The Effect of User Comments on Traffic Application Usage

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***Abstract*—**With the unprecedented rates of technological improvements, people start to solve their problems with the help of technological tools. According to application stores and websites in which people evaluate and comment on the traffic apps, there are more than 100 traffic applications which have different features with respect to their purpose of usage ranging from the features of traffic apps for public transit modes to the features of traffic apps for private cars. This study focuses on the top 30 traffic applications which were chosen with respect to their download counts. All data about the traffic applications were obtained from related websites. The purpose of this study is to analyze traffic applications in terms of their categorical attributes with the help of developing a regression model. The analysis results suggest that negative interpretations (e.g., being deficient) does not lead to lower star ratings of the applications. However, those negative interpretations result in a smaller increase in star rate. In addition, women use higher star rates than men for the evaluation of traffic applications.

***Keywords*—**Traffic App, real–time information, traffic congestion, regression analysis, dummy variables.

I. Introduction

URBAN traffic challenges transport authorities and users with different issues regarding traffic volume, infrastructure extensions, capacity limits, congestion, pollution, sustainability, or economic efficiency [1]. A variety of traffic applications and provisions services try to improve these issues on the level of personal mobility by providing real-time traffic information.

A mobile phone-based approach for traffic monitoring is an efficient match for developing regions because it avoids the need for expensive and specialized traffic monitoring infrastructure. Mobile devices are enabling technologies that have a variety of benefits for people's lives, however, some difficulties exist with it as well. The different nature of Smartphone models in their physical and ergonomic features often causes users to go through a learning curve with each new model [2]. However, the Smartphone supports more than just communication. Being enabled to be "mobile" through installed applications or via the Internet, Smartphone users are able to stay connected and be effective in their work, lifestyle, and fashion [3].

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The provision of real-time travel information is increasingly being recognized as a potential strategy for influencing driver behavior on route choice, trip making, duration of travel and mode choice. Understanding travelers' response to this information is therefore critical to the design and implementation of effective intelligent transport systems strategies such as mobile or fixed advanced traveler information systems (ATIS). These systems provide drivers with real-time information about traffic conditions, accident delays, roadwork and route guidance from origin to destination.

Gathering, organizing, and conveying information about transportation network options and performance are complicated by the inherent spatial and temporal dimensions of such information. Human knowledge of the spatial environment, the cognitive map [4]-[6] is based on an often limited mental representation of route locations and the physical environment. Cognitive maps influence travel behavior [5]-[7]; for example, the propensity to divert in the face of congestion is related to the number of routes known to a person [8], [9]. People widely differ in their ability to understand and utilize spatial information.

Public and private resources are devoted to the collection and dissemination of real-time travel information. Such information may have the potential to alleviate at least part of the increasing traffic congestion in urban areas [8].

In this study, all traffic applications were investigated with respect to their features. People who interpreted and evaluated these apps were also analyzed. The purpose of this study is to find the relationship between traffic applications used all over the world and other features; positive and negative comments, five–star rating scale, gender and travel modes that describe the apps' features whether public transit or private car. In this regard, regression analysis was performed. Dummy variables were also analyzed in order to observe the effect of each other. One of the important contributions of this study is that gender difference can influence interpretation of traffic applications in a different way as well as understanding the advantages of traffic applications which are being used to solve traffic congestion.

II. Methodology

First, a preliminary analysis of traffic applications from around the world, which consist of two parts with respect to their usage area. Those features for public transport modes include offering new options on public transit or telling people the station before, and the features for private car modes involve sharing real–time traffic and road information and enabling to find the shortest and the cheapest route for saving time and fuel. This was followed by descriptive statistics analysis which shows the relationship between variables and their frequencies. Then using the developed regression models, the associated tests were employed to understand how the typical value of the dependent variable changes when any one of the independent variables was varied, while the other independent variables were held fixed. Details of the theoretical approach, the methodology and the statistical tests used for each part are explained in this section.

