Sense of Belongingness of a student on-campus

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ABSTRACT

Sense of belongingness is very important for a student. Measuring it is a challenging task. We designed an app to gather data of how students are feeling at different locations through which we can the sense of belongingness of a student in the university. The app collects the location data of the student when he/she is in the premises of university. The App shoots the relevant questions to find out the belongingness of the student.

Students who feel they are participating tend to find and use campus resources more broadly, driving their success. To know how engaged the students are in the university's resources we are sending them the survey of 2- 6 questions randomly.

While we agree that the characteristics of the environment influence the way people think, feel, and behave, we disagree about which aspects of the environment have psychological consequences. Physical environment, including location, is often one of the objective characteristics associated with a situation. The places people visit regularly can be consistently associated with a set of factors, thus representing a type of situation that has psychological consequences and has a clear connection with the individual location.

So, we are retrieving the locations visited by the user in the university and sending surveys specific to location in university to analyze the sense of belongingness at each location. We had 10 users who installed the app. A notification at 11AM is sent to them to fill out the survey. We analyzed the response rate of their survey and also analyzed how they are feeling at different locations in the campus.

KEYWORDS

Outlier detection, Sense of belongingness, Community sensing.

ACM Reference format:

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INTRODUCTION:

PROOF OF CONCEPT : The project focuses on retrieving the location of the user based on the GPS. We are thinking to use GPS(GPS positioning system) which can be used to get the accurate location of the user. The App will shoot the questions to the user based on the user's location. The questions are asked to infer whether the student feels that he/she belongs to the community. The data collected is sent to the Database and is analyzed using Grafana, a data visualization tool. The user might get questions in between 2 to 5 questions.

In this paper we explain how important 'sense of belongingness' is and what methods have used to know the students state of mind. The react-native application collects the coordinates of location of the user once a day at 11:00 AM. The coordinates are stored in the database and the notifications are sent at later time in the day. The questions are shooted based on the location the student visited when the location was taken from the user. The future scope of the project would be to analyze individuals data and display those results to the user.

The surveys are not efficient these days. For example, if the survey is sent out to 100 people and only 10 % of them would return with the answers. Due to this very less data points, It is inefficient to know the problems and how the students are connected with the campus. We have tried different methods to motivate students to fill the survey by giving free student cash and give aways. Even after this marketing strategy we failed to bring the students for filling the survey. We have analyzed on why students are not responding to the surveys and had agreed on terms that students are receiving bulk emails in which our survey

can be missed out. Even though the student opens the survey, he is not answering all the questions due the size of the questionnaire as it contains 20 to 25 questions and few questions might not relate to them. So, In this project we were trying to figure out what would be the best time to send the survey, how many questions to send in the survey and what questions to send in the survey. To collect more data points, we have designed an application to improve the user experience and sending personalized notification and location related questions.

Belonging is an important aspect of college success, whether it's among classmates, in the classroom, or on campus. It can have an impact on a student's academic adjustment, achievement, goals, and even whether or not they continue in school. We know that belonging is a fundamental human motivation, and that everyone has a strong need to belong .

EXPLICIT CONTRIBUTIONS:

Back- End: Neerab, Front- End: Anuhya.

