Czech University of Life Sciences Prague

Faculty of Economics and Management

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Bachelor Thesis

Municipal information system and e-Democracy

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BACHELOR THESIS ASSIGNMENT

abs. v. š. Nikita Iakovlev

Informatics

Thesis title

Municipal Information System and E-Democracy

Objectives of thesis

The goal of this thesis is to analyze and implement a web-based IS for a Czech settlement directed towards E-Democracy purposes.
The application will have three levels of access:

- *1st* level is provided for public access with basic information about the city (e.g. tourism, local monuments, history of the city, places of interest)
- *2nd* level is proposed for registered citizens or people, who can be considered as habitants (e.g. local agendas, list of municipal institutions: kindergartens, fire departments, employment centers)
- *3rd* level is designed for members of the local representative to collect and analyze requests from citizens, to manage changes within the city borders (e.g. City Hall: mayor, deputies).

Methodology

First part of thesis will be a review of necessary tools, techniques and theory related to the goal completion.
Second part of thesis will be a real software project documentation including an assessment of the best implementation alternative (e.g. direct web-programming vs. configuration of pre-prepared modules in Content Management System ‘‘CMS’’ like Joomla).

The proposed extent of the thesis

30 – 60 pages

Keywords

E-Democracy; Municipal IS; WWW; Regional Government

Recommended information sources

Alfredo Ronchi: e-Democracy, Springer, ISBN: 978-3-030-01596-1.
Czech University of Life Sciences: Internet and Information Systems, ISBN 80-213-1118-5.
International Journal of Electronic Governance, Inderscience Publishers [online]. Available from: https://www.inderscience.com/jhome.php?jcode=ijed

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Expected date of thesis defense

2019/20 SS – FEM

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Declaration

I declare that I have composed my bachelor thesis titled "Municipal Information System and E-Democracy" by myself and I have only used the sources mentioned at the “references” section. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any other person.

In Prague on date of submission _____

Acknowledgement

My deep and sincere thanks to Vojtech Merunka, my supervisor, for his advice and support in process of preparation for thesis.

Municipal Information System and E-Democracy

Abstract

This thesis is about e-Democracy, defined mostly as the implementation of democratic government processes on web-based or electronic structures. Here the added value of usage of ICTs among citizens will be reviewed. An analysis of the public Czech portal will be applied, pointing towards the search of gaps and possible incorrectness of e-Citizenship usage.

Relevant usability analysis will classify core issues within the website. In case any gaps will be found, an alternative approach for realization of democratic services will be proposed. Analysis of technical notations and usability of desired Web environment (Content Management System) will be presented. The comparison between different Web environments usability will be considered.

The effectiveness of the proposed CMS will be checked by evaluation of FURPS+ analysis, concluding if democratic services can be structured and implemented for a public in a better way.

Keywords: E-Democracy; Municipal IS; WWW; Regional Government

Abstrakt

Tato diplomová práce se zabývá elektronickou demokracií, definovanou většinou jako implementace demokratických vládních procesů na webových nebo elektronických strukturách. Zde bude přezkoumána přidaná hodnota využívání IKT mezi občany. Bude provedena analýza veřejného českého portálu směřující k hledání mezer a možné nesprávnosti využívání elektronického občanství.

Relevantní analýza použitelnosti klasifikuje základní problémy na webu. V případě zjištění mezer bude navržen alternativní přístup k realizaci demokratických služeb. Bude prezentována analýza technických notací a použitelnosti požadovaného webového prostředí (Content Management System). Bude zváženo porovnání použitelnosti různých webových prostředí.

Účinnost navrhovaného CMS bude ověřena hodnocením analýzy FURPS + a dojde k závěru, zda lze demokratické služby lépe strukturovat a implementovat pro veřejnost lépe.

Keywords: E-Democracy; Municipal IS; WWW; Regional Government

Table of contents

Table of figures

List of Tables

1 Introduction

"Freedom is nothing but a chance to be better."
-Albert Camus (French author, journalist and philosopher).

Many centuries ago, people started to think about environment they are inhabiting, in sense of controlling it and wisely spread among each other. They desired to participate in events, mattered not only for themselves, but also for their neighbors, people they considered as enemies or friends, people they did not personally know. At some point they realized, by confronting their opinions, they are giving birth to new ideas, so more and more perspectives of thinking are being considered, thus, new decisions appeared in their minds.

Centuries have been growing as humanity was drawn in countless wars, scientific revolutions and international events around the entire world. Despite nowadays media and technology is keeping us aware of the actions being taken worldwide, previous generations were limited in sense of distribution of news or occasions. People were mostly familiar with local problems, territorially expanded on their settlements, tribes, villages, even kingdoms. We can state that at that time the level of participation was approaching its extreme point in collectiveness of labor, shared resource allocations and moral laws.