A. Data Collection and Preliminary Analysis

The data which was obtained from related application stores and websites which include all traffic applications people downloaded was investigated, and results were presented in "Preliminary Analysis" section. Data that are obtained from application stores and websites will be detailed.

B. Linear Regression Model

In linear regression modeling, both for pooled model and segment models, the relationship with dependent and independent variables can be explained as [10]:

$$\hat{y}_{ij} = \beta_0 + \beta_1 x_{ij1} + \cdots + \beta_n x_{ijn} \quad (1)$$

$$y_{ij} = \hat{y}_{ij} + \varepsilon_{ij} \quad (2)$$

where y_{ij} and $\hat{y}_{ij}$ are the observed and estimated parameters at i of type j, ε_{ij} is the associated error, β_0 is the intercept, βn is the model coefficient of independent variable x_{ijn} and n is the independent variable index.

The validity and goodness of fit of the regression equations can be measured by several statistical measures as well as with the coefficient of determination (R^2). First of all, R^2 indicates how much of the observed data is explained by the built regression model. It takes values between 0 and 1, and is expressed by [10]:

$$R^2 = 1 - \frac{Error\ Sum\ of\ Squares}{Total\ Sum\ of\ Squares} = 1 - \frac{\sum_{i=1}^{m}(y_{ij} - \hat{y}_{ij})^2}{\sum_{i=1}^{m}(y_{ij} - \bar{y}_{ij})^2} \quad (3)$$

where *m* is the number of parameters of type j and ŷij is the mean of yij 's. R^2 being close to 1 indicates that the model is a good fit. However, not all regression models having an R2 value close to 1 mean they are good since adding highly correlated independent variables causes an increase in R2 value and over fitting; one should not use highly correlated independent variables at once in a regression model [10]. Also, making inferences only from the R^2 value is not sufficient. The F-test for overall model and t-tests for each model coefficient should be made to statistically check the validity of the model obtained.

The F-test tests the null hypothesis of "All regression coefficients are equal to zero"; i.e., there is no relationship between the dependent variable and the independent variables. The null hypothesis is given as [10]:

$$H_0 = \beta_0 = \beta_1 = \cdots = \beta_k = 0 \quad (4)$$

The F-statistic is calculated as follows [10]:

$$F = \frac{R^2/k}{(1 - R^2)/(n - k - 1)} \quad (5)$$

where k is the number of independent variables and n is the number of observations. The F-statistic in (5) is distributed with the F distribution with s degrees of freedom of k and (n - k - 1).

If the F-test results in rejection of the null hypothesis of "All regression coefficients are equal to zero", it will mean that at least one independent variable has a coefficient that is significantly different from zero. Then, in order to see which coefficients are significantly different from zero, t-test for each model coefficient is carried out; which tests the null hypothesis of "Coefficient of the variable is equal to zero". This null hypothesis can be expressed as the following, with i being the coefficient index [10]:

$$H_0: \beta_i = 0 \quad (6)$$

The t-test, which has a t-distribution with n - k - 1 degrees of freedom, is as follows mathematically [10]:

$$t = \frac{\beta_i}{st.error(\beta_i)} \quad (7)$$

C. Multiple Regression

This is an extension of the above for the case of more explanatory variables and, obviously, more regressors (β parameters). The solution equations are similar to linear regression, although more complex.

In this model, independent and dependent variables contain both scale and categorical data. Multiple regression help modelling regression analysis with categorical ones. Assuming that there are two explanatory variables x_1 and x_2, and that x_2 is categorical, and with that we have a regression equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2. \quad (8)$$

Categorical variables have a problem in regression analysis, so it should be defined as for the selected value "1" as a one group and the rest of them should take the values of "0". In this context, categorical variable, in this study, x_2 =1, we have:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 \quad (9)$$

and for the category where x_2 = 0, we have:

$$Y = \beta_0 + \beta_1 X_1 \quad (10)$$

The explanatory variable with values equal to '1' and '0' is defined as Indicator Variable. In this study, we worked with SPSS Statistics Software that is a widely used program for statistical analysis was used due to developing model. Those of software identify the indicator as dummy variable. In this paper, dummy was created for each categorical data; a detailed explanation will be presented in Section III.

