Disseminating Results of Mining Ordinances and their Tweets by Android App Development

Master's Project Report

In Partial fulfillment of the requirements for a degree in Master of Science in Information Technology

Dec 2019

Submitted by: Christina Babu Varghese

Advisor: Dr. Aparna Varde

Department of Computer Science

Montclair State University

Montclair, NJ, USA

Table of Contents

1 Abstract

This paper focuses on how populations can get more aware, by the use of technology, more specifically, an app to understand how local ordinances are passed in a city, how these ordinances result in changing the city for the better and in extension, make it head towards becoming a Smart City or a leading Smart City

The main goal of this project is to develop an Android-based Ordinance Tweet Mining App that shows how government ordinances contribute towards the making of a Smart City. In this project, we focus on Smart City Characteristics such as Smart Economy, Smart Mobility, Smart Governance, Smart Living, Smart Environment and Smart People.

This app would be beneficial to various users such as environmental scientists, policy makers, city committees as well as the general public in becoming more aware of what committees to reach out to and different ways in contributing to making a region head towards a Smart City.

Keywords: Urban Policy; Smart Governance; Smart Living; Social Media; Sentiment Analysis

2 Background and Problem Definition

New York City comprises of 5 boroughs sitting where the Hudson River meets the Atlantic Ocean. At its core is Manhattan, a densely populated borough that's among the world's major commercial, financial and cultural centers. Its iconic sites include skyscrapers such as the Empire State Building and the sprawling Central Park. Broadway theater is staged in neon-lit Times Square. It is also known as the economy hub of the world which is constantly the center of emerging technologies and smart innovations in every

field. This was the main motivation to choose New York City in our research to show the results of different ordinance-passing sessions in the app, and indicate how it has moved New York City towards enhancing as a Smart City.

According to the Webster dictionary, the definition of an "ordinance" is "a law set forth by a governmental authority". (Merriam Webster, n.d.) [3]. It plays a crucial role in helping cities maintain direction and successful progression towards the future while keeping up with the rest of the world. In our research we look at tweets that are being posted in Social Media i.e. Twitter to measure the sentimental responses of the ordinances being passed in New York City [10].

The goal of our work is to leave the user with a better understanding of the whole process from the start of creating an ordinance and the factors that affect it to find ways to make a given region head towards a smart city [4, 5, 6] or become a leading smart city based on several characteristics.

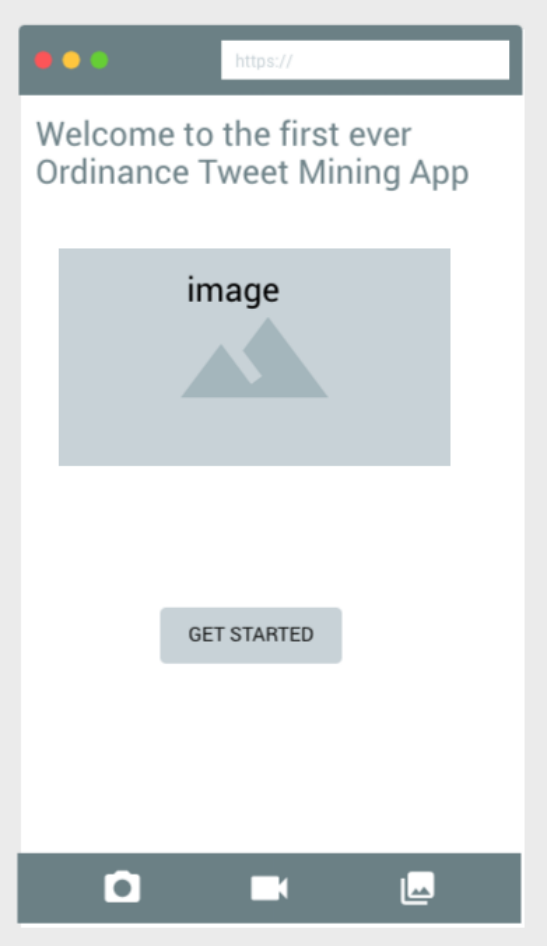
3 Methods and Models

3.1 Methods Deployed

To develop this app, we comprehensively used the principles inspired by Human Computer Interaction (HCI) [19, 20] to create a user experience that would be all encompassing for all kinds of ages and technology users. Since this app would be beneficial to various individuals, ranging from policy makers to the common public, our main goal was to keep in mind that users from all walks of life should be able to use this app and be well informed about the activities of Smart City Ordinances in their local region.

For the creation and layout of the app, mockup designs are initially designed to give a sense of what the blueprint of the app is going to be. The main aspect that we kept in mind is simplicity and efficiency of the app. Whether its navigation, time spent to find an explanation to a question asked by the user or even the analytical graphs being displayed, anybody with a basic sense of critical thinking should be able to decipher the results being displayed.

LAYOUT 1



LAYOUT 2

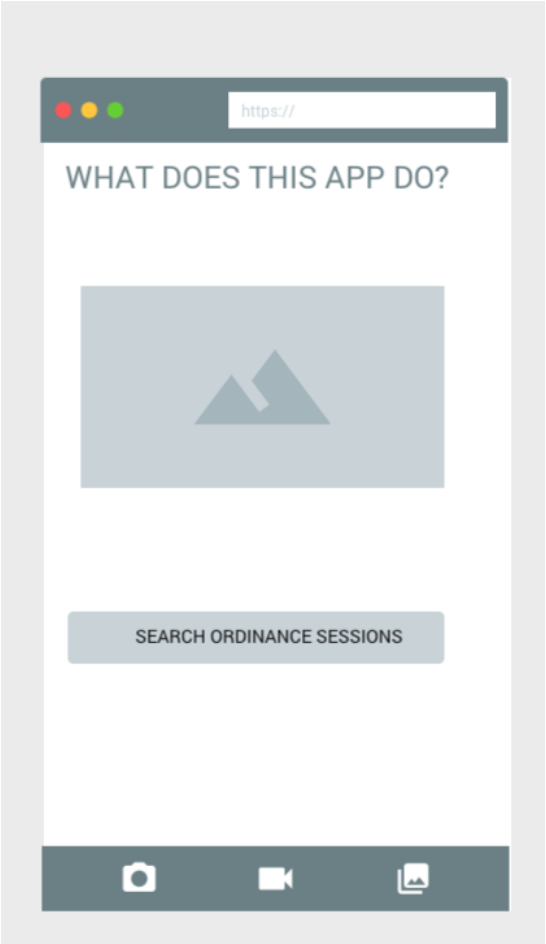


Figure 1a. Mockup Design for the App

LAYOUT 3

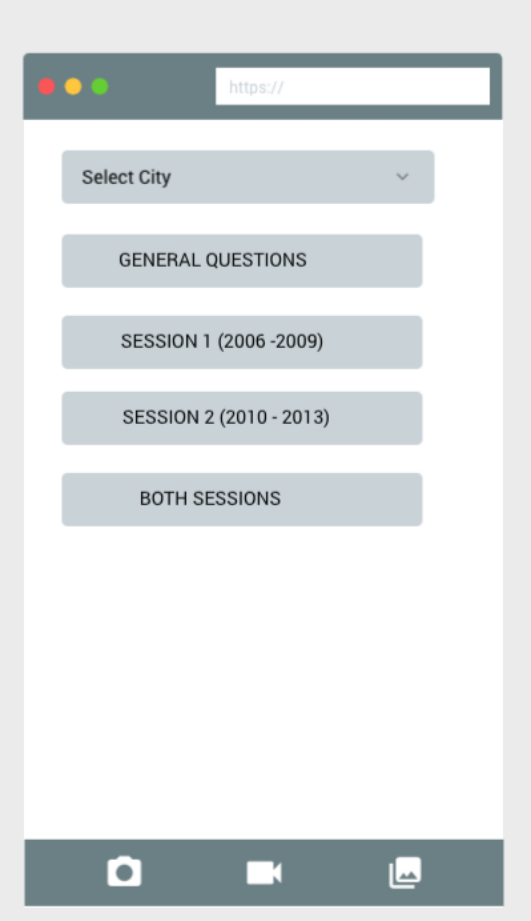


Figure 1b. Mockup Design for the app (cont'd)

Layout 1 serves as a landing page as well as the welcome page to the first ever Ordinance tweet mining app with a call to action button labeled as "Get Started".