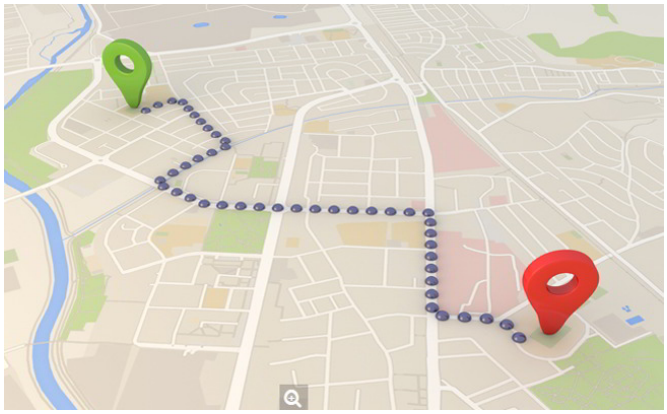


Figure 1:- **GPS Location sensing.**

1.1 LOCATION

1. The location coordinates are fetched from the network provider using the below sample code.

```
import { StatusBar } from 'expo-status-bar';
import React from 'react';
import { StyleSheet, Text, View } from 'react-native';
import * as Location from 'expo-location';

export default function App() {

  const checkPermission = async () => {
                const hasPermission = await
Location.requestPermissionsAsync();
    if (hasPermission.status === 'granted') {
      const permission = await askPermission();
      return permission;
    }
    return true;
  };

  const askPermission = async () => {
    const permission = await Location.getPermissionsAsync();
    return permission.status === 'granted';
  };

  const getUserLocation = async () => {
                const userLocation = await
Location.getCurrentPositionAsync();
    console.log(userLocation.coords);
    return userLocation.coords;
  };

  return (
    <View style={styles.container}>
          <Text>Open up App.js to start working on your app!
{ checkPermission()} </Text>
      askPermission()
      getUserLocation()

      <StatusBar style="auto" />
    </View>


  );
}

const styles = StyleSheet.create({
  container: {
    flex: 1,
    backgroundColor: '#fff',
    alignItems: 'center',
    justifyContent: 'center',
  },
});
```

2. If the user is present in a particular location within the campus, we retrieve the coordinates else the location data will be ignored.
3. We can also find out the congestion in the study areas based on the location and people connected to the network.
4. The App shoots the questions if it finds any anomaly in the location data.

Below are steps to find the anomaly in location data:

1. In order to run anomaly detection job, we must have the latitude and longitude.
2. A data visualizer is used like Grafana.

3. An Anomaly detection job should be created to monitor the anomalies in data

2.1 GPS Vs Wi-Fi LOCATION:

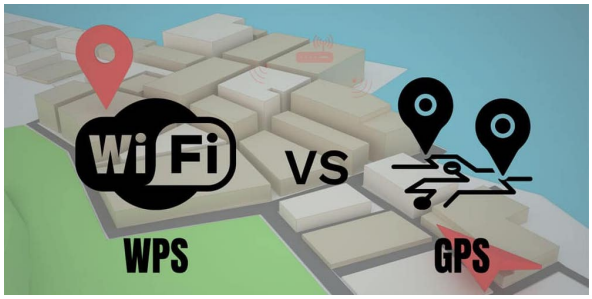


Figure 2:- **Wifi Vs GPS**

The way of acquiring location data is the fundamental distinction between GPS and Wifi locating systems. To calculate a user's location, GPS uses satellites orbiting the Earth, whereas Wifi locating technology uses relative network signal strength acquired from network access points. Each technology has its own set of advantages and disadvantages. Let's take a look at a few of them right now.

The Global Positioning System (GPS) is a radio-based navigation system controlled by the United States government. You must have a clear line of sight with at least four GPS satellites in order to use GPS properly. Mountains, clouds, buildings, and trees all diminish the likelihood of establishing a successful GPS connection.

Although GPS can locate you everywhere on the earth, regardless of how far away you are, it is not the most precise locating technology available. The accuracy of location can only be as close as 4 meters, or around 13 feet, depending on the equipment utilized.

When the user is inside a building, surrounded by buildings, clouds, or trees, however, GPS accuracy is further limited. As a result, GPS works best in wide places with a clear view of the terrain.

Cellular location technology is an umbrella word that encompasses a number of different locating technologies, such as Wifi and SIM-based approaches.

Cellular appears to fill in the gaps where GPS fails. Its powers shine in densely populated areas with a high density of cell towers. Because of how it employs crowdsourced Wi-Fi data, cellular methods thrive in buildings, cities, and heavily inhabited locations. It can determine the location of a device based on its distance from a group of network access points.

The cellular model's accuracy in locating a user's location within buildings and places with network coverage is another advantage. This technology can pinpoint a user's location to within a few feet, allowing emergency responders to take more effective action.

2.2 PRIVACY:

We will ask the user's permission to access the location of the user when he or she is in the campus. Location data outside of the university is not tracked and discarded.

2.3 EMPIRICAL METHODOLOGY:

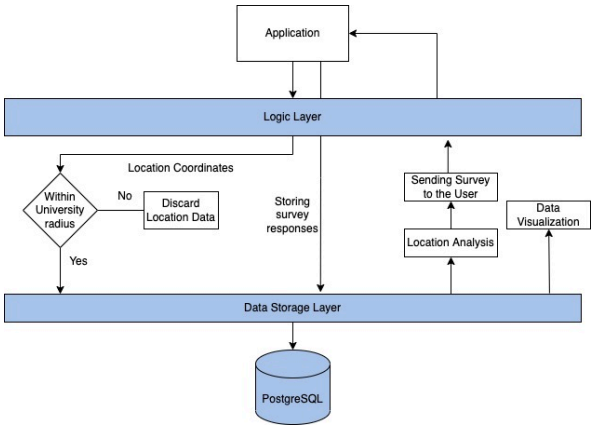


Figure 3:- **Architecture Diagram.**

Procedure:

- Data : We are using the location data generated by the application.

