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Application of interpolation pattern in problem solving of Mashhad smart city

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ABSTRACT: This paper studying and determining the current situation of Mashhad mobility through using the global criteria so that it can be able to do a comparison among Mashhad with other cities which have some population similarities. The method of study is according to the Arthur D. Little's survey which measured the socially smart mobility criteria upon the 84 cities all over the world. These measures for each of the criteria have the best and the worst value based on the expressed statistics by the world cities and according that, for each city one weight score of percent has been determined. In the present study, the information related to the Smart mobility criteria of Mashhad has first been collected and then through providing an average mathematical relationship based on the minimum and maximum recorded by the 84 global cities the weight score of Mashhad was determined equal to 45% and finally Mashhad's score was compared. The result was that the gained score for Mashhad in comparison to compared global cities had a suitable position and has some attractiveness upon the use of the public transportation, but the driving method of the drivers was inappropriate, and due to that reason the statistics of the accidents resulted in death is high. On the other hand, the amount of CO2 and PM10 are much more than the standard level and threaten seriously some dangers such as different cancer types, heart, respiratory and nervous diseases and also the environmental problems of the citizens.

***Keywords*:** Current situation, Smart city, Interpolation pattern, Problem solving, Environmental Problems.

INTRODUCTION

During the last twenty years, the concept of smart city indicated this idea that the information and relationship technology can be used in city activities like application development and competitive stage, finding new ways in order to eliminate social poverty and deprivation and healthiness of the environment (Harimi et al., 2010). The nature of the cited idea comes from the current technologies which need to be coordinated and an integrated to have an active role in city environment to lead to improvement of life quality and functions in the city environment and on the other hand creates new opportunities in the cities with regard to the using the ideas and creatorship, it was due to this that the statement "smart city has many faces", got famous (Sameti, 2010).

However, the concept of a Smart city goes way beyond the transactional relationships between citizen and service provider. It is essentially enabling and encouraging the citizen to become a more active and participative member of the community, for example, providing feedback on the quality of services or the state of roads and the built environment, adopting a more sustainable and healthy lifestyle, volunteering for social activities or supporting minority groups. Furthermore, citizens need employment and "Smart Cities" are often attractive locations to live, work and visit (Dept. for business innovation & skills, 2013).

Therefore in the first steps , the idea of the smart city was in the direction of the social wealth improvement of the cities, to this meaning that it results in increasing the people and society capabilities, based on this model and through the help of the ICT infrastructure, people as the fundamental element of social capital in the society was able to take into consideration their personal, service and social issues, including the voting electronically in elections and providing the requirements necessary for life and relationships with governmental organizations and other institutes,

with a more quality. These issues have been cited in the studies of many researchers(Winter, 2011; Cruick Shank, 2011; Deakin, 2011; Leydesdorff, 2011; Allwinkle, 2011; Mahizhnan, 1999).

Entering the 21th century, many countries like Austria, Denmark, and Germany started making smart their cities. In the year 2007, R. Giffinger from the Vienna University, through cooperating with Edinburgh University identified six characteristics as a roof for the further elaboration of smart cities in European Union. The characteristics are: Economy, People, Governance, Mobility, Environment and Living. These characteristics form the framework for the indicators and the assessment of a city's performance as smart city (Giffinger et al., 2007).

Smart city is a kind of a city which based on Information Technology, try in addition to transformation of the life methods and activities, it can respond to the citizens necessities through planning, designing, development and renewing the societies in order to prompt locality seeing, preservation of natural and cultural resources, just distribution of the development costs and benefits, increasing the ecological integration in short- and long-time courses, and improving the life quality through development of issues related to the issues like transportation, employment, and house desirably. Some definitions of the smart city have been cited in Table 1.