History has been archived and re-written among dozens of cultures and countries as our ancestors were learning faster and faster, shaping the minds of the future generations. As a result, population's lifestyle was involved in frequently growing amount of rotations, started from a great migration to an act of diplomacy or fighting for human rights. As an apple would depend on an apple tree, individuals would depend on society they are being raised and formed in. With the expansion of individual's views and opinions, society was undergoing in change of human's spiritual and physical values, people were undoubtedly realizing that their importance, both individualistic and collectivistic, is about to grow.

Referring to these societal changes in a model of "Spiral Dynamics" by American psychologist Clare Graves, we can observe how those values and demands of individuals have been arising or changing through, possibly, the lifetime of entire humankind. This model describes mostly psychological development of an individual or a society based on their current values or demands towards occurred way of living.

Nevertheless, those demands and values, eventually started to respond to proposals or supplies, which shaped, in fact, our modern economical system. Additionally, we can

observe that even on basic levels of development, the concept of authorities and empowerment of the regulations established, was transforming with the social development to a particular manifestation of power.

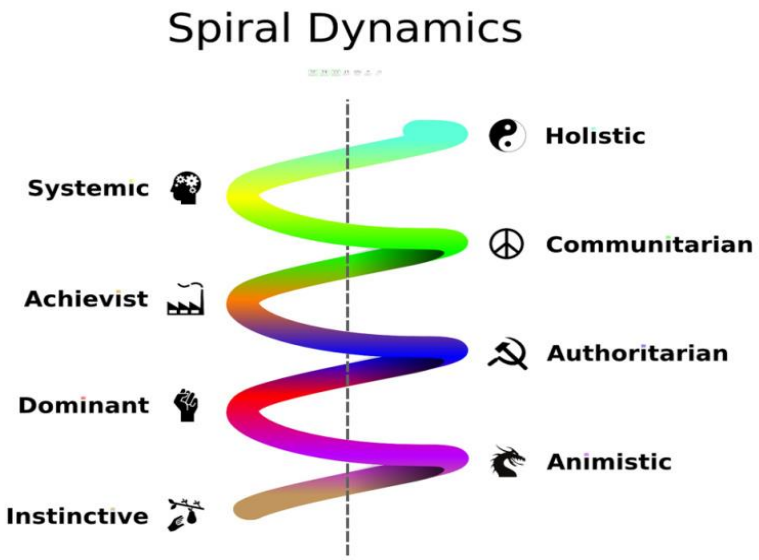


Figure 1. Spiral Dynamics model by Clare Graves.

Source: https://www.toolshero.com/change-management/spiral-dynamics/

Each level can be characterized by a formulation of value mattered for an individual:

- Instinctive – "do what you must to stay alive; obedience to the strongest"
- Animistic – "obey the wisest from you; show loyalty to your kind"
- Authoritarian – "sacrifices for the greater cause; regulations must be followed"
- Communitarian – "seek for peace and harmony; equality among each other", etc…

This model gives us a blueprint on how and under which circumstances society decided to develop a special, generally accepted forms of government, and by which conditions a particular government system is about to flourish or fade.

As the time passes, people realized they need a system, which stores and considers the information they are producing, the unison of ideas being criticized or approved by majority of population. Afterall, they have chosen the wisest and the most experienced individuals, for them to be responsible in front of themselves and others, to guide the rest through a wave of misunderstanding, enmity and inequity, to be able to carry a vast right to judge...

2 Objectives and Methodology

2.1 Objectives

The main purpose of this Bachelor thesis is to propose and review an electronic structure or portal for implementation of democratic services held and processed by governmental authorities in Czech Republic.

Partially, the thesis will gather and consider academic literature that is related to the topic of E-Democracy and its manifestations in European Union and Czech Republic, in particular.

This thesis explores different phenomenon connected to a democratic form of government, it's mechanisms of empowerment and related political fields, by comparing different statistical data, or events related to web-based distribution of democratic services. Then the document researches the current state of distribution of services in Czech governmental portal and seeks to find any possible defects as in its structure, as in ways of implementation of those services.

In addition, a comparison of technical expenses and payoffs between already existing "template-based" Content Management System and direct web-programming development will conclude if the ways of distribution of democratic services might be improved.

2.2 Methodology

The methodology can be represented as an analysis of the current level of distribution of E-Democratic services in the European Union and Czech Republic. Applicable sources will bring an insight on the current level of accessibility of democratic services, as the earlier researches in the field of politics, psychology and economics will underline the most significant features of the democratic empowerment.

Practical task with the following CATWOE and FURPS+ analysis will conclude if using CMS vs direct web-programming is more efficient and accessible for a public.

3 Literature Review

This section is encompassing with theoretical data regarding Democracy, it's modern manifestation of "Digital Democracy" in distinct, common political and economic disciplines, which affect Democratic system or intersect with it. Currently there is a plenty of resources relevantly related to our topic, therefore, this section combines and studies different scientific concepts, definitions and statistical data.

