there are graphing algorithms built into most graphical database management systems that can provide future features to the application. One such utilization of a path analysis algorithm within a graph allows “influencers” to be identified. In the context of Clik, an influencer could be defined to be a Friend who is associated with a high number of reposted events.

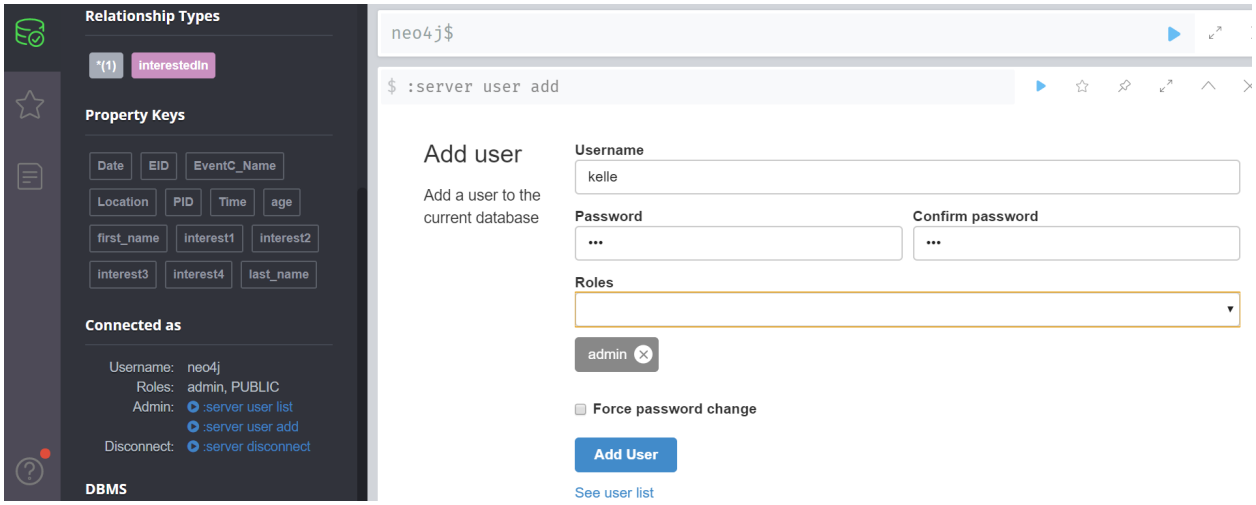
To create the graphical database, the team used the desktop community version of Neo4j available to https://neo4j.com. Within neo4j, a new project “ClickGraph’ was created and then opened with the blue button on the top right of the GUI (Fig 7.3)

Figure 7.3 Neo4j Desktop Software



Once the database is active and opened, a user with their role and password can be set. In Figure 7.4, the user is kelle is added with the role of an administrator and the password is set to 1111. These are important parameters used in the configuration of the driver to connect the local server and the application.

Figure 7.4 The Neo4j Browser User Interface



Next, the database is built one node at a time using the Cypher DDL/DML. To create a Person record from the People Table of the original relational database described above, one uses the sequence of key words and strings or integers followed by the “play” button in the desktop or browser edition of neo4j.

```
create (p:Person {PID:0003,  first_name: "greg", last_name:"sutton", age: "null", interest1: "gardening", interest2: 'travel', interest3:'pets', interest4:'baking'})
```

Here there is no way to set the constraint that the PID is unique, but we will allow a user to enter in the other attribute values and create the node with care to use distinct PID so that PID can be the Primary Key for these nodes. However, when you create any node or edge in neo4j, the system assigns that element a unique identifier...an id. The <id> can be used as a way to uniquely access a node, but it will not prevent multiple records from being created with the same value of all attributes. I accidentally created another Person node with no attribute values, and the neo4j system created a node with <id> = 4 (the fourth node created). To remove this node, it must not have any edges, and so I needed to use the command below to remove the entry from the database.

```
MATCH (n:Person) where id(n)=4
DETACH DELETE n
```

To view a node, you need to find the node in the graph database and return the node. The code to see the Person node with PID 003, use:

```
match (n:Person) where n.PID=003 return n
```