Table 1. Smart City definitions by academic literature

Definition	Reference
A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rail/subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens.	Hall, 2000
A smart community initiative becomes an integrated approach to helping entire communities go on-line to connect local governments, schools, businesses, citizens, and health and social services in order to create specific services to address local objectives and to help advance collective skills and capacities.	Coe, et at.,2001
A Smart City or region is one that capitalizes on the opportunities presented by Information and Communication Technology (ICT) in promoting its prosperity and influence.	Odendaal,2003
A smart environment is an environment that is able to acquire and apply knowledge about its inhabitants and their surroundings in order to adapt to the inhabitants and meet the goals of comfort and efficiency.	Marsa-Maestre etal., 2008
The Smart City provides new instrumentation that enables observation of urban systems at a micro-level.	Harrison and Donnelly,2011
"Smart Cities" would be metropolitan areas with a large share of the adult population with a college degree.	Winters,2011
The concept of the Smart City of which there are many initiatives, projects and demonstrators, is generally underpinned by one or more ambient systems parts that require a mediation process to deliver The interconnectedness required by an ambient system.	Gui and Roantree,2012
a city that is managed by a network and which supplies its citizens with services and content via the Network using both fixed and mobile Smart City infrastructure, based on high-performance ICT.	Lee et al.,2013

Source: Mosannenzadeh and Vettorato, 2014

Context and research methodology

According to the studies of Giffinger et al.(2007), smart city has six dimensions. To prevent the spread of discussion, in this study the smart mobility issue is taken into consideration. The aim of study is determining the current situation of smart mobility in Mashhad metropolis according to its population by the usage of Arthur D. Little assessment criteria in urban mobility and comparing the total score of Mashhad by 10 similar cities in the world.

The smart mobility can be understood as every kind of transportation inside the city and by the help of the intermediary factor of information and communication technology (ICT) which will result in facilitation of issues related to servicing, everyday life, and the relationships among people. Advantages of the smart mobility inside the city totally are as followings:

- Smart Transportation Systems,
- Reducing the traffic knots through simplifying the city routes,
- Creating cultures such as using the new motor vehicles like sunny cars, electric motorcycles, and public transportation vehicles (Bargh-Hormoz, 2013).

On the basis of what has been expressed up to now, the smart mobility is about the changing the ways which reduce the destructive and negative effects of the mobility upon the environment and society and in opposite provided various solutions and alternative approaches to the business sector and the economy and people's need for daily mobility.

Review the current situation of Mashhad

The country Iran is not away from the global transmissions. Therefore, reviewing and analyzing the smart mobility is an undeniable and unavoidable requirement, especially in Mashhad city with a population of 2984491 people (DPDMM,2014) which a very incoherent set up in its place, and this culture difference, habitudes and customs increases the complexity of city environment and this is the strongest reason on studies related to the smart mobility

to be able to reduce the challenges, and give more calmness and consent of life as a gift to the citizens who live in this city.

Arthur D. Little Institute has determined some criteria for smart mobility inside the cities (Table 2) based on done studies, and it determined a weight score for each of these criteria, in a way that the total weight scores of all criteria is equal to 100 and according to it, Arthur D. Little measured the situation of the smart mobility in 84 cities (Arthur D. Little, 2014).

Table 2. Assessment Criteria of Arthur D. Little Urban Mobility

No.	Criteria	Weight	No.	Criteria	Weight
1	Financial attractiveness of public transport	4	11	Initiatives of public sector	6
2	Share of public transport in modal split	6	12	Transport related CO2 emissions	4
3	Share of zero-emission modes in modal split	6	13	NO2 concentration	4
4	Roads density	4	14	PM10 concentration	4
5	Cycle path network density	6	15	Traffic related fatalities	6
6	Urban agglomeration density	2	16	Increase of share public transport in modal split	6
7	Smart card penetration	6	17	Increase of share of zero-emission modes	6
8	Bike sharing performance	6	18	Mean travel time to work	6
9	Car sharing performance	6	19	Density of vehicles registered	6
10	Public transport frequency	6	Total		100

Source: Arthur D. Little, 2014

The basis of measuring current situation of Mashhad was also these criteria and through referring to the statistics and involved organizations, the field data were collected to calculate the amount of each these criteria. In Table 3, the definitions of each of those criteria and the statistical amounts of Mashhad have been written.

