21st International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2018, Karlovy Vary, Czech Republic, 18th – 22nd September, 2018

MULTIMEDIA WEB APPLICATION FOR TRAFFIC MONITORING

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ABSTRACT
In this paper we are created the multimedia web application with ITS (Intelligent Transportation Systems) implemented for traffic monitoring in one road section in Bosnia and Herzegovina (BH). The focus of the research goals are oriented on an application which complements QoS with the some dimensions of Quality of Experience (QoE) through the implementation of Intelligent Transportation System (ITS). Although QoE is much more difficult to determine. Thus, QoE includes the overall functioning of the system from end to end (user, terminal, network, service infrastructure), wherein the general acceptability depends on several factors such as the content provider, the user expectations, the emotional factor. Relevant information about the quality of service and the levels of customer satisfaction can be obtained from the established relationship be-tween QoE and QoS.
Keywords: Web application, Intelligent Transportation System, QoS, QoE

1. INTRODUCTION
According to definition, QoS is on one hand user-oriented (includes subjective user satisfaction), and on the other hand reflects the specific obligation of network to meet those needs [1]. Standard ITU-T-E.800 defines QoS as „a set of requirements for quality of service which describe the behavior of a group of one or more media objects of multimedia system" [2]. Seen from a broader point, QoS "is a set of quantitative and qualitative characteristics of a distributed multimedia system that are needed to realize the desired functionality of the application" [3]. It includes a number of technologies, also known as QoS mechanisms, which are a useful tool in the hands of network administrators. Quality of Experience (QoE) on the other hand deals with user expectation, satisfaction and overall experience [2]. Compared to QoS, it is a subjective metric that involves human dimensions and that is hence not easily quantified or objectively measured. Although, QoE is much more difficult to determine, the standard ITU-T P.10/G.100 this dimension of quality classifies as general acceptability of an application or service to the end user perception of the function [4]. A common approach to obtain QoE feedback is through qualitative user studies [5]. In this research, the application which complements QoS with the quallity of satisfaction (QoE or Quality of Experience) by implementation of multimedia web application which is implementing in Intelligent Transportation system is developed [6]. Multimedia networks need to deliver applications with a high quality of experience (QoE) for users [7]. Discrete measurement data is not sufficient to assess the overall end user experience with particular applications. For the assessment of the level of user satisfaction with a service [3], often is used MOS (Mean Opinion Score) method that focuses on the "average" user of a product [4]. Another method for assessing the degree of user satisfaction with the application or service is WQL hypothesis which the relation between QoS and QoE shows as the logarithmic function of waiting time and QoE, on the linear ACR (Absolute Category Rating) scale - (WQL Hypothesis "The relationship between waiting time t and its QoE evaluation on a linear scale is Logarithmic ACR"). According to WQL Hypothesis "The relationship Waiting time between t and its

evaluation QoE on a linear ACR scale is Logarithmic") [3], the QoE function can be summarized with the form [3]:

$$QoE = k \cdot \ln(t) + c \qquad (1)$$

where:

k and c are experimentally obtained constants,
t is the load time of web pages.

2. BASIC HYPOTHESIS

QoE can be described by a variety of factors in a definition; nonetheless this does not create any problems if those factors are objective and can be easily assessed. It is difficult to accomplish such thing as QoE involves a lot of subjectivity and various challenges to the multimedia community. The idea is to design first implemented ITS service in the territory of BiH, because currently there is not any like web application for traffic monitoring and managing. The concept of the proposed architecture is based on the recommendations of the European architecture for ITS (FRAME European ITS Framework Architecture) and is in line with the international standard ISO 14813-1 by which is made identification service and the domain of ITS in eleven groups. Structure (CCMS) (Central Control Multimedia System) is a modular (Figure 1) with four main subsystems: for traffic management, for transport management; contextual module and residual module with implementing Intelligent Systems.