Layout 2 gives the user a brief description of what the app does through a small description and overview of the app's focus.

Layout 3 shows the main selection page where the users get to choose the region. This is followed by the 4 main selection categories labeled as: “general questions”; “session 1” (a time span ranging 3 years from 2006 – 2009); “session 2” (a time span ranging from 2010 – 2013); and “both sessions” (information collected from the 2 sessions and combined to give the overall results of ordinances passed and the sentimental tweet analysis from these sessions).

3.2 Models and Materials

For this particular app development, we used models derived from Microsoft Excel such as bar graphs and pie charts, as well as statistical models to derive the information displayed on the app. Figure 2 depicts the flow of the app navigation process, by referring to useful sources [1].

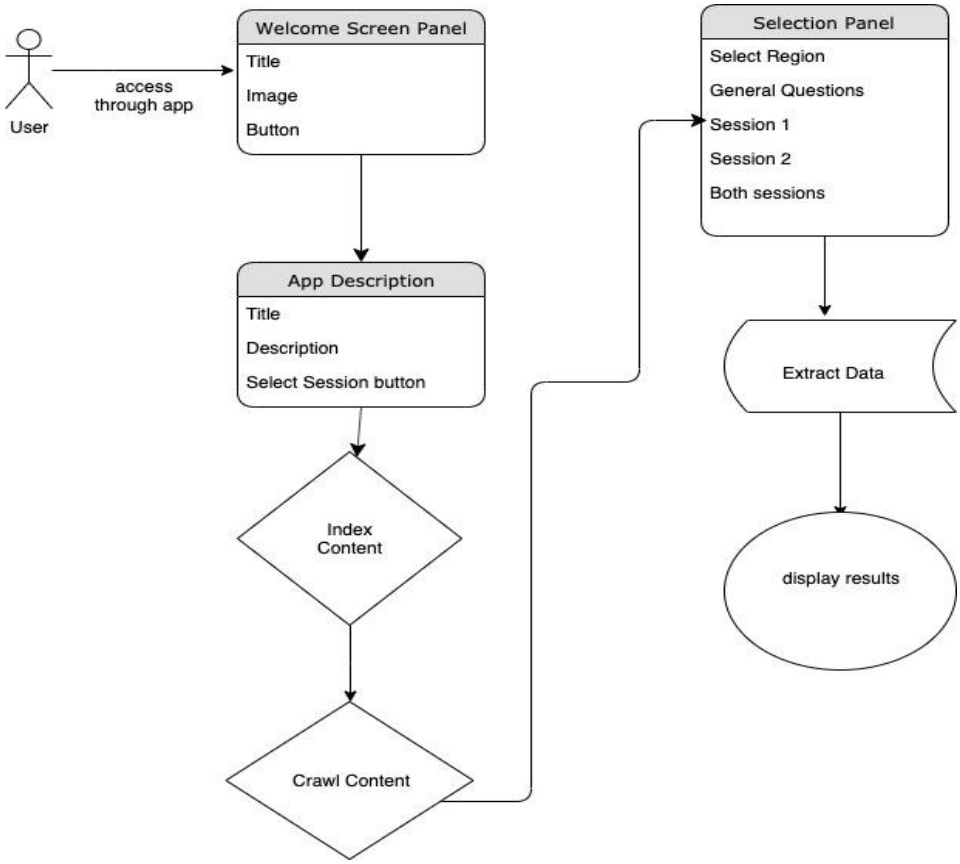


Figure 2. App Navigation Process Flow

Figure 2 shows the flow of output results desired by the user at various pages of the app. Figure 2 also summarizes the user interaction with the system and illustrates how HCI concepts [19, 20] are implemented into the architecture of the app. From the results and positive feedback of the survey conducted, it has already proven to be beneficial to the targeted users of New York City.