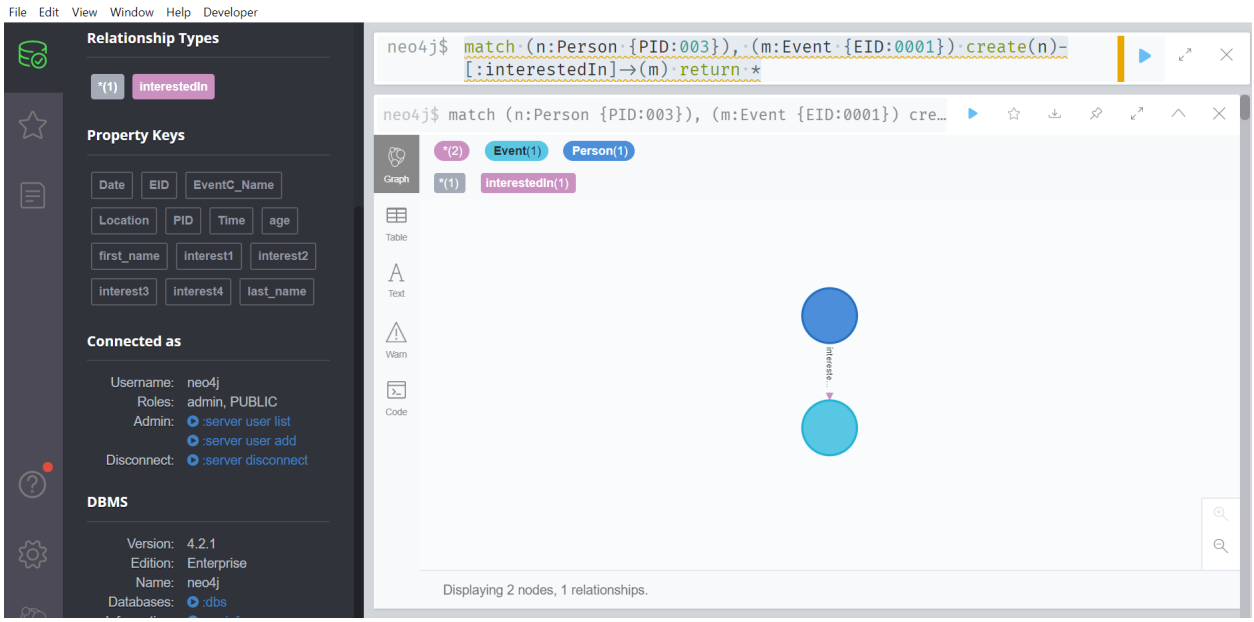
To generate a beginning database for testing the application, the team created a number of Persons and Events. An example cypher line to create the Event with PID 0001 is:

```
create (e:Event {EID:0001,EventC_Name:"",Date:'04/01/2021',Location:'OMally_Bar',Time:'2100'})
```

And to establish an edge demonstrating that Person PID 003 is interestedIn the Event EID 0001, use the cypher command below. The results can be viewed as a graph, a table or as a list of json objects as shown in Figure 7.5

```
match (n:Person {PID:003}), (m:Event {EID:0001}) create(n)-[:interestedIn]->(m) return *
```