III. Data Collection and Preliminary Analysis

A. Data Collection

The data for this study was obtained from some related websites which include all traffic application people downloaded such as “Google Play Store” and “Similar Play”. Ranging from the most to least preferred traffic applications are obtained from these websites and their features for the travel modes, including both public transport and private car modes, are received by means of these. Download counts of traffic applications which are determined as count range, namely, data type is categorical variables and given a five–star rating scale are also obtained. In addition to these, the gender of the traveler who uses the traffic applications and their interpretation concerning positive and negative comments are taken from the web sites.

B. Traffic Applications for Public Transport Modes

In terms of Public Transit Applications, only Yahoo Maps was used for the purpose of displaying some common features that are shown in Table I.

TABLE I
Common Features for Public Transit Applications

APP Name	Types of Apps	Common Features
Yahoo Maps	Public Transit Apps	The apps show up to date bus, metro, ferry, minibus and other schedules which allows us to detect traffic jams and offer the most optimal route to traveler’s destination. It reports traffic jams, accidents, closures and everything else. Combining all transit options together in a single app, public transport apps control the travelers' excursion so that they can finally enjoy peace of mind when using public transportation.

C. Traffic Applications for Private Car Modes

Private Car Applications have some common features that are shown in Table II.

TABLE II
Common Features for Private Car Applications

APP Name	Types of Apps	Common Features
Google Maps Waze Sygic GPS Navigation Yandex Maps Google Maps Navigation Yandex Navigator Google Earth Here Maps 2GIS Map Factor GPS Navigation MapQuest GPS Navigation & Maps AT&T Navigator: Maps, Traffic Maps Me GPS Route Finder Route 66 OruxMaps OsmAnd Google Streetview GPS Navigation & Maps - Scout by Telenav NAVIGON MobileNavigator CoPilot Live TomTom Locus Map ViaMichelin: Route GPS Traffic Beat the Traffic Traffline: Traffic & Parking INRIX Traffic Maps & GPS 7 Ways Navigator Maps 3D and Navigation	Private Car Apps	Private car types of traffic applications offer street maps, a route planner for traveling by foot, car, or bike. Moreover, it is also recommended for people who travel for business. It is a community-based traffic and navigation app that lets travelers share real-time traffic and road information. It will alert travelers before approaching police, accidents, road hazards or traffic jams and allows travelers to sync with friends to coordinate meetups. With new additional features, travelers can also search to find the cheapest gas station along their route to save a little bit of money, and it can display top-rated restaurants or local businesses wherever you are. They can mark a location as a “favorite” if they have the exact address. Some applications use an Internet connection to a GPS navigation system to provide turn-by-turn voice-guided instructions on how to arrive at a given destination. The application's traffic congestion map shows the route marks with different color light depending on the current traffic condition. The traffic data are obtained by cameras and speed and location are also taken from other devices that access Maps for Mobile. By means of the private car traffic applications, travelers choose several journey options that consider traffic jams and public transport connections and it continues being updated with real-time information on heavy traffic, accidents, speed cameras, road blocks, etc.

D. Interpretation for Traffic Applications

Interpretations concerning the positive and negative comments are obtained from the application stores and website. Negative interpretations are taken as being the opposite of the positive interpretations and these are presented in Table III.