Table 3. Definitions of Criteria and Method of Calculate for Mashhad Metropolis

No.	Criteria	Definitions and Calculates	References
1	Financial attractiveness of public transport	• Ratio between the price of a 5 km journey with private means of transport and the price of a 5 km journey with public transport within the agglomeration area. • The cost of each trip = entrance average + meter average (based on the 200 meters), average delay (on the basis of minute) • The cost of trip with motorized individual transport + fuel usage average every 5 kilometers (the average is 10 liters in each 100 kilometers) + cost of depreciation every one kilometer (based on the average 0.01 $) **Calculating the cost of public transport**= 0.368 $ **Calculating private means**= 0.25 $ **0.368 / 0.25 = 1.5**	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014; DPDMM, 2014.
2	Share of public transport in modal split	• Percentage of the total number of person trips which are made with public transport in the last available measurement. • According to the transportation statistics book (2014), this percent was equal to 43.43% .	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
3	Share of zero-emission modes in modal split	• Percentage of the total number of person trips which are made by bicycle and walking in the last available Measurement. • This amount is 4% percent according to the current statistics of Mashhad.	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
4	Roads density	• Ratio between the total road length in an urban agglomeration and the urbanized surface area. • The length of urbanized surface area in Mashhad= 695 kilometers • Traffic regions level= 285.7 square kilometers	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.

		*695*km ÷*285.7*km2=**2.43**	
5	Cycle path network density	• Ratio between the total length of cycle lanes and cycle paths in an urban agglomeration and the urbanized surface area of this urban agglomeration. • The urbanized surface area in Mashhad: 695 kilometers • Traffic regions level: 285.5 square kilometers 10 km ÷*285.7*km2= **0.035**	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
6	Urban agglomeration density	• Ratio between the population of an urban agglomeration and its urbanized surface area. • The regions level is considered the same as 285.7 • According to Mashhad transportation statistics, Agglomeration density is equal to 91.5 persons per Hectare.	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
7	Smart card penetration	• Ratio between the total number of transit smart cards in circulation in an urban agglomeration area and the population of this area. • The number of the smart cards (Man Cards) to use in bus and subway in Mashhad is equal to 3200000 pieces according to the last statistics. 3200000 ÷ *3000000*= **1.066**	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
8	Bike sharing performance	• Ratio between the total number of bikes in bike sharing systems in an urban agglomeration area and the population of this area. • At present, the number of shared bike is equal to 3000 bicycles according to the statistics of the public bicycle system. 3000 ÷ *3* = **1000**	Arthur D. Little, 2014; Mashhad public bicycling system, 2015.
9	Car sharing performance	• Ratio between the total number of cars in car sharing systems in an urban agglomeration area and the population of this area. • This system is not available in Mashhad.	Arthur D. Little, 2014. Mashhad transportation statistics book, 2014.
10	Public transport frequency	• Frequency of the busiest public transport line in an urban agglomeration. • The busiest public transportation vehicle was considered bus, and the frequency average of arriving to station is equal to 15 minutes during the rush hours. (*7* * 60)/*15* = ***28***	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
11	Initiatives of public sector	• Qualitative evaluation of strategy and actions of public sector with regard to urban mobility along 5 dimensions: General sustainability and restrictions; Alternative engines; Multimodality; Infrastructure; Incentives. • Based on the current routine in these designs, we should consider a grade between 0 up to 10 which after interviewing with authoritative experts the Mashhad grade is considered **3.7**.	Arthur D. Little, 2014;
12	Transport related CO2 emissions	• Ratio between the total amount of carbon dioxide emitted by the agglomeration area p.a. as a consequence of its transport activities and its population. • According to the receipt statistics from the related organizations, the average of these pollutants is 1950 kilograms for each citizen, per year.	Arthur D. Little, 2014; KRMOEP, 2014; DPDMM, 2014; Shokohian and Ghazinejad, 2010.
13	NO2 concentration	• Annual arithmetic average of the daily concentrations of NO2 recorded at all monitoring stations within the agglomeration area. • The average of pollutant amount is 24 micrograms per square meters.	Arthur D. Little, 2014; KRMOEP, 2014; Shokohian and Ghazinejad, 2010.