3.1 Democratic Roots

Before straightly stepping to a concept of "digital democracy", it is important to identify the origins and core mechanisms of democracy, as a form of government.

The history of democracy goes back to an Ancient Greece, whereas its creation was stimulated by a desire of people to have a right to choose a leading legislation for themselves. As it was previously mentioned in "Introduction" section, we can justify the origins of democratic system by formulating a value, a belief, which mattered the most for the society of that times. We can surely state that the main value of that epoch was "freedom" or, perhaps, "equality among each other", both of formulations later will become an engine for democracy, an issue that democratic development was focused on. Since that time the idea to let the people govern the state represented one of the potential ruling systems in contrast with monarchy, aristocracy, oligarchy and many other ruling structures. (Britannica, Robert A. Dahl)

Centuries later people have discovered different ways of implementation of democracy, as a result, two core applications of democratic system appeared – direct and representative. Eventually, the ideal concept of a power structure ruled by citizens, direct democracy, is hard to implement even in the Internet era, whereas an alternative approach, representative democracy, implies an election of representative structure in order to mediate between citizens and the political power. (A. Ronchi, 2019)

Inequality of resources, immigration, terrorism, unemployment, rule of law, civil rights – those are the examples of operating areas of democracy, the concepts which democracy seeks to resolve by various types of activities.

A picture below will bring an insight on current democracy levels worldwide.
Each color represents a governmental regime accepted in a country; an explanation follows us:

- Green – Full/Flawed Democracies
- Yellow/Beige – Hybrid Regimes
- Orange/Red – Authoritarian Regimes

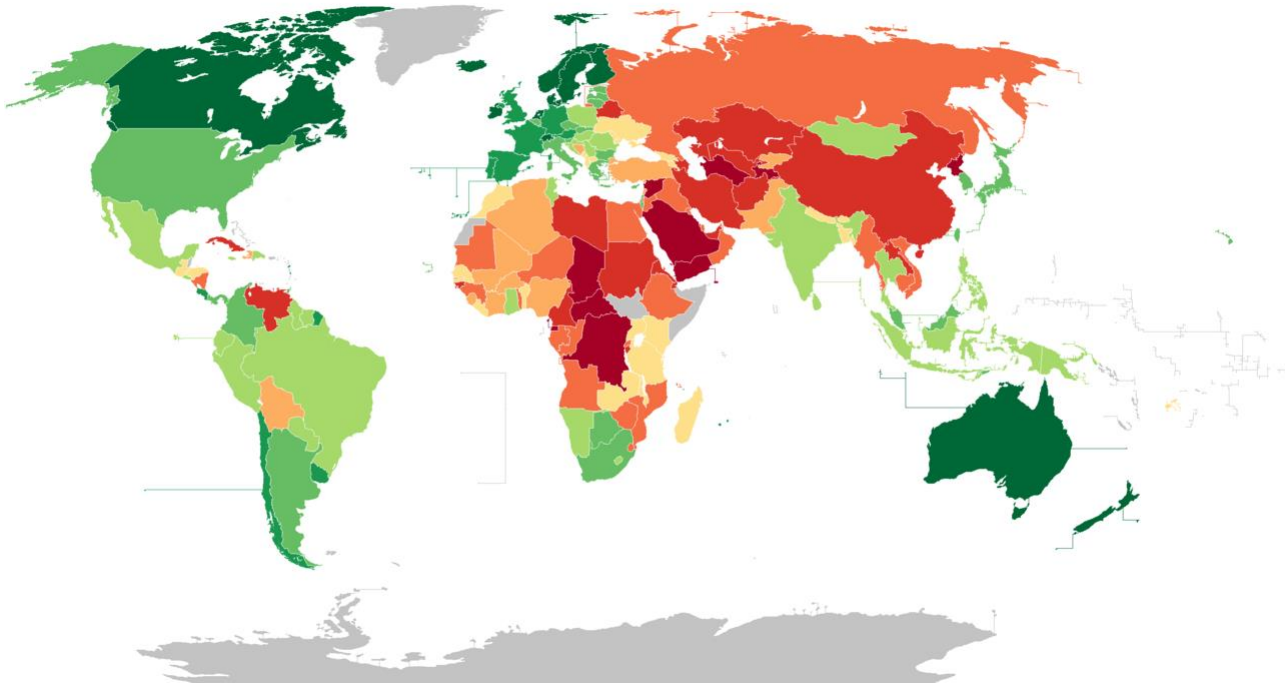


Figure 2: The levels of Democracy Worldwide
Source: https://www.eiu.com/n/products-and-services/country-analysis/

Another statistical reference explains how a particular ranking score, assigned to a country within its democracy index, is being calculated. Usually, there are much more instances that affects democracy index, than it is mentioned below, an example of those might be gender equality, gender comprehensiveness or knowledge levels of population.