TABLE III
INTERPRETATION FOR TRAFFIC APPLICATIONS

Positive & Negative Interpretation	
Accurate / Inaccurate	Displaying all the possibilities that it enables travelers to get the information about bus route, time to arrive to the bus station or giving real-time traffic information, including traffic jams, accidents, and closures as being accurate and reliable. On the other hand, travelers comment on the apps as being inaccurate while conveying that all information from the apps as unreliable
User Friendly / Not user friendly	The app usage and its interface are quite understandable and simple. However, travelers comment on the app as not user-friendly, as its interface is quite deficient and inadequate.
Detailed / Not detailed	All details, including street maps, density maps and all other details exist in the apps. However, commuters interpret the apps as undeteiled, while the apps do not include any detail in its interface.

IV. Statistical Results and Discussion

A. Statistical Results for Data

The data set comprises of the traffic applications based on their features, download counts, gender, given star rating for each of the apps and interpretation, including both positive and negative ones. A total of 900 responses were given for each of the variables. In this section, the frequency distribution of these data sets and the relationship between variables are presented by using cross tabulation.

Most of the respondents who interpret the applications and give them a star rating for evaluating their feasibility of this research (84%) were male.

There are 102 traffic applications that people generally use in the world. These data were collected from related websites in which people interpret and evaluate the traffic apps. The last 24 in the category of traffic apps were excluded because of the fact that there were no user comments available. In this research, the top 30 traffic applications were selected with respect to their download counts. The cut-off was determined through the maximum difference between the download counts. Traffic applications were chosen up to 1M – 5M download count interval. The cut-off can be clearly shown in Fig. 1.

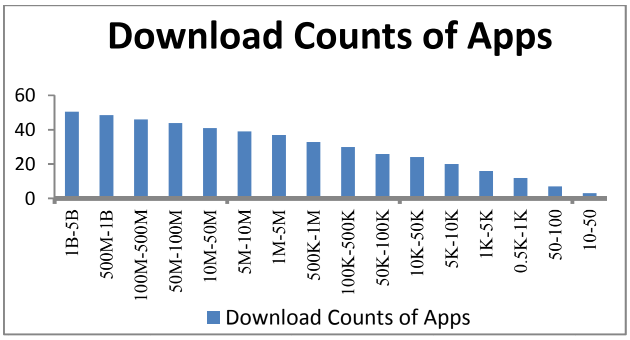

Fig. 1 The selected cut off for the download counts of apps

Fig. 2 shows the frequency of traffic applications based on their intended purpose. Some 3.3% of the selected traffic applications were used for public transport modes and 96.7% of apps were used for private cars. It can be understood that the most downloaded traffic applications have the purpose of private car usage.

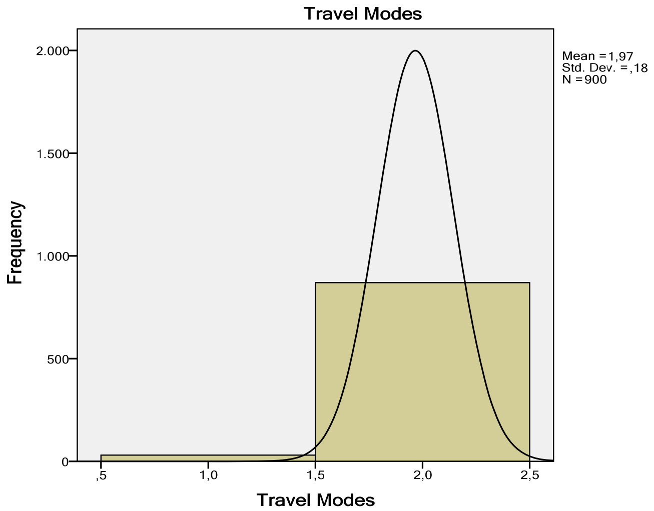

Fig. 2 Frequency of Traffic app based on their intended purpose

Respondents evaluate the traffic applications with giving a number of stars ranging from 1 to 5. Most positive experiences are given five stars, while one star is given if any problems are encountered. People associate a five–star with "strongly good" and a one–star with "too poor". Almost 56.1% of the people gave the five-star rating for the apps and the frequency of the given star percentage decreases with the star rating scale. Meanwhile, 5.9% of users gave only a one star rating for traffic applications.