14	PM10 concentration	• Annual arithmetic average of the daily concentrations of PM10 recorded at all monitoring stations within the agglomeration area. • According to statistics, this amount is equal to 73.7 micrograms per square meters.	Arthur D. Little, 2014; KRMOEP, 2014; DPDMM, 2014; Shokohian and Ghazinejad, 2010.
15	Traffic related fatalities	• Number of deaths related to transport i.e. an annual number of people killed as a result of transport accidents that occurred in an urban agglomeration area p.a. • The rate of traffic fatalities in Mashhad was equal to 356 people based on the last transportation statistics. 356 ÷ 3 =118.7 person per million people	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
16	Increase of share public transport in modal split	• Increase of the percentage of the total people trips which are made daily by public transport in the last available measurement compared to its share in the last but one measurement. • According to the collected questionnaires of experts, increase up to 20% is possible.	Arthur D. Little, 2014; Mashhad transportation statistics book, 2014.
17	Increase of share of zero-emission modes	• Increase of the percentage of the total people trips which are made daily by bicycle and walking in the last available measurement compared to its share in the last but one measurement. • According to comparing the two last statistics, this amount can be increased up to the 15 percent.	KRMMOEP, 2014; Mashhad transportation statistics book, 2014.
18	Mean travel time to work	• Total number of minutes that it usually takes the person to get from home to work each day during the reference week. • According to the questions asked from the experts, this time amount is equal to 40 minutes.	Arthur D. Little, 2014; Mashhad Transportation statistics book, 2014.
19	Density of vehicles registered	• The ratio between the total numbers of passenger motorized vehicles (incl. cars, motorcycles, taxis) within the urban agglomeration and its population. • The numbers of these vehicles during a day is recorded up to 2504649 vehicles. 2504649 ÷ *3000000*= **0.83**	Arthur D. Little, 2014; Mashhad Transportation statistics book, 2014.

Source: Research studies based on Arthur D. Little Urban Mobility 2.0

The next step is calculating weight score averages. In this study, according to the Best Value and the Worst Value in each of the 19 criteria identified by Arthur D. Little's study, Linear Interpolation Relationship was used.

Linear interpolation has been used since antiquity for filling the gaps in tables, often with astronomical data. It is believed that it was used by Babylonian astronomers and mathematicians in Seleucid Mesopotamia (last three centuries BC), and by the Greek astronomer and mathematician, Hipparchus (2nd century BC). A description of linear interpolation can be found in the *Almagest* (2nd century AD) by Ptolemy. Linear interpolation is often used to approximate a value of some function using two known values of that function at other points, or used to fill the gaps in a table. Suppose that one has a table listing the population of some country in 1970, 1980, 1990 and 2000, and that one wanted to estimate the population in 1994. Linear interpolation is an easy way to do this.

If the two known points are given by the coordinates (x_0, y_0) and (x_1, y_1), the linear interpolate is the straight line between these points. For a value *x* in the interval (x_0, x_1), the value *y* along the straight line is given from the equation1 (Meijering, 2002).

Equation 1: $$\frac{y - y_0}{x - x_0} = \frac{y_1 - y_0}{x_1 - x_0}$$

This equation is rewrite again based on the values obtained for the worst and the best value in Arthur D. Little study of 84 cities (2014) for the equation (2) and (3) :

Equation 2: $$\frac{Worst.Wheight - Best.Wheight}{Worst - Best} = \frac{Mashhad.Wheight - Best.Wheight}{Mashhad - Best}$$

And finally:

Equation 3: $$\frac{Rw - RB}{W - B} = \frac{Rx - RB}{X - B}$$

According to the gained statistics from field studies, in Equation 3, *X* is the calculated number for Mashhad and *Rx* is weight score that regarding each criterion is calculable. In Table 4 the best value (*B*) and the worst value (*W*) for every type of the 19 criteria is observable. Also in order to avoid excessive decimal numbers, *RW* value of 1 is considered.

Now by the help of minimum and maximum amounts of Table 4, and calculated weights for Mashhad in Table 3 and by using equation 3, find the weight scores for each criterion and earn the overall score for Mashhad. This gained overall score for the Mashhad Metropolis in comparison to 15 selected cities are observable in Table 5.