The comparison chart for a period between 2008 and 2015 provided below shows us the points received for these categories in a maximum scale set us 100, and with the mean scores depicted as points in a scale between 40 and 90.

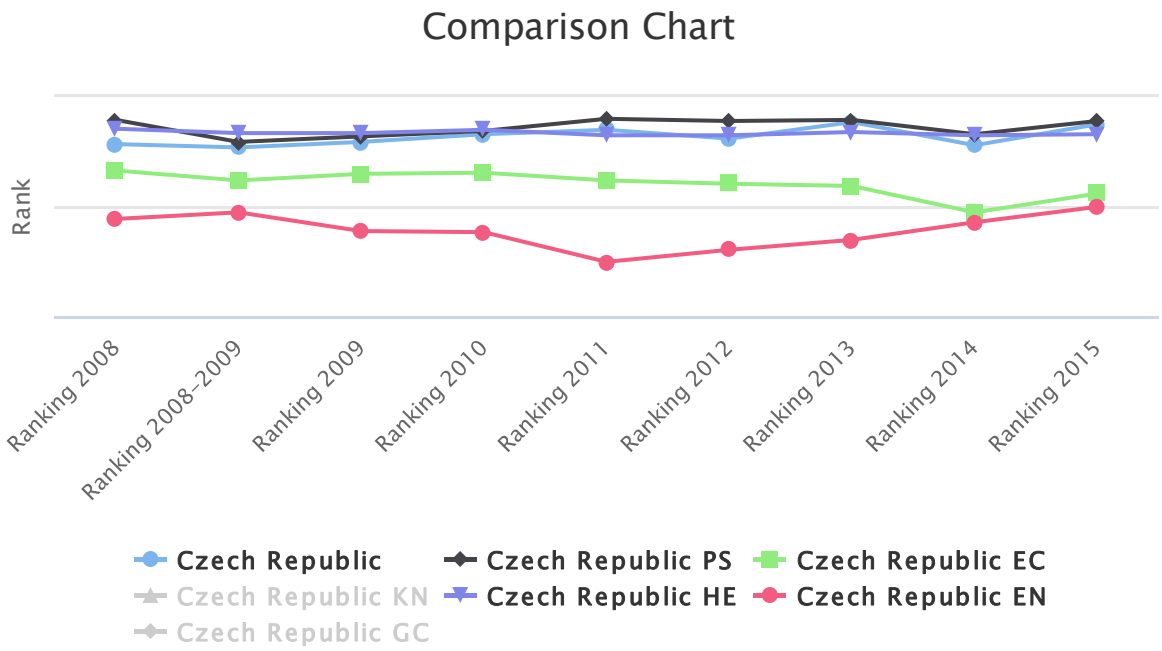


Figure 3: Comparison Chart of Instances of Democracy in CZ

Source: http://democracyranking.org/wordpress/rank/

In this example a country of evaluation is Czech Republic and the calculation of overall democracy index requires the levels of multiple sub instances:

- EN - Environment
- EC - Economy
- PS – Political System
- HE – Health Quality

Now that the background of democracy is explained, we can introduce a product of modern communication technologies and democratic manifestations – E-Democracy. Future articles will explain the dependency of Democratic development to an E-Democratic enhancement processes and the importance of "E" or digital applications for a productive government to citizen connectivity.

3.1.1 Democracy and ICT's expansion towards users

In the beginning of the twenty-first century, a huge number of governmental agencies and private enterprises spread worldwide among different regional institutions and countries, invested time and resources on allocation of their products and services within "web" environment. But due to a diffusion of online content and services started at the end of 90s, the interactions between citizens and government were changing its' borders. From one point of view, technology usage simplified and structured the ways that "Citizenship" applications were forwarded to a legislature, from the other – it offered an entire, new system for civic-governmental relationships, yet to be fully discovered and analyzed by the leading scientists and critics worldwide.

Term "E-Democracy" or "Digital/Internet Democracy" can be considered as a relatively modern phenomenon, a product of civic and governmental technologies, while a standalone "E-" represents here just an approach, a modern implementation of how people are being involved in governmental processes and political self-determination.
According to A. Ronchi, " technology is stimulating changes in the way most people earn their incomes, varying the balance between our roles as consumers and producers, changing the way we educate succeeding generations and train ourselves, changing the way we form communities, varying the way we obtain and communicate information, contributing to bridge some cultural or physical gaps." (A. Ronchi, 2019)

Currently, a huge part of our population can afford itself to take part in electronic activities, pay taxes, donate or learn, contact to representatives of different international funds online, using "WWW". And a lot of people consider the application of Internet Communication Technology (ICT) as an incredibly practical and efficient tool, therefore it underlines their involvement to an "e-citizenship" process.
According to A. Ronchi, "e-citizenship is a critical process involving opportunities and threats, benefits and drawbacks. In addition, there is still a gap to be bridged due to cultural behaviors, age and education". (A. Ronchi, 2019)

Further image describes global internet usage for 2019 worldwide.