Interpretation for the apps also gives an idea about the feasibility of applications. In this paper, positive interpretation contains Accuracy/Reliability, being user-friendly and being detailed. On the other hand, negative interpretation includes the opposite of the positive ones such as unreliable/inaccurate, and being deficient and undetailed. People interpret the apps as user-friendly, accurate and reliable with almost an equal percentage (33%). The frequency of interpretation for traffic apps are presented in Fig. 3.

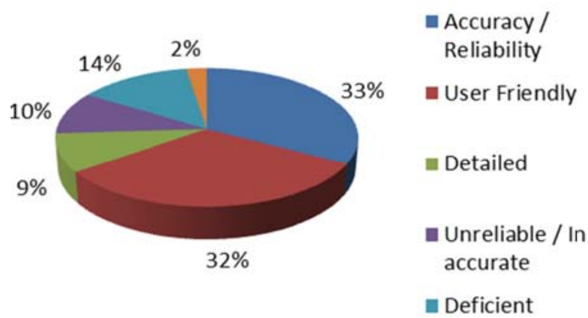

Fig. 3 Frequency of Interpretation for Traffic Apps

Interpretation of each traffic application gives information about its feasibility and area of usage. The applications in this study have both positive and negative interpretations.

Negative comments on the app makes people consider the inadequate attributes it has. Most people generally control the comments relating to an application from their mobile devices before downloading the apps. With the help of the cross tabulation, positive and negative comments for each traffic applications can be made. Potential users interpret the apps within the framework of their own ideas and commented on them based on the comments which correlate with the independent variables.

Outstanding interpretation for specific traffic applications are shown in Table IV. In this context, “INRIX Traffic Maps & GPS”, “Waze”, “Google Maps Navigation”, “Yandex Navigator”, “ViaMichelin: Route GPS Traffic” and “GPS Navigation & Maps - Scout by Telenav” are thought to be more accurate and reliable. In addition, “Google Maps”, “Maps me”, “Tom Tom”, “2GIS” and “Map Factor GPS Navigation” are mostly commented as user-friendly. In the light of the interpretation, the most detailed traffic application is found as “OsmAnd”. In the negative interpretation perspective, “AT&T Navigator: Maps, Traffic” and “Beat the Traffic” has the most negative interpretations in terms of being unreliable/inaccurate. Yet, “INRIX Traffic Maps & GPS” and “NAVIGON MobileNavigator” are found to be more deficient.

TABLE IV
INTERPRETATION FOR EACH TRAFFIC APPLICATIONS

APP Name	Interpretation						Total
	Accuracy / Reliability	User Friendly	Detailed	Unreliable / In accurate	Deficient	Not Detailed	
Google Maps	7	16	0	2	5	0	30
Waze	14	10	0	2	3	1	30
Google Maps Navigation	13	9	1	2	5	0	30
Yandex Navigator	13	9	1	1	5	1	30
2GIS	7	13	5	0	3	2	30
Map Factor GPS Navigation	8	13	3	2	4	0	30
AT&T Navigator: Maps, Traffic	5	8	2	7	5	3	30
Maps Me	6	16	2	1	4	1	30
GPS Navigation & Maps - Scout by Telenav	14	5	4	5	2	0	30
NAVIGON MobileNavigator	11	7	1	2	7	2	30
TomTom	4	15	2	3	4	2	30
ViaMichelin: Route GPS Traffic	14	6	2	5	3	0	30
Beat the Traffic	8	8	3	7	4	0	30
INRIX Traffic Maps & GPS	16	4	3	0	7	0	30
Total	140	139	29	39	61	12	420

TABLE V
GENDER BASED INTERPRETATION TABLE

		Interpretation						Total
		Accuracy / Reliability	User Friendly	Detailed	Unreliable / In accurate	Deficient	Not Detailed	
Gender	Male	256	247	69	73	96	15	756
	Female	41	41	12	16	27	7	144
Total		297	288	81	89	123	22	900