4 Implementation of the App

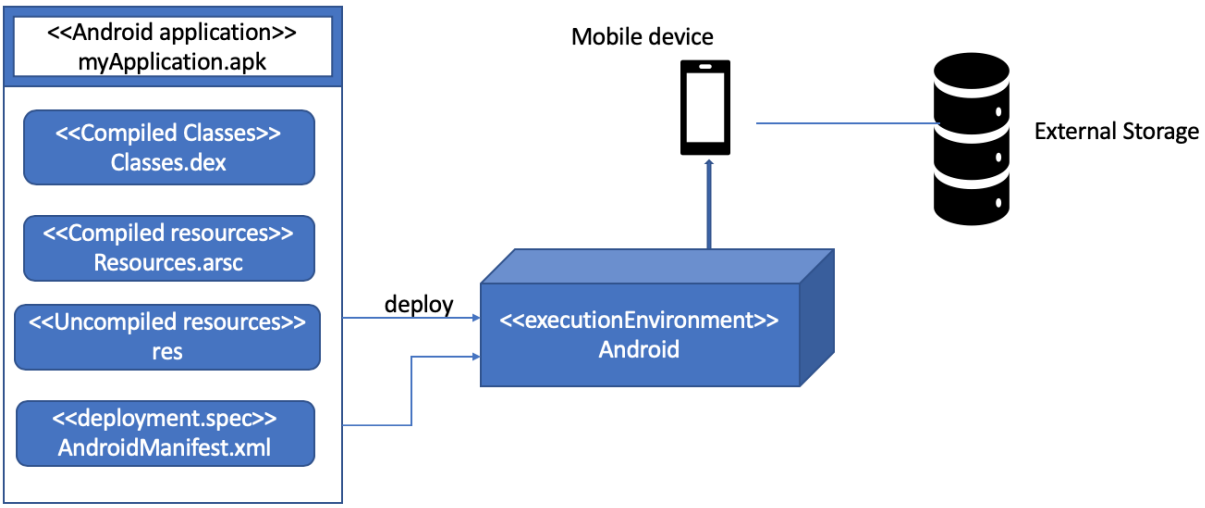


Figure 3. Implementation Diagram

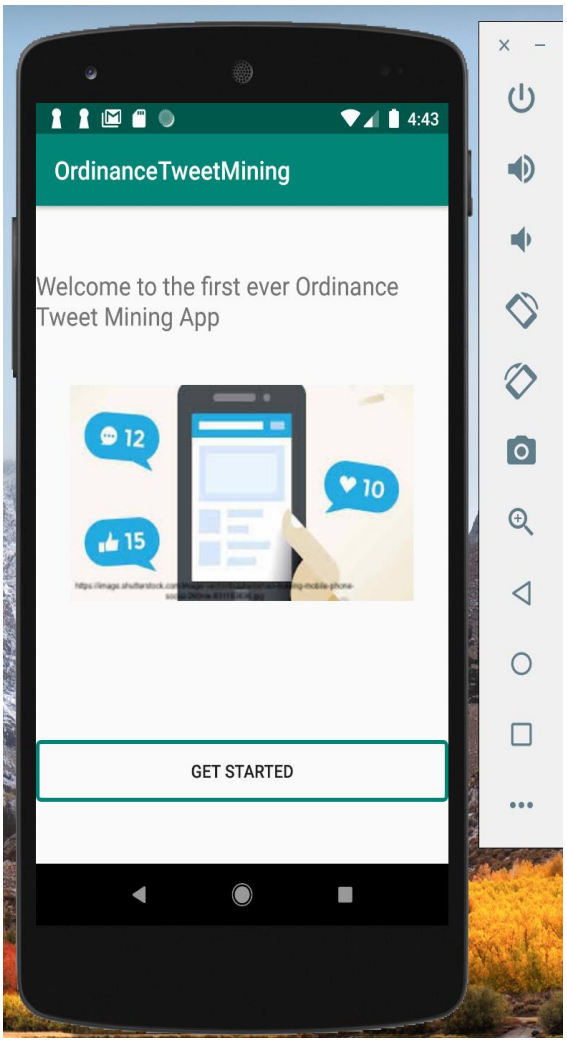
Figure 3 illustrates the deployment process of an application first created and developed in Android Studio [2]. The following steps are used for the implementation of this app based on relevant sources in the literature [1, 2, 9]. Android applications are written in Java. It uses Android SDK tools to compile classes, resources and package the code along with any required data. Android depends on Linux OS for essential operating services such as security management, process management, network stack etc. The Linux kernel plays the role of an abstraction layer between the hardware and the software stack.

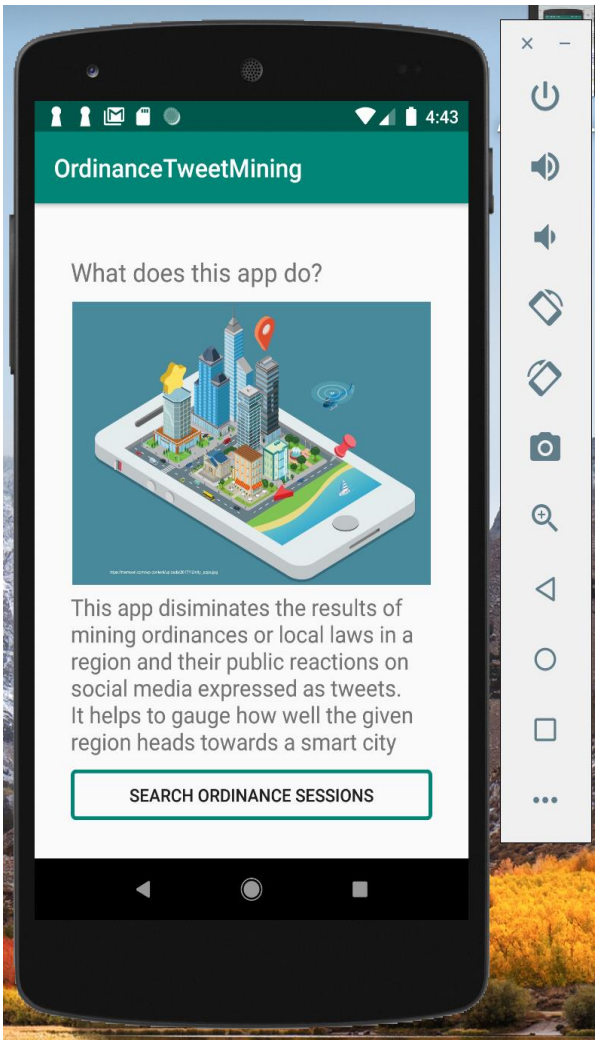
1. The application is first initialized by creating a new project in Android Studio
2. The main activity page is where the app is built and prompted to run with the help of an emulator
3. For the front end of the application, XML files are created to outline the layout of the application's user interface
4. The Android manifest .xml file then describes the main characteristics of the project to express each of its modules
5. The ordinance data for the app is provided by researchers from the Department of Earth and Environmental Studies and the Department of Computer Science at Montclair State University, via their earlier works [15, 16, 17, 18]
6. The ordinance session records are extracted from knowledge bases (KBs) that encompass Common Sense Knowledge (CSK) [21], which is very useful in AI (Artificial Intelligence) systems today. More specifically, we use web-based repositories such as WebChild [7] and WordNet [8]
7. The records are then mapped to tweets to create a sentiment analysis behind each ordinance
8. The results are finally imported to Android Studio and displayed in their respective selection category