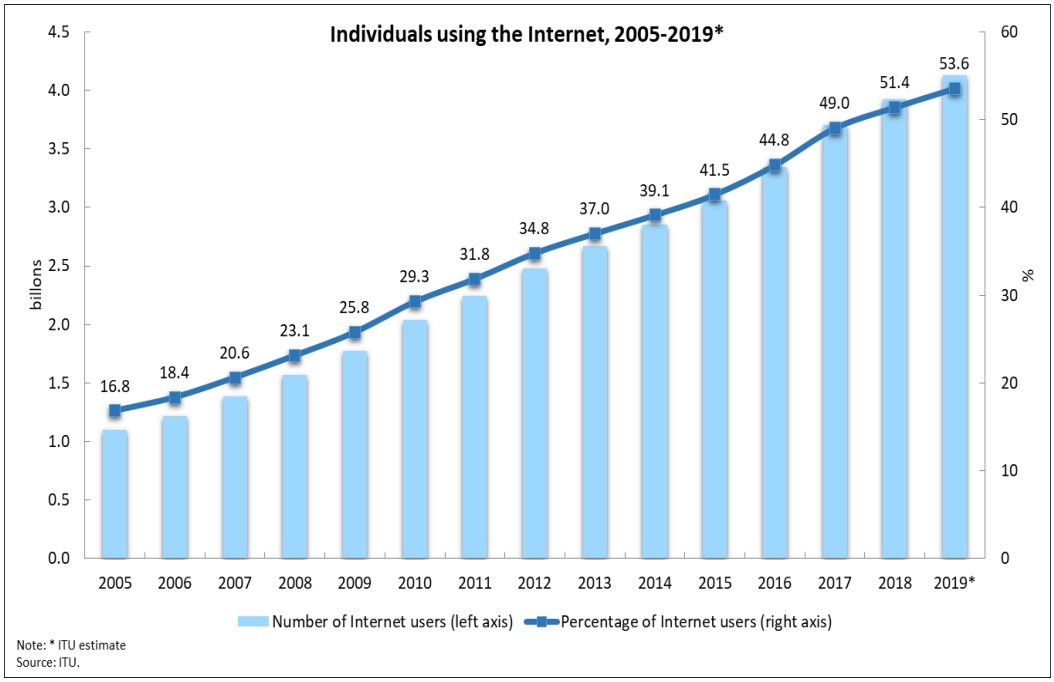


Figure 4: Global Internet Usage (2019)
Source: https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

3.1.2 Requirements of E-Democracy

So far, this paper described a complex, large-scaled system, which tends to interconnect different social groups and institutions, seeking to enhance and stabilize the connection of people to government through a high-tech communication systems or trade networks for services.

According to an Internet and Information Systems, "basic components of any Information System are users/society, Information Technologies and the data/information". (Internet and IS, CZU.)

This massive information system has to have its essentials, necessities for maintaining its operating capacity, and it is a matter of responsibility to monitor the changes happening within the system, to improve it and make it more accessible for everyone.

Nevertheless, an application of ICT partially entails different types of threats and complications.

Within an extreme level of accessibility, for each user the amount of data to process is reaching its elevated point, citizens are being surrounded by an unconsumable amount of information, sometimes vital or interesting – sometimes useless or provocating, and in

some way they find it difficult to eventually filter this dynamic stream of data.
According to A. Ronchi, “social media forces people to disembody the world around themselves, become dislocated in order to access the benefits of access to large amounts of information”. (A. Ronchi, 2019)
Those difficulties emphasize an importance, according to an InderScience, for “governance to produce solutions in a citizen-friendly way”. (InderScience, 2008)

As observed, some of the core requirements of healthy development of digital democracy are:

- Social activity in participation – meaning, a motivation of users to influence and take part in social development and inclusiveness.
- Internet Security – meaning, a systematization of online transactions and communications among users, provided with guaranties of fairness and secureness of private data.
- Government responsiveness - meaning, an ability of the legislatures to attract people to a democratic or, perhaps, governmental events, actively reminding them about the importance of the relationship between people and their representatives.

3.1.3 Democratic Institutions and other e-disciplines

According to UN, “democracy is a core value of the United Nations. The UN supports democracy by promoting human rights, development, peace and security”. (United Nations)

Nowadays, a lot of international institutions and funds are performing their activities pointed towards support of democracy and it’s manifestation worldwide, including: United Nations Development Programme (UNDP), the United Nations Democracy Fund (UNDEF), the Department of Peace Operations (DPO), the Department of Political and Peacebuilding Affairs (DPPA), the Office of the High Commissioner for Human Rights (OHCHR),and the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), and many others.