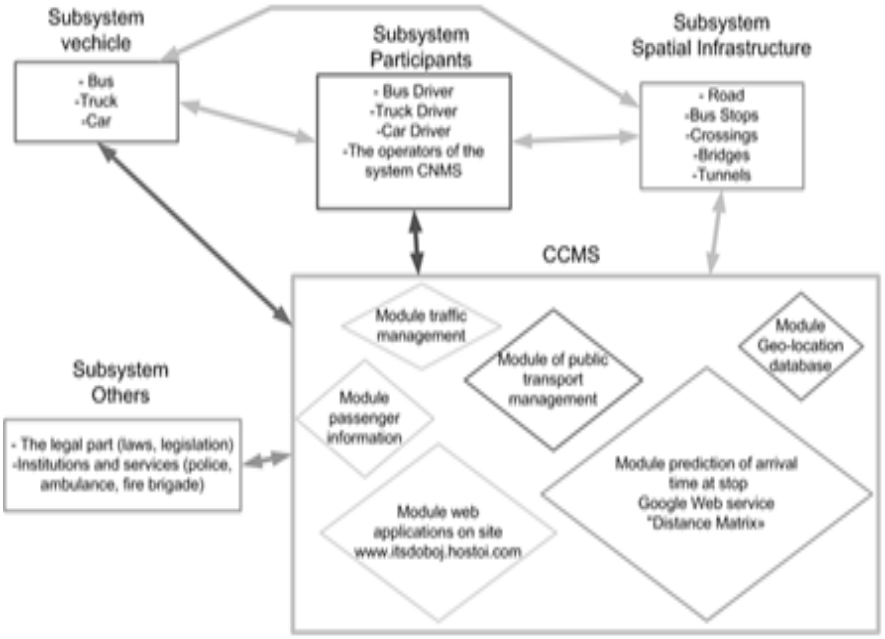

Figure 1. System for monitoring and managing of bus transport

For the purposes of the experiment the contextual functionality of system are extended so the system is enriched with two cameras for monitoring traffic at critical points and the software sensor based on web camera for measuring the speed of vehicles on the observed section. Graphical display of geolocation of elements of the system is visible in Figure 2.

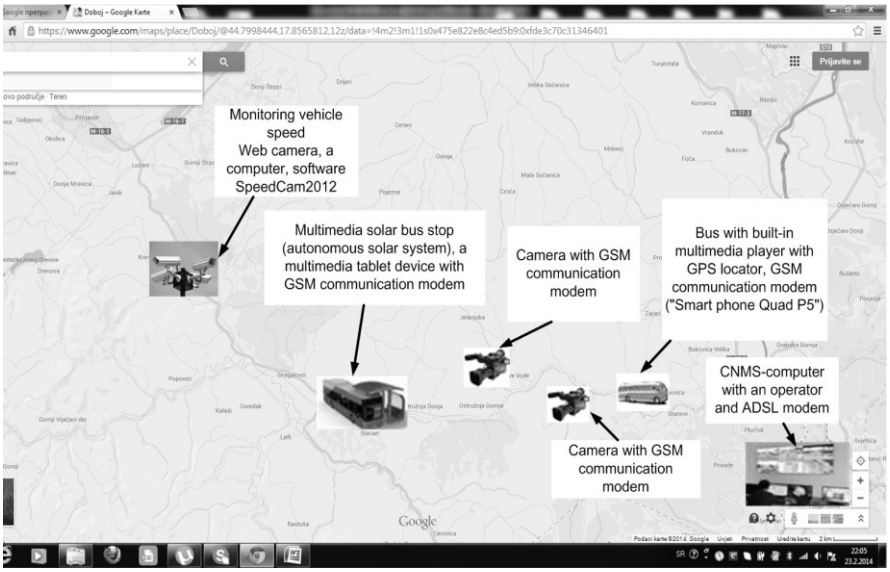

Figure 2. Main elements of ITS at the road section Doboj-Prnjavor

User interaction with the individual modules of CCMS is designed as a multi-modal including text, audio, haptic and graphic visual channel with multimedia web application [8].

3. RESULTS AND PRESENTATION OF METHODS

Results of the research level of customer satisfaction are related to the registration of speed, loading a web application and users sense of quality applications expressed with a subjective evaluation of the tested users. As already mentioned for measuring QoS are usually associated parameters such as Bandwidth, Bit Rate, Delay, Jitter and Loss Rate, while on the other hand they are usually described with QoE Responsiveness (Promptness), Interactivity, Availability, Resilience, Task completion, Acceptability, Fatigue (Tiredness), Satisfaction, Delight (Annoyance), Joy and other.

Testing the application was made in a sample of 50 users via the MOS factor which is used for measure in the domain of Quality of Experience. The MOS is expressed as a single rational number, typically in the range 1–5, where 1 is lowest perceived quality, and 5 is the highest perceived quality. The results obtained with MOS function where is a system parameter is the page load time PLT are shown in Figure 3.