Table 4. Best and Worst Values of 84 Worldwide Cities

Criteria	Worst Value of 84	Best Value of 84	Criteria	Worst Value of 84	Best Value of 84
1-Financial attractiveness of public transport	**6.7**	**0.2**	11-Initiatives of public sector	**3**	**10**
2-Share of public transport in modal split	**1%**	**64%**	12-Transport related CO2 emissions	**7390**	**55**
3-Share of zero-emission modes in modal split	**5%**	**75%**	13-NO2 concentration	**86**	**12**
4-Roads density	**12.6**	**0.1**	14-PM10 concentration	**200**	**11**
5-Cycle path network density	**0**	**4678**	15-Traffic related fatalities	**193**	**4**
6-Urban agglomeration density	**0.7**	**17.8**	16-Increase of share public transport in modal split	**-53%**	**+186%**
7-Smart card penetration	**0**	**3.1**	17-Increase of share of zero-emission modes	**-61%**	**+148%**
8-Bike sharing performance	**0**	**2384**	18-Mean travel time to work	**62.1**	**18.4**
9-Car sharing performance	**0**	**1312**	19-Density of vehicles registered	**0.69**	**0.03**
10-Public transport frequency	**32**	**512**			

Source: Arthur D. Little FUM 2.0, 2014

Table 5. Overall Score and Population of Compared Cities

No.	City/Population(Million people)	Overall Score	Compare with Mashhad
1	Los Angeles / 3.8	38.1	+6.9
2	Toronto / 2.6	44.4	+0.6
3	Buenos Aires / 3	42.4	+2.6
4	Caracas / 2.2	40.1	+4.9
5	Berlin / 3.5	51.7	-6.7
6	Madrid / 3.2	50.3	-5.3
7	Rome / 2.8	40.9	+4.1
8	Addis Ababa / 3.4	36.5	+8.5
9	Baghdad / 4.2	28.6	+16.4
10	Dubai / 2.5	40.6	+4.4
11	Melbourne / 4	41.9	+3.1
12	Osaka / 2.7	38.5	+7.5
13	Singapore / 3.5	55.6	-10.6
14	Bangalore / 4.3	38.9	+6.1
15	Lahore / 5.2	33.1	+11.9
16	Mashhad / 3	45	

Source: Arthure D. Little, 2014; Wikipedia, 2015

Results and Discussions

As it was expressed before in context and research methodology, the overall score of Mashhad determined equal to 45, which if we want to judge on the basis of 100, it isn't a suitable weight score, but if we refer to the Arthur D. Little study regarding the mobility in the 84 world cities, it is observed that the most privilege of 58.2 belonged to Hong Kong, and therefore, the weight score of Mashhad is considered an ideal weight score in comparison to many other world cities. To respond this question that why smart cities in regard to mobility or other smart components don't obtained the evolution yet, we use what expressed in the European Parliament Report :

"Almost 2/3 of the sample European smart cities are in the stage of planning and testing (Pilot Testing)…, most cities under the process of testing which focus upon the energy goals of the year 2020" (European Parliament, 2014).

Therefore, no one of the European cities has reached the final stage of implementation and due to this reason achieving low scores doesn't seem too much unreasonable. But in other parts of the world, especially in countries which have not any planning and visions to become an smart city, Obtaining the low weight score is an indicator of the lack of planning and lack of correct understanding of the future situations and interrelations of the world and future cities.

Among this Mashhad city has some specific situations. This city had a plan from the year 2004 for becoming electronic city which was arranged by Mashhad Municipality. But this plan was not implemented due to some reasons; however there are different plans and suggestions for Mashhad to become electronic and smart city. during the last 5 years, the municipality has done many activities for making Mashhad an smart city(DPDMM, 2014), and these activities continue yet and the infrastructures also have been provided for this issue, such as ICT infrastructures like: increase of availability to internet, high-speed internet, Wi-Fi and so on.