Even though there is a great number of international organizations seeking to contribute to a democratic development, the operating area of democracy essentially expands on few other
According to A. Ronchi, ”E-Democracy encompasses several online activities, such as e-Governance, e-Government, e-Parliament, e-Empowerment, e-Voting, e-Inclusiveness, e-Participation and many more.” (A. Ronchi, 2019)

3.2 E-Governance as a part of E-Democracy

As was previously stated, E-Democracy is closely related to many other online activities, nevertheless most of them are narrowly specialized in their operating fields, altogether those disciplines form and maintain communications between government and citizens, providing an access to different sources or services for users all around the world. According to A. Ronchi, “the notion of e-Governance has its roots in attempts in many countries to ‘modernize’ government in response to perceived citizen dissatisfaction or disengagement”. (A. Ronchi, 2019)

There is still a point to be taken, considering the difference between e-Governance and e-Government, even both of terms are being inevitably common to the attributes of e-Democracy, eventually they are still following different aims and performing on different tasks.

While e-Government closer relates to a concept of system, which guides alterations in governmental structures, by manipulating with social, technological and political innovations, e-Governance, in comparison, serves mostly as a function of implementation of those innovations, which is supposed to unite governmental structures with civil or business stakeholders and provide control over proposed services.

Broadly speaking, we can consider e-Governance as a part of e-Government, but importantly, e-Governance expands on application of ICT as a source of connectivity of legislatures to stakeholders, empowering citizen’s accessibility to governmental portals and communication with their representatives.
And at last, e-Government operates within one-way protocol (G2C), while e-Governance implies two-way connectivity (G2C, C2G), providing users a possibility to take part in legislating processes.

According to Council of Europe, "there are 4 primary reasons why e-Governance is a valuable aspect for government:

- It encourages the take-up of digital technologies that are crucial to economic competitiveness.
- It allows government to redefine its role and become more citizen focused.
- It enables us to 'join-up' information and hence govern more effectively.
- It can reduce the cost while not compromising the quality of public services. (A. Ronchi, 2019)

Since e-Governance closely relates to e-Government, we can define the activity of e-Governance while analyzing statistical data on e-Government.
The following table and pictures will depict the average level of E-Government Development Index (EGDI) within the borders of European Union, Czech Republic and nearby European countries.

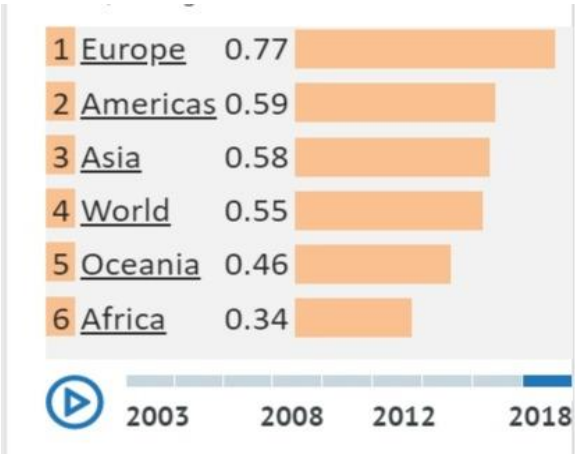


Figure 5: EGDI by Region (2018)

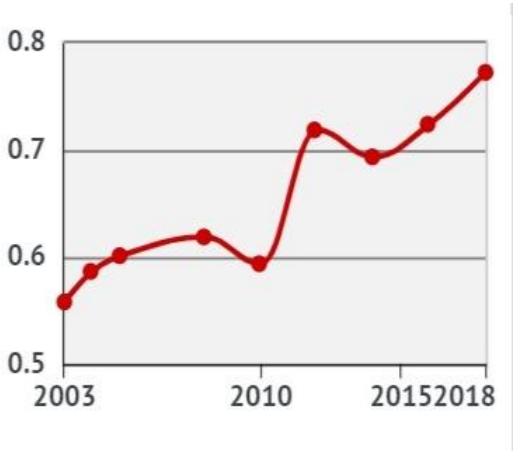
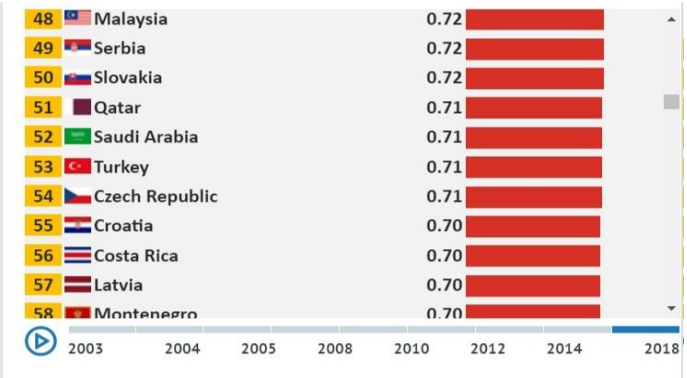