TABLE VI
RELATIONSHIP BETWEEN FIVE – STAR RATING SCALE AND INTERPRETATION

		Interpretation						Total
		Accuracy / Reliability	User Friendly	Detailed	Unreliable / In accurate	Deficient	Not Detailed	
Star	too poor	0	0	0	46	6	1	53
	poor	0	0	0	28	23	5	56
	medium	0	5	0	15	42	13	75
	good	70	78	13	0	47	3	211
	strongly good	227	205	68	0	5	0	505
	Total	297	288	81	89	123	22	900

Gender difference can influence interpretation for traffic applications in a different way. In this study, it is found that males mostly comment on traffic applications as “accurate and reliable”. Moreover, females equally found the traffic applications as both “accurate and reliable” and “user friendly”. In addition, at the negative interpretation perspective, both males and females find the traffic applications as deficient. Gender based interpretation for traffic applications, both as positive and negative, are presented in Table V.

Rating or grading schemes are mostly made up of compulsory and voluntary requirements [11]. However, people generally express their appreciation or dissatisfaction about their experience of the traffic applications through giving a five star rating or criticizing its features voluntarily. The star rating system should provide an accurate appraisal of the property that is consistent with the expectations of the user and thus, they need to be monitored regularly in order to check if standards are being maintained or improved over time and are not deteriorated [12]. In a similar way, interpretation for the traffic apps almost gives same results about apps. Positive recommendation and given high star rates always make a good impression. The relationship between the star rates and positive/negative interpretations are shown in Table VI.

B. Multiple Linear Regression and Correlations Analysis

Data in this model are all categorical variables, and therefore, dummy variables should be formed due to understanding the effect of dependent variables on each independent variable. A Dummy variable or Indicator Variable is an artificial variable created to represent an attribute with two or more distinct categories/levels. The logic of dummy variables can also be extended to enable them to include nominal level variables with more than two categories in multiple regressions.

The data were collected with regards to whether the traffic application is accurate, user-friendly and detailed, or not. Therefore, an index of rating will be investigated with the help of three analyses for the traffic applications used in the study. The indicators for gender (G), travel mode (TM) and interpretation of traffic applications can be defined as follows:

$$Gender(G) = \begin{cases} 1 & if\ Male \\ 0 & otherwise \end{cases}.$$

$$Travel\ Mode(TM) = \begin{cases} 1 & if\ Public\ Transportation \\ 0 & otherwise \end{cases} \tag{11}$$

$$Interpretation\ of\ Traffic\ Apps = \begin{cases} 1 & if\ Interpretation\ of\ Traffic\ Apps \\ 0 & otherwise \end{cases}$$

C. The Effect of Comments on Traffic Apps Used in the World as Being an Accurate Rating

The analysis is made for users who interpret the traffic applications as accurate or not. In this survey, there are 386 users who find those apps to be accurate or inaccurate. In order to measure the average difference between the two groups, Table VII indicates the coefficient and significance of the parameters. It can be shown in Table VII that the interpretation of being accurate (A) and the traffic applications having features of public transit (PT) is significant, which is less than the cut–off (<0.05). It indicates that one can reject the null hypothesis. They are significantly different from zero at the 95% confidence level. The reference (default) category in this regression is five-scale star.

Equation (12) for the normal multiple regression is:

$$Y(Rating) = 1{,}706 + 3{,}114xA + 0{,}356xPT \tag{12}$$

The coefficients presented in Table VII indicate that the coefficient for being accurate has positive value of coefficient. In this context, for every unit increase in making interpretation for traffic application as being accurate, a 3.114 unit increase in the star scale is estimated.