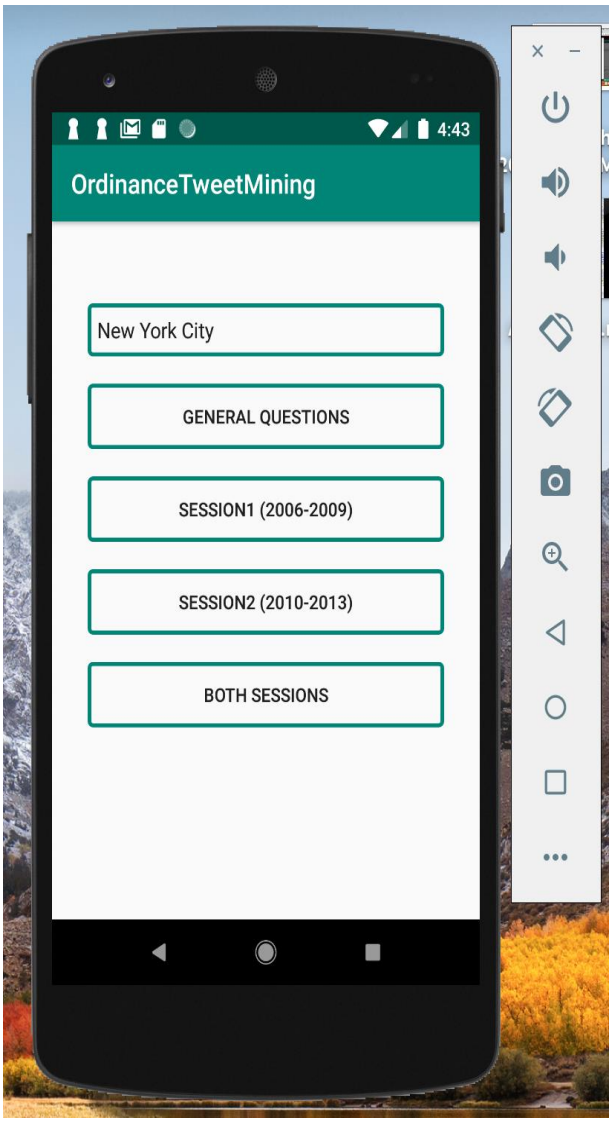
5 Results

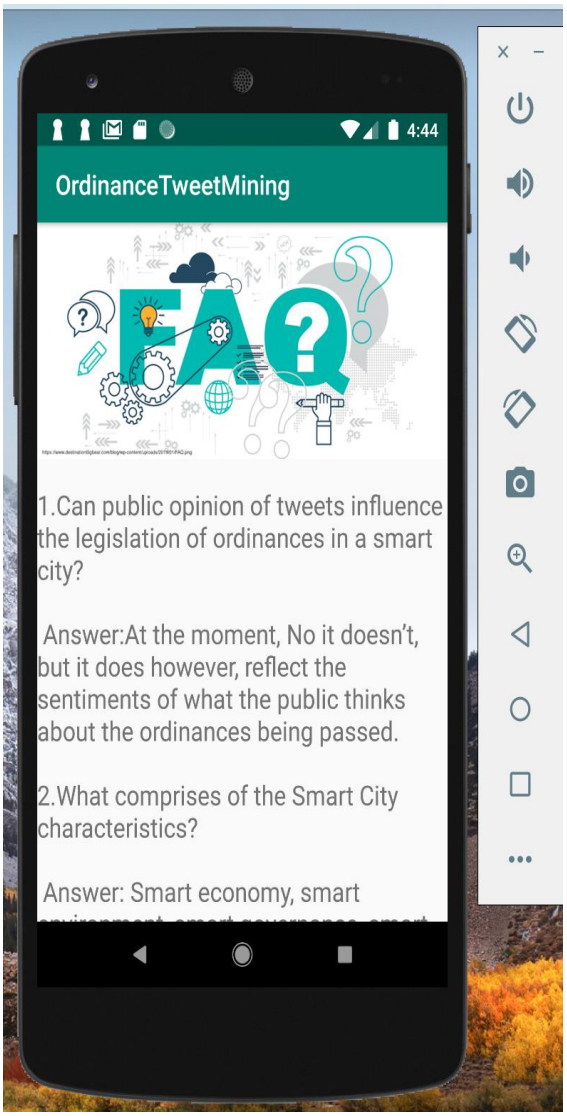
5.1 App Implementation Results

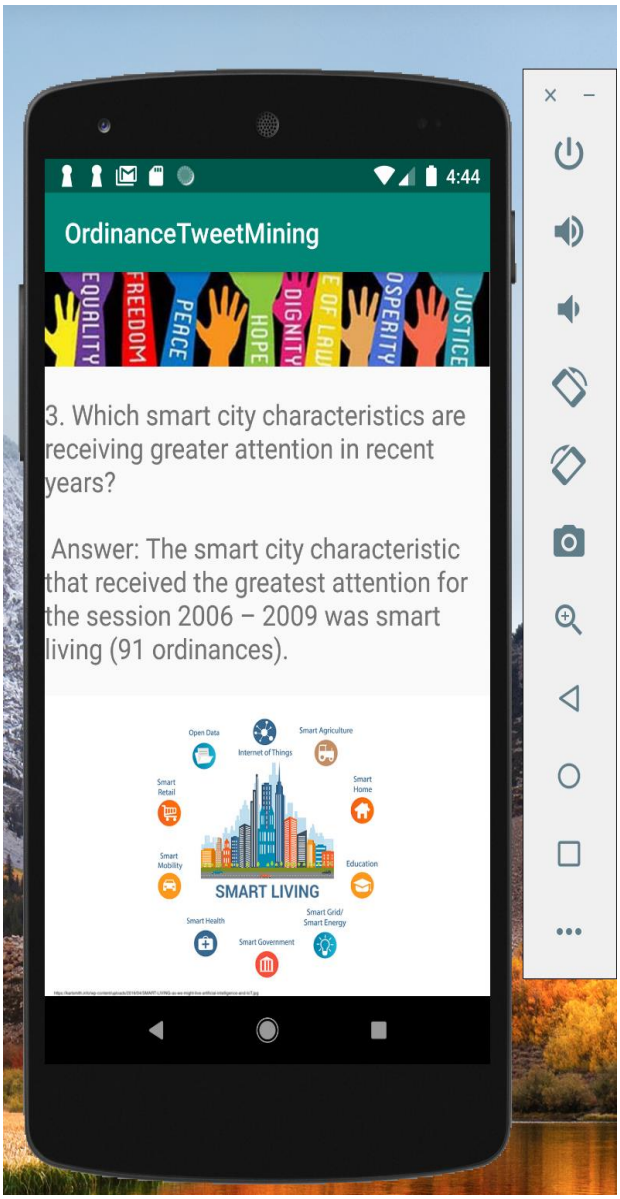
This Ordinance-Tweet Mining App gives very good results with graphical displays and FAQs (Frequently Asked Questions). We demonstrate the results of the app with the following 7 example screenshots that together constitute Figure 4.

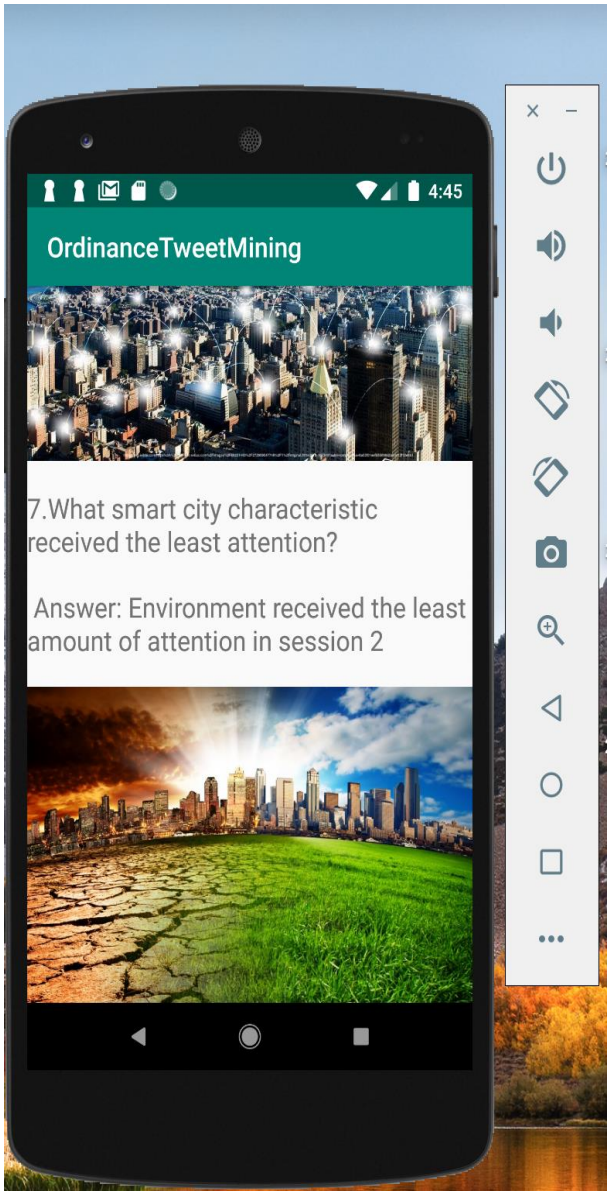





4:43
OrdinanceTweetMining
New York City
GENERAL QUESTIONS
SESSION1 (2006-2009)
SESSION2 (2010-2013)
BOTH SESSIONS


4:44
OrdinanceTweetMining
FAQ
1.Can public opinion of tweets influence the legislation of ordinances in a smart city?
Answer:At the moment, No it doesn't, but it does however, reflect the sentiments of what the public thinks about the ordinances being passed.
2.What comprises of the Smart City characteristics?
Answer: Smart economy, smart


4:44
OrdinanceTweetMining
EQUALITY
FREEDOM
PEACE
HOPE
DIGNITY
OSPERITY
JUSTICE
3. Which smart city characteristics are receiving greater attention in recent years?
Answer: The smart city characteristic that received the greatest attention for the session 2006 – 2009 was smart living (91 ordinances).
Open Data
Internet of Things
Smart Agriculture
Smart Retail
Smart Home
Smart Mobility
Education
SMART LIVING
Smart Health
Smart Grid/ Smart Energy
Smart Government


4:45
OrdinanceTweetMining
7.What smart city characteristic received the least attention?
Answer: Environment received the least amount of attention in session 2