Figure 6: EGDI development in EU



Country	2018 Index	2018 Ranking
Germany	0.88	12
Czech Republic	0.71	54
France	0.88	9
Italy	0.82	24
Austria	0.83	20
European Union	0.77	

Figure 7: EGDI for Czech Republic (2018)
Source: https://knoema.com/mctunlb/un-e-government-development-index?indicator=E-Government%20Index

3.2.1 Models of E-Governance

Recently this form discovered that even though technological applications of e-Governance might be structured in a similar way, plenty of cultural or political factors, including, for example, regulations and admissions or religious laws, add variation to e-Governance and it's manifestation in different countries.

According to A. Ronchi, "there are at least three main models of e-Governance currently operating:

- The 'new economy' model—widely used model in US, emphasizes similarities between e-Government and e-Business, it is focused on delivering high-quality public services and on moving to a more 'self-service' citizenship."
  This model invests a lot of resources to a private sector, satisfying demands of businesses and citizens, providing various sponsorships for them to actively use and, perhaps, improve their technological (frameworks) and economical (markets) potential.

- "The 'e-Community model'—more preferred in continental European societies, particularly those from Northern and Central Europe, which have a strong tradition of civil society and freedom of information, high levels of education and technology penetration and a relatively even distribution of wealth."
  This model encompasses with potential social innovations resulting from widespread internet access, the role of e-Citizenship in establishing and receiving services using ICT and a tendency of a user being involved to a e-Participation.

- "The planned economy model—used in countries such as Singapore or Malaysia, which traditionally use interventionist public sector tools to drive and shape private sector activity and investment."
  Here economic development becomes a primarily task, thus, the set up of technological and infrastructural conditions becomes a governmental responsibility, usually with high subsidiary levels.

  (A. Ronchi, 2019)

3.2.2 Attributes of E-Governance

According to A. Ronchi, the core attributes of e-Governance framework are:"

- e-Administration defined as public investment in ICTs to foster transparency and accountability within both national and local public institutions, to improve their functioning and effectiveness.
- e-Service Delivery Public investment in ICTs to foster the delivery of public services to every possible stakeholder.
- e-Participation Public investment in ICTs to encourage interaction between public institutions and citizens, to promote better policies, services and public operations.
- e-Participation has three levels: information provision to citizens, consultation with citizens, and dialogue between government and citizens. This component is usually linked to voice and accountability, civil society strengthening, and parliamentary development".

(A. Ronchi, 2019)

A wonderful example of a comprehensive way of distribution of governmental services and arranging the design of public portals has been allocated on "Republic of Mauritius E-Services portal". All E-Governmental attributes are combined under different and clearly separated from each other categories and articles, whereas the attention of citizens is mainly captured by a simple and easy to navigate page structure, which is not overwhelmed by various types of banners and tags, conversely providing latest news, future occurring activities and an information, useful for citizenry empowerment .

We can observe that a lot of conditions were met, the websites are fully accessible for citizens, providing different types of activities and related information. An example of E-Services supported and implemented are search function, official statistics of country, latest news, different type of proposed services (application for a learner's license, etc), connectivity to different governmental departments.