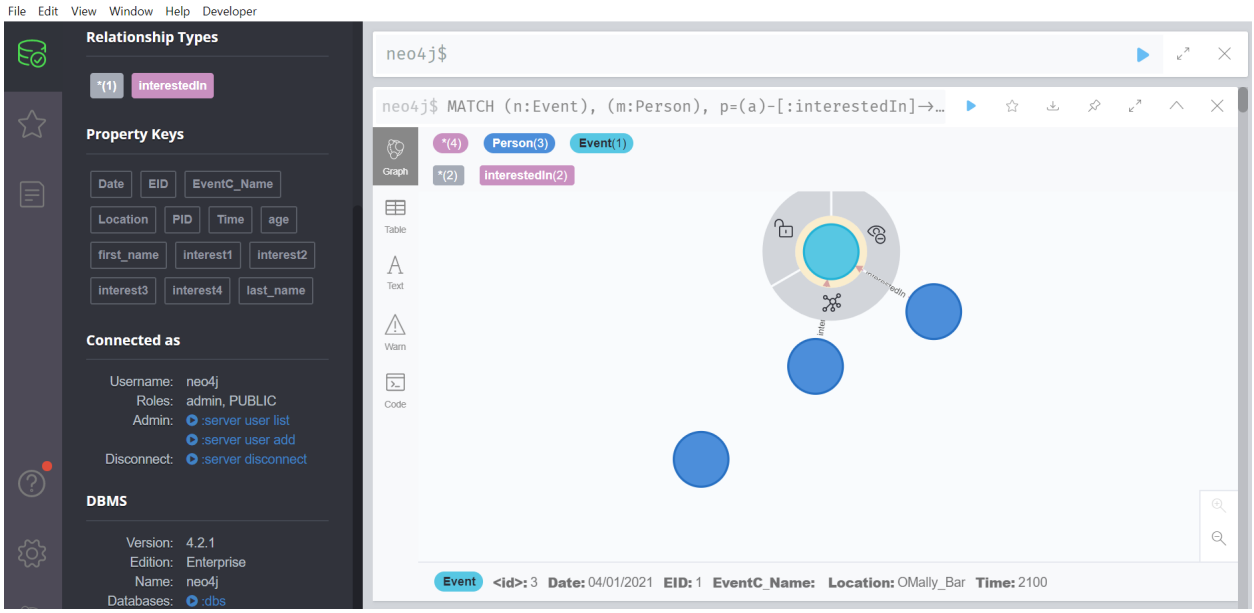
Figure 7.5 The views of the database



The entire collection of Events and Persons is the Clik network that would be seen by kelle if this person was the logged in user interacting with Clik. To gain access the three different views of the data (as a table, as code and as a graph) use the command below and the network illustrates the friend Kelle and Greg are both interested in attending the event on 4/01/2021 at 2100 hours at O'Mally Bar (note the attributes in Figure 7.6 below).

```
match (n:Person), (m:Event), p=(a)-[:interestedIn]->(b) return *
```

Figure 7.6 The attributes and Neo4j system defined id for each node is unique for every node.



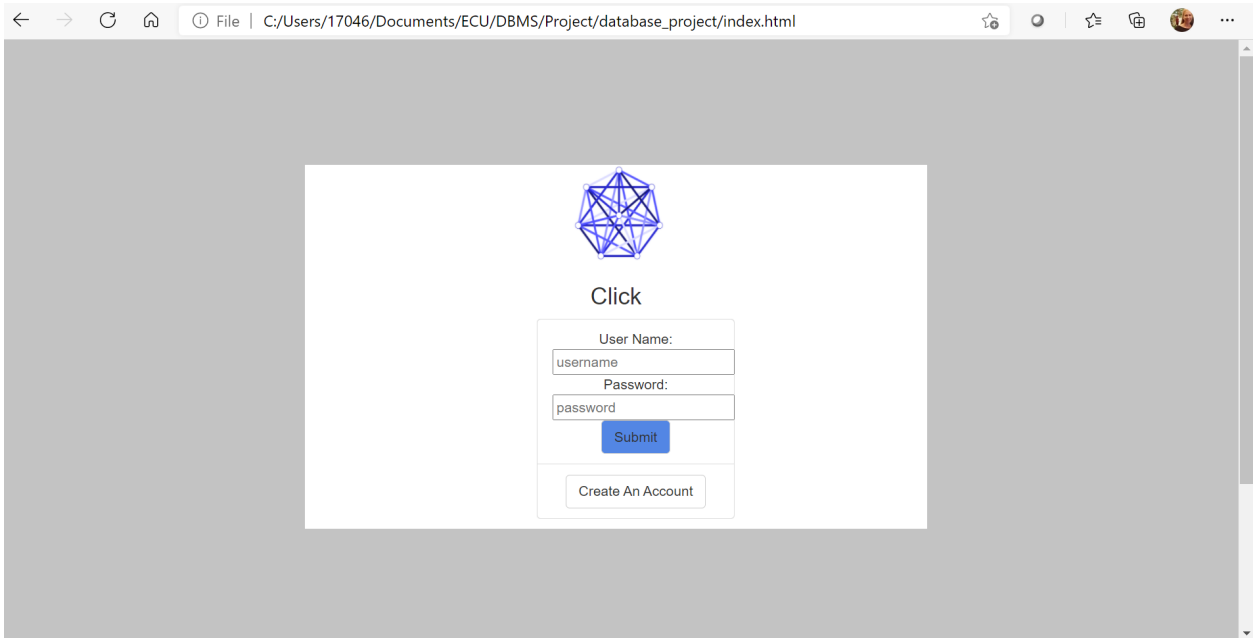
Section 8 The User Interface and Happy Flow

The team is developing the User Interface (UI) incrementally. Currently, the team is using the neovis driver to render the graph. Another option for the system would be to use D3js and the simple neo4j driver for javascript which would potentially make options for color choice and the labeling of the nodes available to the user.