1. The application collects the coordinates of location from the user.
2. The data will be formatted and sent through a messaging queue to the back end.
3. Back end stores the data in database and process that data to identify if it is an outlier.
4. If there is a pattern change the application sends a survey to the user.

2.3 METHODS

I. USER'S MOST VISITED PLACE:

1. User's most visited place place is determined by taking the location data of the user and the data is undergone through cluster analysis. The cluster with most points is taken as the location that is spent most of the time on that particular day.

II. GENERATING QUESTIONS:

1. Once we get the user's most visited location, the questionnaire is prepared based on the location. The number of questions will be decided based on the previous answers he/she provided.

III. STORING ANSWERS:

1. Answers are stored in the database with the timestamp of when the user submitted the survey.

3. RELATED WORK:

In the paper 'Putting mood into context' [1] the user was sent a notification during the day. The location is self reported by the user using the app, whereas in our application we infer the location based on the location coordinates and compare it to the near by university buildings. so that user doesn't have to go through the hassle of reporting the location. In our application we are detailed questions unlike in the above mentioned article which only knows how the person is feeling at that place. we send out personalized questionnaire with questions ranging from 2 to 5.

In the paper protecting privacy in community sensing [6]. As we know privacy is a major concern in location based services such as traffic monitoring, maps , etc. How can we overcome this privacy concern so that user is not concerted about his location to the third party users. One approach they came up with defeat device type algorithms where they reveal the location updates to the third party application if it follows few rules. They have implemented algorithms such as bounding box, k- block. The motivation of this paper is not protect the users location all the times but how many times they can reveal so that any third party user cannot infer their location by using any prediction algorithms.

In the paper, driving towards the community sensing [8], they have tackled the privacy concern in a different way. As we know utilizing the private sensors such as camera, wifi, GPS location services where it takes into the concern of battery power and users dis-interest of not using this real time applications. In this real time location based applications, How can get the required data without accessing location continuously. In other words, can we optimize the calls to the user private device sensors to optimize the battery power and users increase usage of this applications. They came up with demand analysis, different predictive algorithms, which makes the final decision on when to access the private sensors.

In many papers authors are researching the sense of belongingness in a psychological aspect rather than analyzing it in a multi disciplinary way including mathematical and computer science point of views. In our project we came up questions that are shotted to the users with the help of psychology department at our university. This way our work stands out the rest.

In the paper 'Sense of belongingness at university'[2], the sample size is much more larger which is n=578. They have also analyzed the sense of belongingness of students who drop out. It also analyzed the level of belongingness of first generation college students.

In the paper 'journal of big data' [3] the outlier detection for graph based data is explained in a neat fashion. However we are using DBSCAN for the outlier detection in our application. We are using DBSCAN to identify the most visited place. The paper also compared and contrasted between supervised and unsupervised models.

In the paper 'Beyond diversity' [4], the paper explained about cultivating sense of belongingness in firms. However, they did not analyze how many feeling belonged as such. It seems like they considered only psychological point of view. To the contrast we are considering every point of view in our paper.

In the paper 'College student sense of belonging'[5], the author emphasized more on importance of community sensing and has shown real life instances and did not provide any kind of analysis on why sense of belongingness is most important in students.

In the paper 'sense of belonging' [7], the author focused more on first generation college students sense of belongingness and their financial aspects. The author also analyzed the completion rate of the degree of first generation college students unlike in our paper we analyzed the sense of belongingness of all students.

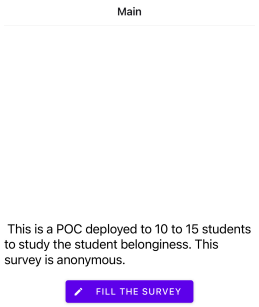
In this paper ' sense of belonging at school'[9], the author listed some attributes, if we follow we feel belonged to the community. The author has mentioned all the qualities that are needed to get involved in a community.