In the field of smart mobility, applications are designed for the smart city of Mashhad.
But the main problem in the municipality organization to implement the smart mobility is asking help just from the ICT experts and unfortunately, the advice of Humanities scholars and experts have not a major role, and due to this reason look at this issue is largely technical and social problems and needs less attention.

After calculating the overall weight score based on Arthur D. Little mobility criteria (2014), for determining the current situation in smart mobility of Mashhad, the score should be compared with some other cities in order to be able to judged regarding the current situation of Mashhad. For this reason, it was necessary to select the cities which have similarities with Mashhad and then do the comparison. Mashhad city has 3 million fixed population (Mashhad-statistics, 2014), which it is not a very exact foundation, because this city, due to pilgrimage and tourist characteristics, have 20 millions pilgrims and tourists yearly, on the other hand, about one million people live in sidelines of Mashhad which they use the welfare and official facilities of this city, and these are the reasons which Mashhad has floating population. Therefore the cities which were selected for compare with Mashhad have population between 2.5 up to 5.2 million people. Among the 84 cities studied by Arthur D. Little, 15 cities had similar population to Mashhad which they were elected comparison. The results of the comparing analyses among the Mashhad and the 15 selected cities are as followings:

As a whole the weight score of Mashhad is in the fourth rank and after the three cities of Berlin, Madrid, and Singapore. It also has a weight score equal to Toronto. In the weight score of Mashhad metropolis, Financial attractiveness of public transport and share of public transport in modal split (1st and 2nd criteria) located in a suitable status and the smart cards' penetration (7th criterion) is also high, because 3200000 smart cards related to transportation has been issued in this city (Transportation Statistics Book, 2014), but the Share of zero-emission modes in modal split (3rd criterion) is very low, because the citizens, in spite of the suitable number of bike sharing (8th criterion) and limitation of Cycle path network (5th criterion) and the high risk of bicycling due to the high numbers of Traffic related fatalities (15th criterion) use bicycles and walking less in their daily trips, and because of this fact we can't be very hopeful to Increase of share of zero-emission modes (17th criterion) in Mashhad and About 15 percent improvement prediction for the next 10 years is very little progress.

On one hand, the road density (4th criterion) is high and due to this and considering the high numbers of roads and pathways, the frequency of the most public used vehicle, namely buses and mid-buses (10th criterion) to reach the stations, is about 15 minutes in urban routes and sub-routes and that is an acceptable time, on the other hand, the Density of vehicles registered (19th criterion) is high, and therefore passengers don't wait much time to get on these transportation vehicles.

The other point which is related to the road density and their high traffic is the reality that there isn't any car sharing system (9th criterion) available in Mashhad and there is no any planning to implement that, because, on one hand, that increases the traffic, and the parking place of these cars is a big problem in Mashhad, on the other hand, because lack of the suitable parking places for personal cars, motorcycles, and bicycles in Mashhad metropolis, especially in the central core of this city, leads always to the increase of traffic, more disorder of transportation and the weather pollution.

The Mean travel time to work (18th criterion) has been calculated 40 minutes for Mashhad which this time in comparison to the Worst Value, that is 62.1 minutes and the Best Value that is 18.4 minutes for the 84 cities studied by Arthur D. Little, isn't a favorable time, but regarding to the high density and compaction of roads and traffic, is considered acceptable time length.

With regard to the weather pollutants caused by the traffic based on measured criteria in this research, namely CO2, NO2, and PM10, the results were yielded are as following:

The amount of Transport related CO2 emissions (12th criterion) for each citizen is 1950 kilograms yearly, namely about 2 tons in every year which it is a very grievous number. The worst value in the Arthur D. Little study(2014) was recorded equal to 7390kilograms, however it is related to the few numbers of cities (maybe one or two cities) and it can't has generality, but because of CO2 beyond limitation amount in the worst value, the gained weight score for Mashhad compared to other cities is on average amount which it can't be the suitableness of the amount of 1950 kilograms for each citizen yearly.