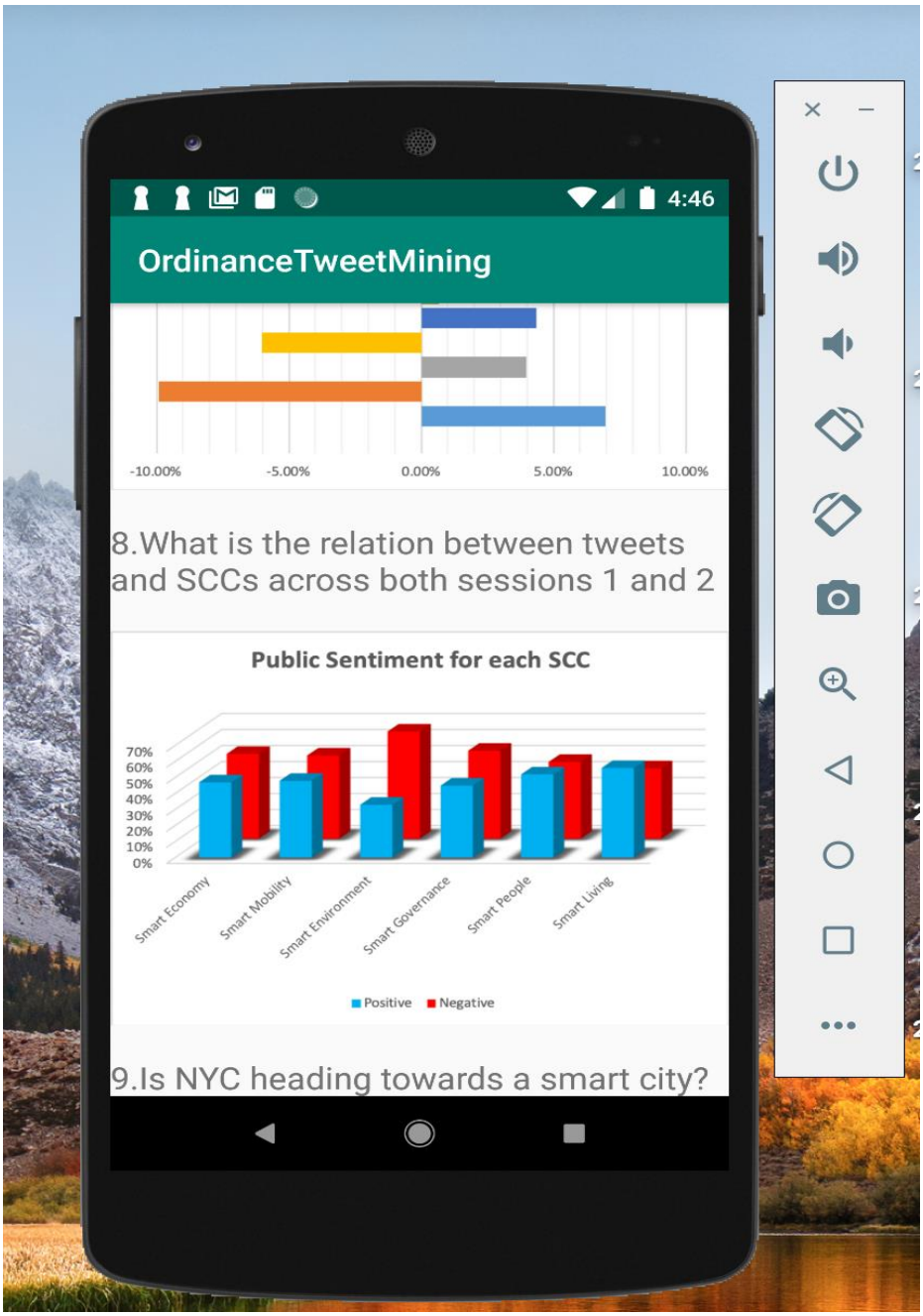


Figure 4. Results of the App after Implementation

As shown in Figure 4, the app is successfully implemented with the main aspect of simplicity and efficiency of use for any user. The user can easily navigate from different pages of the app and select the New York City region, to get the information from the desired session or category to obtain the required results.

6 User Surveys

In order to evaluate the success of this app, we conduct user surveys. We create the survey questions mainly with a Likert Scale format. The objective results of the survey appear in Figures 5 to 10. The results summarize the responses of 32 participants, which include Computer and Environmental Scientists, students, Lawyers, policy makers, students and researchers. The following results show favorable responses towards this Ordinance-Tweet Mining App.

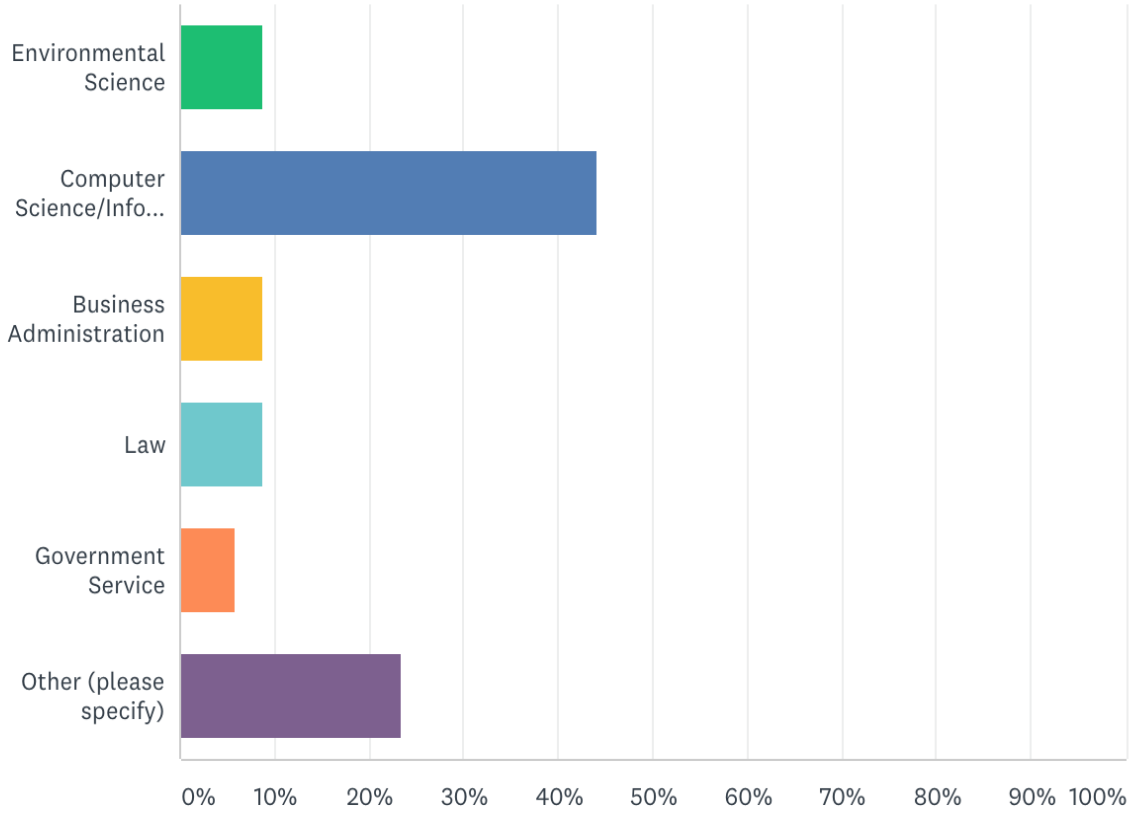


Figure 5. Responses to Q1 on most relevant field of work

The answer choices for the Q1 are as follows

Answer Choices	Response Rate	Qty
Environmental Science	8.57%	3
Comp Science/Info Tech	45.71%	16
Business Administration	8.57%	3
Law	8.57%	3
Government Science	5.71%	2
Other (Please Specify)	22.86%	5
Total		32