TABLE VII
COEFFICIENTS OF INDICATORS FOR TRAFFIC APPS USED IN THE WORLD FOR PEOPLE WHO INTERPRET THE APPS AS ACCURATE OR NOT (DV: FIVE-SCALE STAR)

Variable	Coefficients	P - Value
(Constant)	1.706	0.000
Accuracy	3.114	0.000
Male	-0.076	0.307
Public Transit	0.356	0.033
R^2	0.867	
F (Sig)	829,361 (0,000)	

a. Dependent Variable: Star

Furthermore, for males who think the traffic applications to be accurate, the estimated star scale rating would be 0.076 points lower than for females. Namely, women thought to be the traffic apps as user friendly give more high star rate than men do. What is more, traffic applications that its feature is suitable for public transit have positive coefficient value. It means that, for public transport features that app has, the estimated star scale rating would be 0.356 points higher than features for private cars that traffic app has. Namely, Traffic applications for public transit receive a higher star rate than for private cars.

Coefficient of determination tells us the goodness of fit. The R^2 value of 0.867 indicates that there is good fit between the observed variables.

As one can observe from the F-statistics of the linear regression models, the null hypothesis stating that all variables are equal to zero can easily be rejected with at least 95% level of confidence. Furthermore, all coefficients of explanatory variables are statistically different from zero with at least 95% level of confidence.

D. The Effect of Comment on the Traffic Apps used In World as Being User Friendly on Rating

The analysis is made for the people who interpret the traffic applications as accurate or not. In this survey, there are 411 people who find those apps to be user-friendly or not user-friendly. Table VIII indicates the coefficient and significance of the parameters. It can be shown in table below that interpretation of being user friendly (U) is significant, which is less than cut–off (<0.05). It indicates that one can reject the null hypothesis. They are significantly different from zero at the 95% confidence level. The reference (default) category in this regression is five-scale star.

Equation (13) for the normal multiple regression is:

$$Y(Rating) = 3.242 + 1.520xU \tag{13}$$

The coefficients presented in Table VIII indicate that the coefficient for being user-friendly has a positive value of coefficient. In this context, for every unit increase in making interpretation for the traffic application as being user friendly, a 1.520 unit increase in star scale is estimated. Furthermore, for males who think the traffic applications to be user friendly, the estimated star scale rating would be 0.086 points lower than for females. Namely, women thought the traffic apps to be user friendly and give a higher star rating than men do. What is more, traffic applications that its feature is suitable for public transit have positive coefficient value. It means that, for the public transport features available on the app, the estimated star scale rating would be 0.219 points higher than features for private car that the traffic app has. Namely, traffic applications for public transit receive a higher star rate than private ones.

TABLE VIII
COEFFICIENTS OF INDICATORS FOR TRAFFIC APPS USED IN WORLD FOR PEOPLE WHO INTERPRET THE APPS AS USER FRIENDLY OR NOT (DV: FIVE-SCALE STAR)

Variable	Coefficients	P - Value
(Constant)	3.242	0.000
User friendly	1.520	0.000
Public Transit	0.219	0.305
Male	-0.086	0.334
R^2	0.524	
F (Sig)	149,602 (0,000)	

a. Dependent Variable: Star

Coefficient of determination tells us the goodness of fit. The R^2 value of 0.524 indicates that there is moderate fit between observed variables.

As one can observe from the F-statistics of the linear regression models, the null hypothesis stating that all variables are equal to zero can easily be rejected with at least a 95% level of confidence. Furthermore, all coefficients of explanatory variables are statistically different from zero with at least 95% level of confidence.

E. The Effect of Comment on the Traffic Apps Used in World as Being Detailed on Rating

The analysis is made for the people who interpret the traffic applications as accurate or not. In this survey, there are 103 people who find those apps to be detailed or not detailed. Table IX indicates the coefficient and significance of the parameters. It can be shown in Table IX that interpretation of being detailed (D) is significant which is less than the cut–off (<0.05). It indicates that one can reject the null hypothesis. They are significantly different from zero at the 9% confidence level. The reference (default) category in this regression is five-scale star.