Authors believe that according to Province Main Office of Environmental Preservation reports, the amount of transport related CO2 emissions in Mashhad is very high, and it causes many environmental problems and the illnesses as a result of whether pollution for citizens. Among the most important problems which occurs for human being as a result of high mass of CO2 the heart, cordial, and nervous diseases, respiratory and lung problems and also the cancers can be mentioned (KRMOEP, 2014).

Another criterion related to the weather pollutants due to the traffic is the NO2 concentration (13th criterion) in every year, the standard amount of NO2 is 21 mcg/m3 which the amount of this pollutant in Mashhad weather is measured about 24 mcg/m3 and because of this reason and on the basis of comparing its average weight with the worst and best values gained for the cities studied by Arthur D. Little(2014), Mashhad weight score is acceptable.

According to Lahsaizade(2014), NO2 results in irritating of lungs. Short-time contact with the NO2 pollutant causes coughing and functional disorder of lungs and long-time contact with NO2 increases the likelihood to suffer from respiratory infections and leads to structural changes in lungs. Nitrate and NO2 ingredients also results in disordering of seeing and nitrogen sedimentation leads to acidity of ground, lagoon and marine systems (Lahsaizade, 2014).

The current nitrate in atmosphere in the form of acidity products react to the ingredients that sediment as acidity rain, fog, snow, or other ingredients.

The last studied pollutant is the PM10 concentration (14th criterion). The suspended ingredients little than 10 micron formed from the first ingredients which can be produced from the ignition of cars' fuel, industrial and power plant processes, wood fireplaces, Shumen, agronomical and forestry activities, routes dusts, and conflagrations, and jungles(Lahsaizade, 2014).

The yearly reported average for these pollutants in Mashhad is equal to 73 mcg/m3, which its normal amount is 20 mcg/m3(KRMOEP, 2014) , it can be concluded that the density of these ingredients in Mashhad is very high. Some cities such as Baghdad in Iraq, compared to selected cities, the PM10 density is very high due to the problems caused by dusts in weather, and it increases the amount of worst value, however the density of PM10 is high in Mashhad.

Suspended ingredients affect the respiratory and immune systems of body and intensify the respiratory, heart and cordial illnesses. The size of these ingredients is the main reason of lowering the seeing ability and they have damaging effect on herbage ecosystems, buildings color and materials, and their surfaces (KRMOEP, 2014; Lahsaizade, 2014).

Conclusions

Based on the total of what said in this research, we can conclude that, however the gained weight score of Mashhad regarding the smart mobility was about 45% percent and comparing the cities located in the population range of Mashhad it is almost a favorable score, but it cannot be the illustrative of many problems due to the mobility. Because, in spite of suitableness of public mobility system in Mashhad and the lowness of wait time of citizens to get on the public vehicles, some factors such as high density of Mashhad city, being a good tourist place, high number of public and personal cars quartering in this city, being excess and aimless many of inside trips of citizens, not using of the efficient and new electronic and technological tools in order to reduce that inside trips, lack of smart system for guiding and directing citizens inside the city and finally lack of correct understanding the intelligence word and smart mobility by the city managers causes that no one of the planning related to smart-making and smart mobility in Mashhad to be efficacious (cause to good results) and on the other hand the pollution created by the traffic and aimless mobility inside the city increased than before, in as much as that the CO2 mass for every citizen reach into near 3 tons yearly which this itself cause a human catastrophe. The PM10 density which is three times more than the standard amount, also causes that this catastrophe to get more tragedy, therefore the only way to get off this catastrophe is using the intelligence regarding mobility in order to be able to reduce the inside trips and emit gradually some of the eroded cars from the transportation system to reduce slightly the pollution and traffic problems.

Acknowledgement and Remembrance

Many resources have been used in this article which was in English but they were translated into Persian by researchers during the last year and to use these article, sometimes, due to non-availability of the main text, they

were translated from Persian to English again, and because of this, it is likely that they have word differences with their main text, but have regarded trusteeship and the authors' names have been cited completely in all places.
We also thank the Arthur D. Little Institute which has done a very valuable study regarding the smart mobility and in this study it has been used frequently. We also remember the valuable study of Giffinger and about the smart city in Vienna University that showed the way to us and many other researchers in this regard.

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