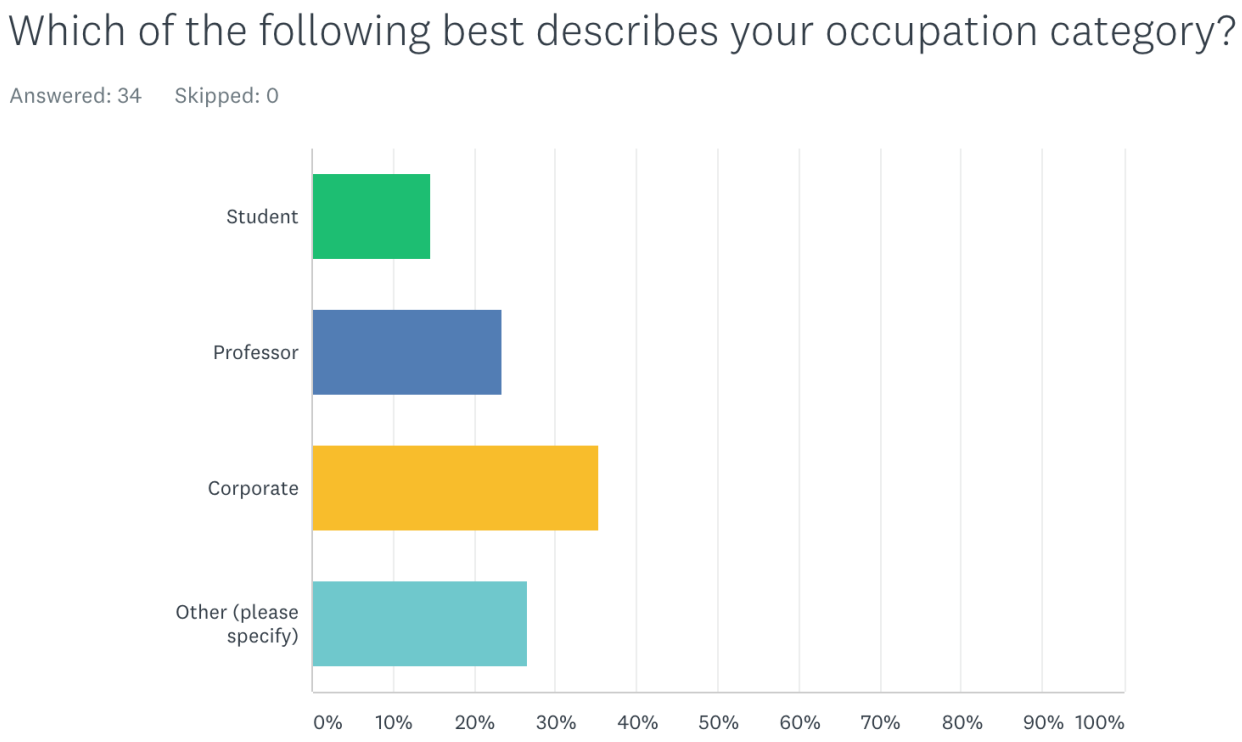


Figure 6. Responses to Q2 on occupation category

The answer choices for the Q2 are as follows

Answer Choices	Response Rate	Qty
Student	14.29%	5
Professor	22.86%	8
Corporate	37.14%	13
Other	25.71	9