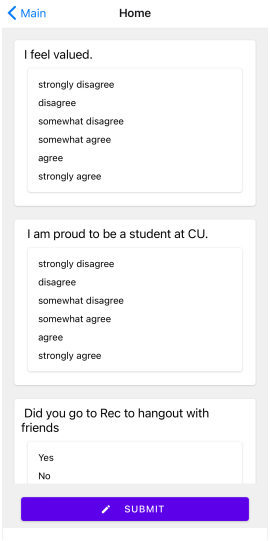
In this paper 'school belonging'[10], the author analyzes the school belonging and academic success and also the behavioral outcomes such as engagement and cognitive ability. The author analyzed that Schoo belongingness is very important for the student academic success.

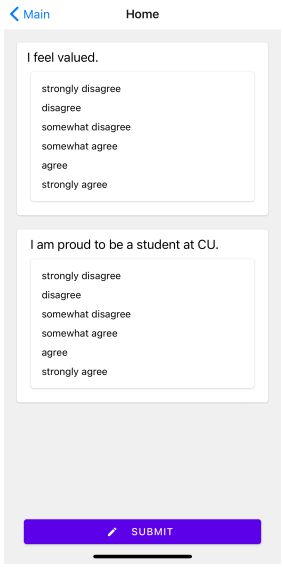
4. RESULTS:

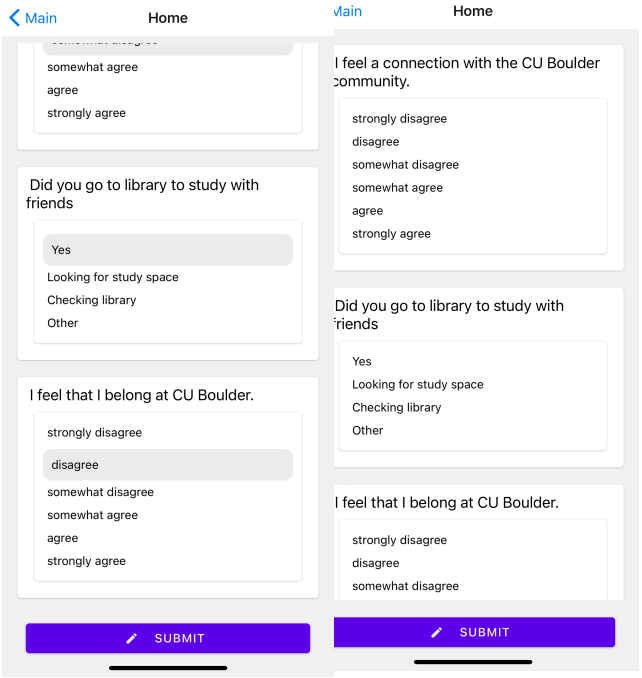
The response rate was higher when we shooted three questions rather than five questions. Most of the surveys are filled at 3:00 PM which we retrieved from the backend.

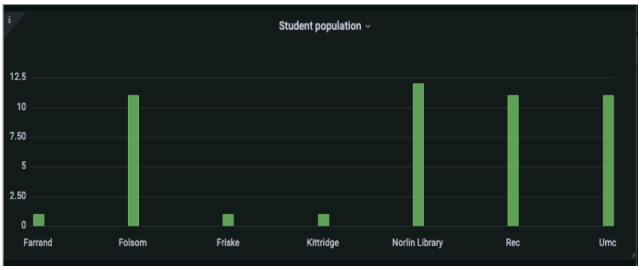
The survey was sent to 10 students with questions varying from 2 to 6 questions. We have sent the apk file to the android users. Apple developer account is needed for generating an IPA file for ios users. As the Developer account is 100$ and is costly for us, we decided to go with android apk file.

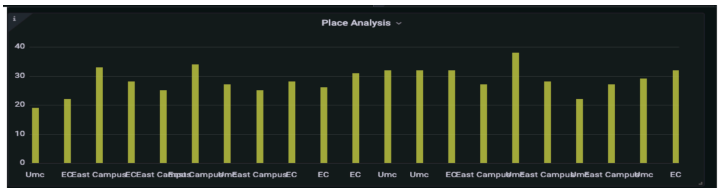












We analyzed the response rate for each student on the first day in the below table.

Response rate for the questions on the first day:

Student	Number of questions sent	Questions answered	Response rate
1	5	3	60%
2	4	4	100%
3	2	2	100%
4	3	2	66.66%
5	6	3	50%
6	4	4	100%
7	5	4	80%
8	3	3	100%
9	6	6	100%
10	4	3	75%

Response rate for the questions in 5-day interval:

We maintained a table to store the status of the survey sent to students, to analyze the response for the number of questions we sampled.