The “happy flow” for a user of the system will consist of:

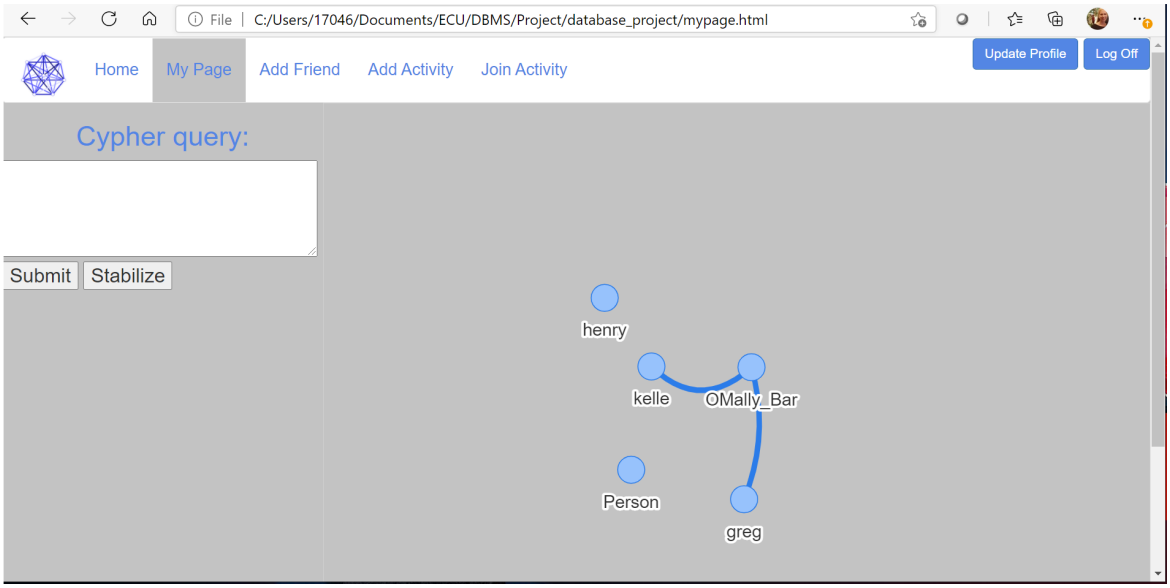
1. Person will sign up with a username and password that is unique in the database (the system will check this). A node will be added to the database with the username and password.

Figure 8.1 The home page of Clik (Click)



2. Person will sign in with their credentials. When authenticated, the system will update the user view to mypage.html that displays only the friend and events in the user's node. The current mypage.html (Figure 8.2) shows that the team has gained control over color scheme including the KNOWDS and Events.
3. The Person will add a Friend, add an event, update their profile.