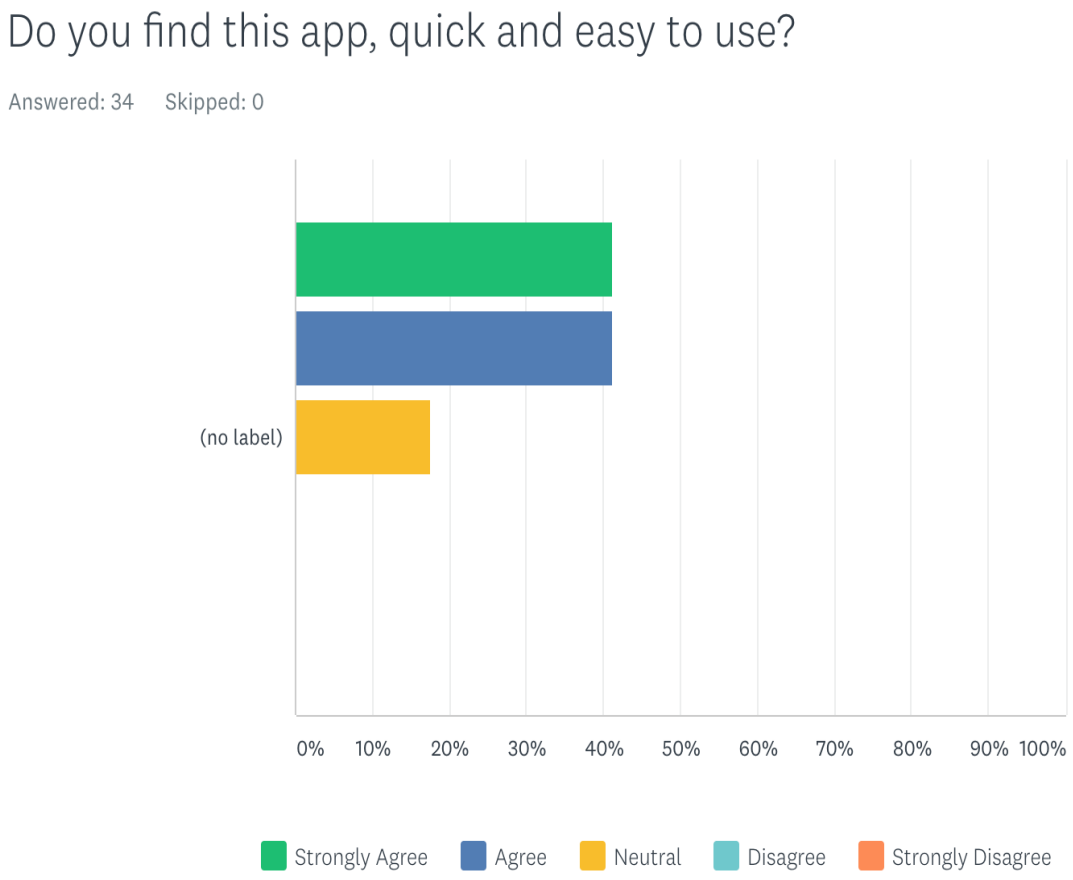


Figure 7. Responses to Q3 on ease of use of the app

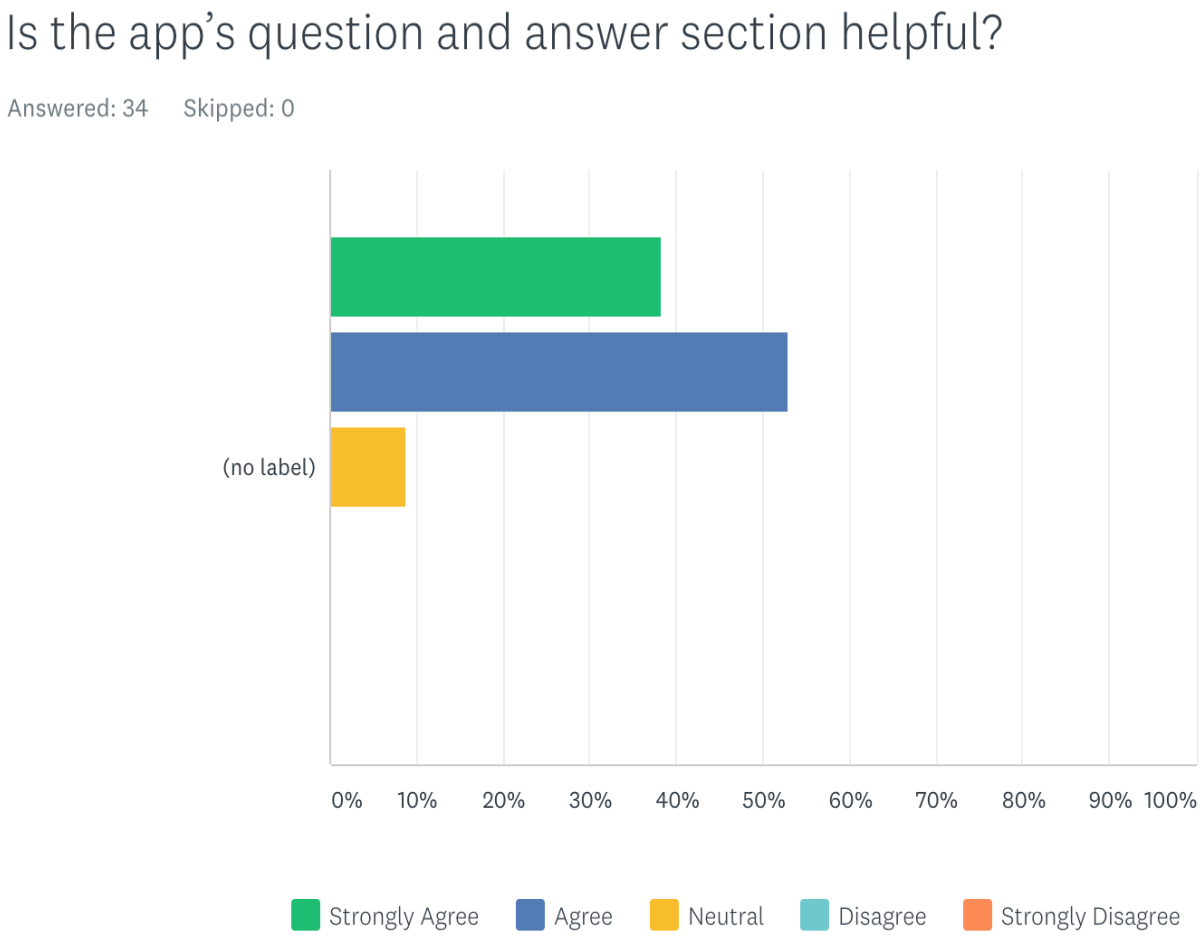


Figure 8. Responses to Q4 on helpfulness of the app's question and answer section