Equation (14) for the normal multiple regression is:

$$Y(Rating) = 2{,}778 + 2{,}012xD \tag{14}$$

The coefficients presented in Table IX indicate that the coefficient for being detailed has a positive value of coefficient. In this context, for every unit increase in making interpretation for traffic application as being detailed, a 2.012 unit increase in the star rating scale is estimated. Furthermore, for males who think the traffic applications to be detailed, the estimated star scale rating would be 0.050 points higher than for females. Namely, men who thought the traffic apps to be user-friendly give a higher star rating than women do. What is more, traffic applications that have a feature suitable for public transit have a positive coefficient value. It means that, for the public transport features that app has, the estimated star scale rating would be 0.219 points higher than the features for private car that traffic app has. Namely, traffic applications for public transit receive a higher star rating than private ones.

TABLE IX
COEFFICIENTS OF INDICATORS FOR TRAFFIC APPS USED IN WORLD FOR PEOPLE WHO INTERPRET THE APPS AS DETAILED OR NOT (DV: FIVE-SCALE STAR)

Variable	**Coefficients**	**P - Value**
(Constant)	2.778	0.000
Detailed	2.012	0.000
Male	-0.050	0.685
Public Transit	0.067	0.671
R	0.762	
F (Sig)	105, 662 (0,000)	

a. Dependent Variable: Star

Coefficient of determination tells us the goodness of fit. The R^2 values of 0.762 indicates that there is good fit between observed variables.

As one can observe from the F-statistics of the linear regression models, the null hypothesis stating that all variables are equal to zero can easily be rejected with at least a 95% level of confidence. Furthermore, all coefficients of explanatory variables are statistically different from zero with at least a 95% level of confidence.

V. CONCLUSIONS

In this study, the data, which were obtained from related websites including all traffic applications people downloaded in the world, was investigated in order to understand the advantages of traffic applications used to solve traffic congestion. In the survey, traffic applications that consist of two parts with respect to their usage area, including features of traffic apps for public transport modes and features of traffic apps for private car modes, were analyzed. Some applications' related features were also obtained from there. The regression model has been developed and was used to represent the correlation between the interpretation for the traffic apps and other independent variables. As a result of Multiple Linear Regression Analysis with Dummy Variables for traffic applications use around the world, some outstanding outcomes emerged.

With the help of cross tabulation some important findings were obtained. Gender difference can influence interpretation for traffic applications in a different way. In this study, males mostly comment on traffic applications both as "accurate and reliable". Moreover, females mostly find the traffic applications both as "accurate and reliable" and "user friendly. In this regard, females attach more importance to its accuracy and giving reliable information than males. In addition, from the perspective of negative interpretation, both females and males find the applications as deficient more than other attributes. They generally comment on the download websites suggesting new attributes for the apps due to their perceived deficient features. Furthermore, analyzing given interpretations and star scale gives an idea about the traffic applications. In this context, "INRIX Traffic Maps & GPS" is found to be the most accurate application, as well as, Google Maps is thought to be the most user-friendly application. "Beat the Traffic" is also found as the most detailed traffic application when compared to others.

In the negative interpretation perspective, "AT&T Navigator: Maps, Traffic" and "Beat the Traffic" has the most unreliable/inaccurate interpretation, as well as, "NAVIGON MobileNavigator" are found to be not user-friendly.

As a result of analyzing each of the indicators, substantial findings are presented. The gender difference can also influence giving a star rating in a different way. Women who interpret traffic applications as accurate, user-friendly, and as detailed or not, give higher star rates than men globally. It can be asserted that women attach more importance to evaluate the traffic applications and tend to be more critical than men. Furthermore, traffic applications have different attributes which lead to giving different number of stars on the five-star scale rating for traffic applications used around the world. Traffic applications having features of public transit have positive coefficient values. That means traffic applications for the purpose of using public transit receive higher star rates than private ones. In this context, commuters generally prefer and evaluate more traffic applications for public transit than traffic applications having features of private cars.

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