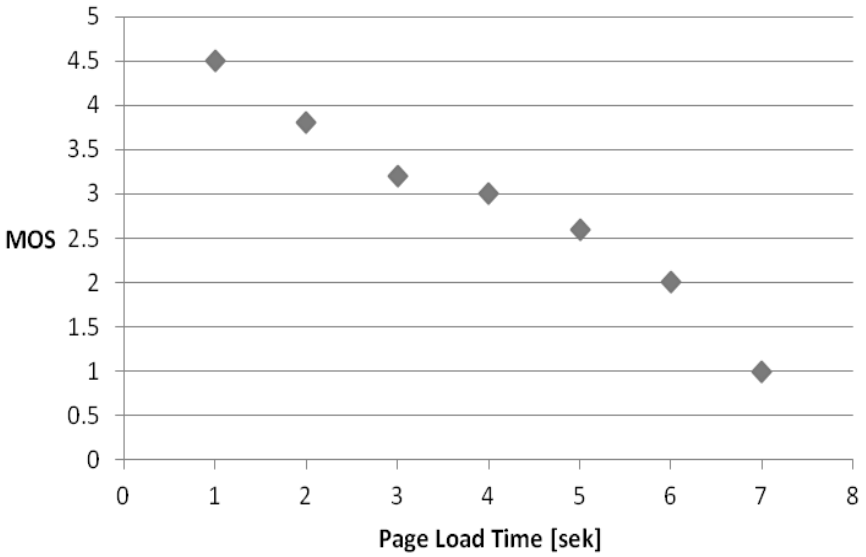

Figure 3. MOS function with PLT parameter

From the graph coefficients k = -1.01 and c = 4.5, are obtained which are used in equation (1), and QoE is presented in the new form:

$$QoE = -1.01 \cdot \ln(t) + 4.5 \qquad (2)$$

Form (2) shows the relationship between page load time and user QoE, which follows a logarithmic dependence QoE of PLT.

4. DISCUSSION

When a user accesses CCMS through web application, he has the feeling that system does not have an adequate response if the website load time is very large i.e. more than ten seconds. In such situations, the MOS factor has a value between 0 and 0.5. Page loading time values less than 1sec, MOS factor is about 4.5. By analyzing page load times depending on the content, the size of the images has a dominant impact on the page load time.

5. CONCLUSION

In designing web applications with ITS the method for the assessment of user QoE measurement system based on the MOS was used. Multimedia web application with ITS for accessing the service has a role of the interface between the user and the CCMS. The necessary load time of web pages were selected as a processing performance of the system. According to a logarithmic functional dependency it is done QoE evaluation of users.

6. REFERENCES

[1] Stjepanovic A., Banjanin M. (2014.) Distributed Multimedia Information System for Traffic Monitoring and Managing. In: Corchado E., Lozano J.A., Quintián H., Yin H. (eds) Intelligent Data Engineering and Automated Learning – IDEAL 2014. IDEAL 2014. Lecture Notes in Computer Science, vol 8669. Springer.

[2] Peter Reichl, Sebastian Egger, Raimund Schatz, Alessandro D'Alconzo (2010.) The Logarithmic Nature of QoE and the Role of the Webwer-Fechner Law in QoE As-sesment, IEEE ICC 2010 proceedings.

[3] Raimund Schatz, Tobias Hossfeld (2012.) Web QoE Lecture1: Quality of Experience, PhD School Krakov, Cost TMA.

[4] T. Hoßfeld, D. Hock, P. Tran-Gia, K. Tutschku, M. Fiedler (2008.) Testing the IQX Hy-pothesis for Exponential Interdependency between QoS and QoE of Voice Codecs iLBC and G.711, 18th ITC Specialist Seminar on Quality of Experience, Karlskrona, Sweden.

[5] S. Egger, T. Hossfeld, R. Schatz, M. Fiedler (2012.) Waiting times in Quality Experience for Web based Services, Forth International Workshop in Quality of Multimedia Experience (QoMEX), Melbourne , Australia.

[6] Jarma Prokkola (2007.) QoS Measurements Methods and Tools, Easy Wireless Work-shop,IST Summit Budapest.

[7] Le thu Nguyen, Richard Harris and Jusak Jusak (2011.) Based on Varying Network Parameters and User Behavioar, Internatioanl Conference on Telecommunications Technology and Applications, IACSIT, Vol.5, Singapore.

[8] Dragan Cvetkovic, Dragan Markovic, Srdjan Trajkovic, Ivana Cvetkovic (2016.) The interaction between human and computer "Through" dialogue, 20th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology", TMT2016, Mediterranean Sea Cruising.