Figure 8.2 The Person's view of their KNOWD Network



Section 9 The Database

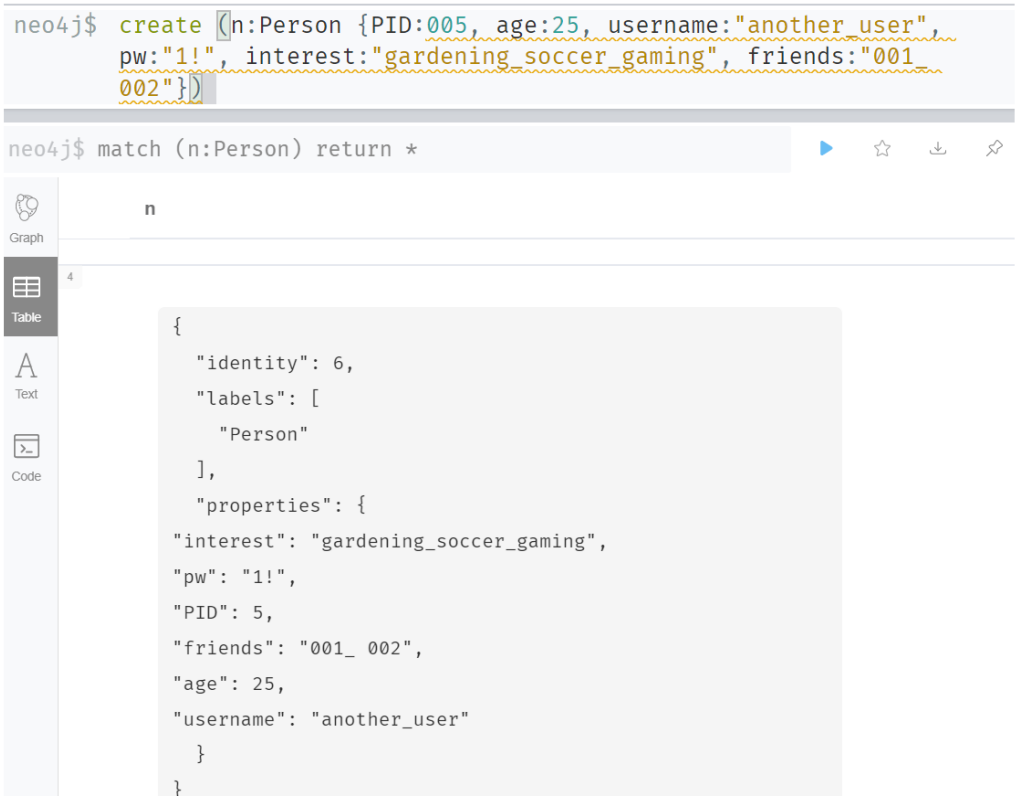
To connect the Clik website to the Neo4j Clik database, the team utilized the open source javascript code libraries Neovis.js (https://github.com/neo4j-contrib/neovis.js/) and npm (https://docs.npmjs.com/) for their ability to connect to Neo4j instances, create visualization features for the website and to compile our code. The team also imported ajax and bootstrap libraries for current and future feature development. The mypage.html code is included in Figure 9.1 to demonstrate the configuration embedded.

9.1 The html document for the “mypage.html” rendered by the browser when a user is logged in.

```
153
154         <script src='C:\Users\17046\node_modules\neovis.js\dist\neovis.js'></script> -->
155
156     <script src='https://cdn.neo4jlabs.com/neovis.js/v1.5.0/neovis.js'></script>
157         <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.min.js"></script>
158         <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.0/js/bootstrap.min.js"></script>
159
160
161     <script
162             src="https://code.jquery.com/jquery-3.2.1.min.js"
163             integrity="sha256-hwg4gsxgFZhOsEEamdOYGBf13FyQuiTwlAQgxVSNgt4="
164             crossorigin="anonymous"></script>
165
166     <script type="text/javascript">
167                 // define config car
168                 // instantiate nodevis object
169                 // draw
170
171                 var viz;
172
173                 function draw() {
174                         var config = {
175                                 container_id: "viz",
176                                 server_url: "bolt://localhost:7687",
177                                 server_user: "kelle",
178                                 server_password: "111",
179                                 labels: {
180                                         //"Person": "name",
181                                         "Person": {
182                                                 "caption": "first_name",
183                                                 "size": "2",
184                                                 "community": "10"
185                                                 //"sizeCypher": "MATCH (n) WHERE id(n) = {id} MATCH (n)-[r]-() RETURN sum(r.weight) AS c"
186                                         },
187                                         "Event":{
188                                                 "caption":"Location",
189                                                 "size": "1",
190                                                 "community": "5"
191                                         }
192                                 },
193                                 relationships: {
194                                         "interestedIn": {
195                                                 "thickness": 1,
196                                                 "caption": false
197                                         }
198                                 },
199                                 initial_cypher: "MATCH n=(:Person), m=(:Event),p=(:Person)-[:interestedIn]->(:Event) RETURN n,m,p"
200                         };
201
202                         viz = new NeoVis.default(config);
203                         viz.render();
204                         console.log(viz);
205
206                 }
207     </script>
```

An update of the database node was required to accommodate a design change allowing for a Person to SignUp, SignIn and only see Persons in their KNOWD network in the view. The new database for a Person is shown in Figure 9.2.