No of Questions	No of samples sent for 10 users in 5 days	No of samples completely filled	No of samples not filled completely	Response rate (who filled the survey completely)
2	12	10	2	83.33%
3	10	8	2	80%
4	6	4	2	66.66%
5	14	7	7	50%
6	8	3	5	37.5%

From the above table we were not able to figure out which particular 2 set question has the most response rate because the questions were randomized. However, we were able to figure out that sample of 2 and 3 questions has the most response rate.

Response rate for the questions ranging from 1 to 6 :

When we sent a survey ranging from two to six questions, some users responded their preference of number of questions ranging from one to six questions. In the below table we can see how many users submitted numbers of question in a survey irrespective of number of questions sent to them. In this analysis we considered both completely filled and partially filled surveys.

Question Sample	No of users answered
1	6
2	16
3	10
4	9
5	7
6	3

From the above analysis we found out that users are more inclined to fill one to three questions. Even though we did not include one question samples users preferred answering one question in long surveys with 4,5,6 question samples.

Response rate at different interval of time in a day:

We stored the timestamp at which the user is submitting the survey during the day.

The time at which most of the users responded is in between 1Pm to 3 PM. Overall more than 50 percent of the users submitted their survey in between the time interval of 1 PM to 5 PM during the day. Where as the users responded very less during the time interval of 9 PM to 11 PM in the night.

We can conclude from this as the users responded more in the afternoon to evening than in the morning or at night. As the number of users installed the app are 10, the analysis was limited. If there were more users participating in the survey we could analyze more as there would be sufficient data points to infer some knowledge.

Time Interval	Response rate
11 AM to 1 PM	10%
1 PM to 3 PM	33%
3 PM to 5 PM	27%
5 PM to 7 PM	18%
7 PM to 9 PM	10%
9 PM to 11 PM	2%

5. FUTURESCOPE:

1.We can generate more personalized survey questions for the user.

2. Displaying the analysis of their mood in various locations.

3. Visualization of the time the user spent most at various locations in the campus.

4. Projecting all the data points of location on the map to find out the density population at each of the study spaces which might look like the below image figure 2.

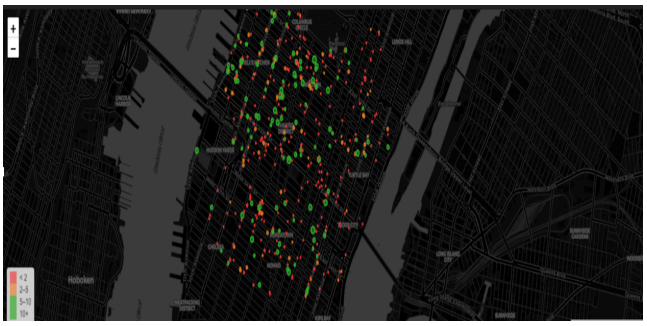


Figure 2:- **Plotting the data points of location**

6. CONCLUSION:

We developed an app to improve the sense of belongingness among the students at the university. The application collects the coordinates of the location data daily and stores it in a database. At the later time of the day the location data is analyzed and a survey is sent out to the user based on the location they visited when the location was tracked. The number of questions in the questionnaire varies from two to five and location specific questions were sent.

Questions that we used in the survey are:

1. I feel a connection with the CU Boulder community.

2. I feel like I fit in at CU Boulder.

3. I feel that I belong at CU Boulder.

4. I view CU Boulder as my home during my undergraduate years.

5. People on campus are generally supportive of my individual needs.

6. There are people on campus who are genuinely interested in me as a person.

7. There are people on campus who care about my future.

8. At CU, I'm treated like I belong.

9. I have a sense of community at CU.

10. I feel valued.

11. I am proud to be a student at CU.

12. I feel supported.

7. LESSONS LEARNED:

I.WHAT WENT WELL?

1. Designing the survey in the front end went well.

2. Identifying the location was also easy.

3. In the backend everything went well.

II. WHAT DIDN'T GO WELL?

1. Sending push notifications daily was challenging as there are lack of proper tutorials.

2. Retrieving the location daily in a recurring fashion.

3. Explored the cumulosity platform but in turn found out that its paid

4. Generating IPA file was difficult because of the Apple developer account creation.

III. WHAT WAS CONFUSING?

1. Deciding on a data visualization tool.

2. Deciding on a database that can go well with react-native.

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