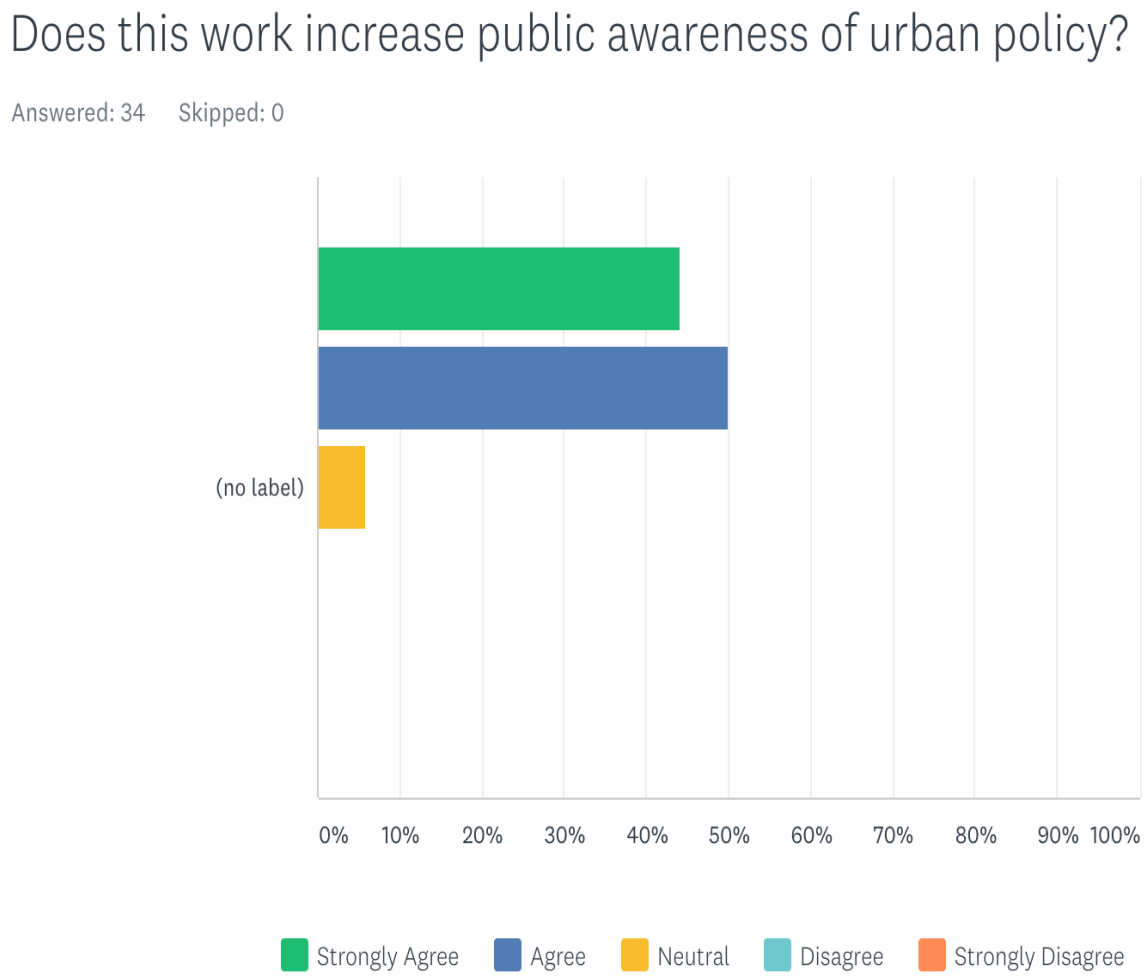


Figure 9. Responses to Q5 on awareness of urban policy

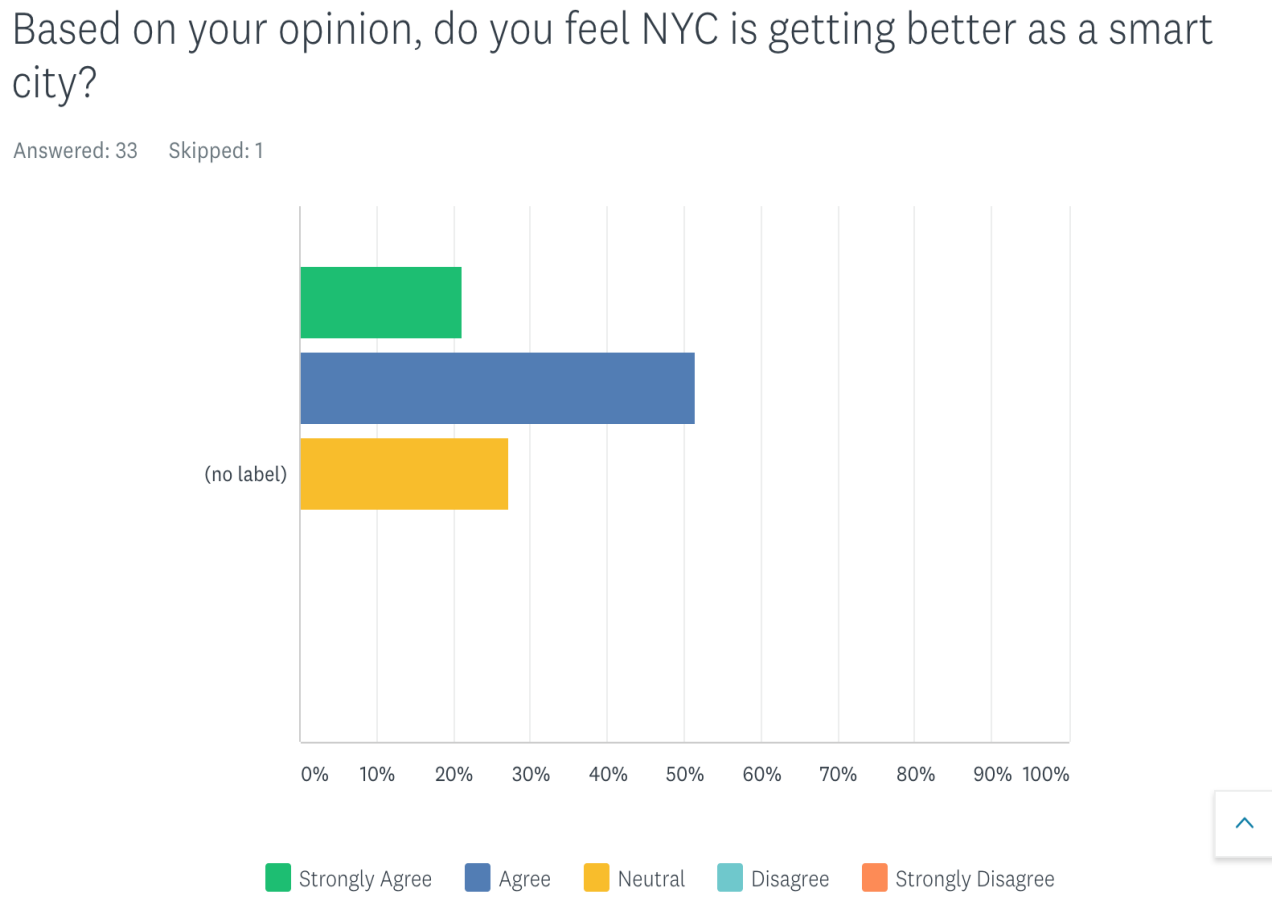


Figure 10. Responses to Q6 on user opinion of NYC getting better as a Smart City

In addition to these objective results seen in the survey questions designed using the Likert Scale, there are subjective responses of the survey participants (Q7). These appear next, combined into a common Figure 11.

“This can be useful in courses on urban policy. ”

“This app looks great- simple and informative is what New Yorkers need. I would have liked to have access to links to the researcher's published work, if available. Or maybe lists of smart city ordinances as a resource.”

“I would like to see the real app, the video was good.”

“I like the idea!”

“Very good usage of graphics, makes data easier to understand. ”

Cool App!

Figure 10. Responses to Q7 on additional comments of the app

7 Conclusions

This project addresses the issue of Ordinance Mining and the sentimental tweet analysis attached to each ordinance related to a smart city characteristic between the sessions of 2006 – 2009 and 2010 – 2013. An ordinance tweet mining app was created to get the public involved with the processes of passing ordinances within their region and bringing awareness towards the different smart city characteristics that encompasses a smart city. From this data, the users can make well informed decisions within their local region and contribute in new ways whether becoming a part of the city council committee or by supporting the region in general through financial means or community outreach.

The work done has a huge potential to be extended worldwide to different existing smart cities around the world or regions that are heading towards becoming a smart city.

8 Acknowledgement

I would like to thank each and every individual who helped me through my master's journey, all the group project team members from different courses taken over the years. I like to thank Xu Du, a PhD student in Montclair State University for all the help he gave me in guiding me through the Ordinance tweet mining process and explaining how the data has been gathered and derived. A very special thanks to Dr. Aparna Varde who saw the best in me and my potential even when I didn't see it myself, for being patient with me and working with my current abilities to make me a better programmer and an overall better student in the field of Computer Science and Information Technology. I would like to thank my family for being there for a great support system throughout the years even though we're continents apart and especially my father who passed away a few months ago for teaching me to be a person of impact by always giving back to the community you are a part of, no matter how big or small it may seem.

9 Works Cited

[1] *Android Application UML Deployment Diagram Example*. (n.d.). Retrieved from wml-diagrams.org: https://www.uml-diagrams.org/android-application-uml-deployment-diagram-example.html

[2] Android Studio, https://developer.android.com/studio

[3] Merriam Webster. (n.d.). *Ordinance*. Retrieved from Merriam-Webster: https://www.merriam-webster.com/dictionary/ordinance

[4] H. J. Scholl and S. Al Awadhi, "Smart governance as key to multi-jurisdictional smart city initiatives: The case of the ecitygov alliance," Social Science Information, vol. 55, no. 2, pp. 255–277, 2016.

[5] TU-Wien, "European smart cities, technical report," Tech. Rep., Vienna University of Technology, Austria, 2015.

[6] IEEE, "IEEE smart cities technical community," 2018.

[7] N. Tandon, G. de Melo, F. Suchanek, and G. Weikum, "WebChild: Harvesting and organizing commonsense knowledge from the web," in WSDM (Web Search and Data Mining comference), pp. 523–532, 2014.

[8] G. A. Miller, "WordNet: A lexical database for English," Communications of the ACM, vol. 38, no. 11, pp. 39–48, 1995.

[9] Google Developers. (n.d.). *Create an Android project*. https://developer.android.com/training/basics/firstapp/creating-project

[10] N. Y. C. Council, "Legislative research center web page."

http://legistar.council.nyc.gov/, 2018.

[11] T. Mikolov, I. Sutskever, K. Chen, G. S. Corrado, and J. Dean, “Distributed representations of words and phrases and their compositionality,” in Advances in Neural Information Processing Systems, 2013.

[12] Q. Li, S. Shah, X. Liu, A. Nourbakhsh, and R. Fang, “Tweetsift: Tweet topic classification based on entity knowledge base and topic enhanced word embedding,” in ACM CIKM (Conference on Information and Knowledge Management), pp. 2429–2432, 2016.

[13] L. A. Zadeh, A. M. Abbasov, and S. N. Shahbazova, “Analysis of Twitter hashtags: Fuzzy clustering approach,” in 2015 Annual Conference of the North American Fuzzy Information Processing Society (NAFIPS) held jointly with 2015 5th World Conference on Soft Computing (WConSC), pp. 1–6, 2015.

[14] L. Sorensen, “User managed trust in social networking - comparing Facebook, Myspace and LinkedIn,” Wireless Communication and Electronic Systems Technology, pp. 427–431, 2009.

[15] X. Du, D. Liporace, and A. Varde, “Urban legislation assessment by data analytics with smart city characteristics,” in IEEE Ubiquitous Computing, Electronics and Mobile Communications Conference (UEMCON), pp. 20–25, IEEE, 2017.

[16] M. Puri, X. Du, A. S. Varde, and G. de Melo, “Mapping ordinances and tweets using smart city characteristics to aid opinion mining,” in WWW (The Web Conference) Companion Vol., pp. 1721–1728, 2018.

[17] M. Puri, A. S. Varde, X. Du, and G. de Melo, “Smart governance through opinion mining of public reactions on ordinances,” in IEEE ICTAI (International Conference on Tools with Artificial Intelligence), pp. 838–845, 2018.

[18] X. Dong and G. de Melo, “Cross-lingual propagation for deep sentiment analysis,” in AAAI Conference (Association for Advancement of Artificial Intelligence), pp. 5771–5778, 2018.

[19] R. Harper, T. Rodden, and Y. Sellen, *Being Human: Human Computer Interaction in the Year 2020*, Microsoft Research, 2008.

[20] Y. Rogers, H. Sharp, J. Peece, Interaction Design: Beyond Human Computer Interaction, 4th Edition, Wiley, 2015.

[21] N. Tandon, A. S. Varde, and G. de Melo, “Commonsense knowledge in machine intelligence,” ACM SIGMOD Record, vol. 46, no. 4, pp. 49–52.