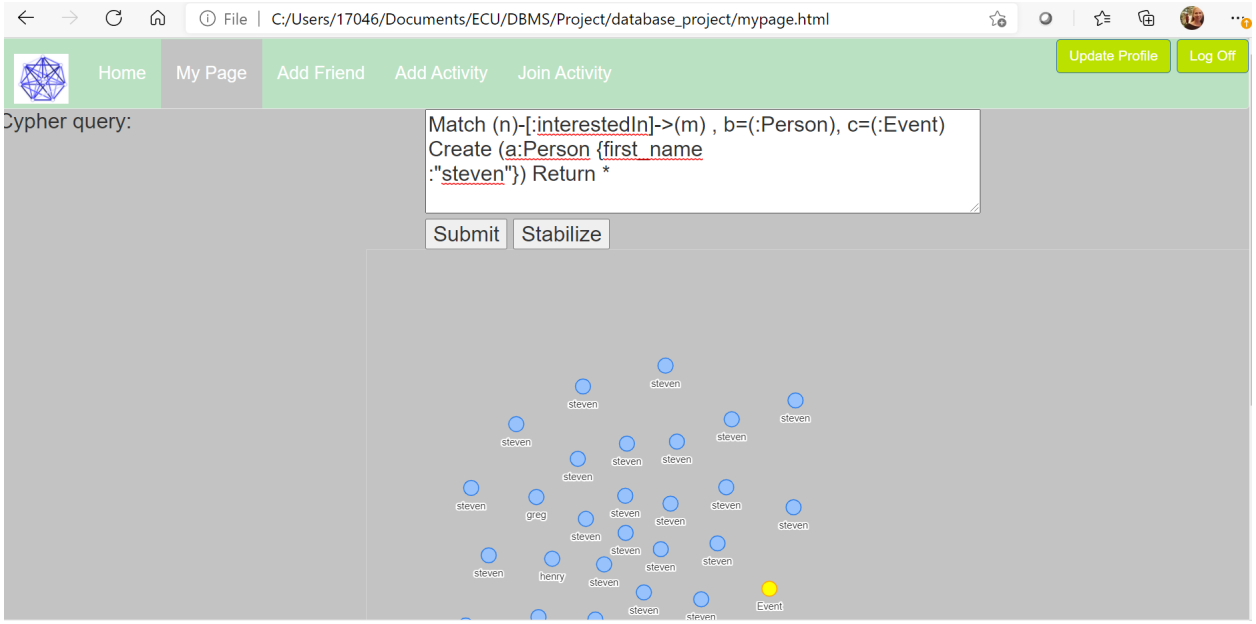
Figure 9.2 Person



The change of attributes to allow a user (Person) to sign in will use a username instead of first_name and last_name and creates a password string attribute. The Persons' in the user's network will be indicated by a string of PID (Person Identification) where each unique PID is separated by an underscore delimiter allowing the system to parse the value of this attribute, match Persons in the database on this attribute and to return all KNOWDS (Friends of the user) and Events posted by these KNOWDS.

Other information about the user's age and interest can be updated when the user selects the Update Profile feature of the application. When the user signs in, the application will be able to authenticate the credentials using the database using the unique username.

The system currently implements many features through a Cypher Query textbox. This input allows the user to enter in cypher code to add a Friend, add an Event, or Search for Persons with similar interest. This textbox will be updated into "stored procedures" that accept only the value from a set form and enable the user to interact with the database without having to know cypher. Note, this is also how the team discovered the need for a delete option...way too many Friends named Steven AND the need for distinct record control through this (earlier) UI.



Section 10 The Continued Plan

While our presentation is quickly approaching, the team feels confident that they will be able to provide the following features within the application before they present.

1. Implement constraints on a Person username and password to that they are unique.
2. Allow a user to add a friend, add an event without using cypher code, rather use a form or select an entry from a table.
3. Develop a test database
4. Make some progress to using available graph algorithms to demonstrate influencer analysis in the database.
5. Continue to improve the quality of the UI and design for appeal and ease of use.