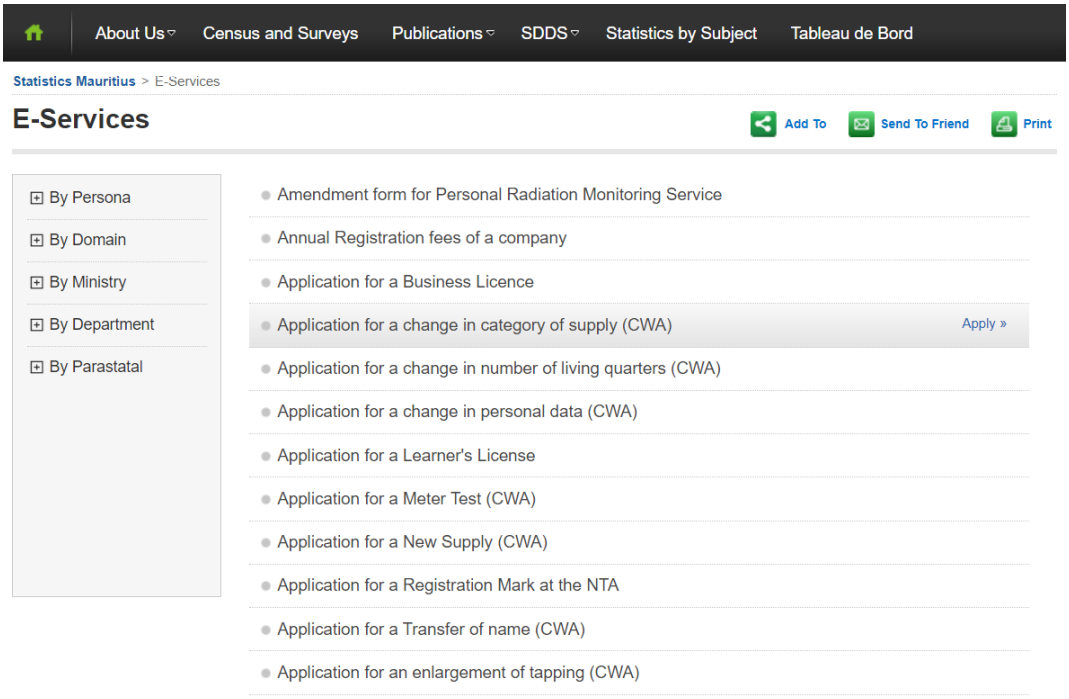


Figure 8: E-Services portal of Mauritius Republic

Source: http://statsmauritius.govmu.org/English/Services/Pages/default.aspx

We will continue defining common "e" disciplines of our topic, anyhow affecting the nature of E-Democracy. While E-Governance mostly establishes ICT and communication between government and citizen, E-Participation defines the importance of e-Citizenship and the ways to enhance it.

3.3 E-Participation

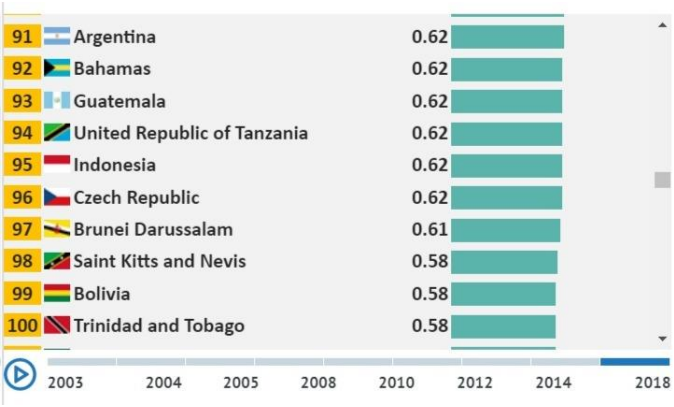
Defining E-Participation, we can declare that this discipline finds its application in enhancement of political participation by authorizing citizens with a connection to governmental portals and their representatives, by means of ICT usage.
One of the main issues E-Participation is focused on, is an interest gap between to citizen's (stakeholders) and services providers within e-Government development. It balances the relationship between potential E-Participation users and E-Services providers, protects citizen's interests and seeks to arrange governmental/democratic services in a citizen-oriented way. Besides interest's protection, E-Participation also researches processes of administration and decision/policy making.

According to A. Ronchi, “As a reaction to a public’s interest loss, many European countries have started exploring the potential of Information and Communication Technology (ICT) to regain citizens’ trust and revitalize European democracy by developing a more responsive, transparent, and participatory decision-making process”. (A. Ronchi, 2019)

According to (A. Ronchi), we can respectfully divide E-Participation to a different dimensions or scales of influence, each of which will be focused on an expandable filed of E-Participation, separately enhancing different E-Participation activities:”

- The Political Dimension—measuring e-Participation as a concept and set of tools to empower, activate and mobilize political and civil society actors to meet public affairs or objectives. Attention here will be focused on EU democratic challenges, such as: transparency, privacy and citizens’ inclusiveness, development of representative democracy.
- The Democratic Dimension—measuring e-Participation as an instrument to strengthen citizen participation in the democratic and decision-making processes, providing citizens with all necessary resources to make their argument and independently choose their legislature.
- The Civic Dimension—measuring e-Participation as a guide to inform, train and educate citizens about their institutions, representatives, political processes, decision-making and governance structures.
- The Economic, Competitiveness and Social Dimension—measuring e-Participation as a set of tools in relation to economic (growth), competitiveness (e.g. quality of public services, transparency) and social (e.g. inclusive government, digital divide, new forms of citizenship) activists.
- The Technological Dimension—measuring the diversity of ICT tools proposed, by its efficiency, availability, performance, usability, accessibility and innovation”.

  (A. Ronchi, 2019)



Country	Score	Rank
Czech Republic	0.62	96
France	0.97	14
Croatia	0.77	58

Figure 9: E-Participation index in CZ and EU (2018)

Source: https://knoema.com/mctunlb/un-e-government-development-index?indicator=E-Participation%20Index

One of the core mechanisms of E-Participation, E-Voting, can be represented by an online activity, strongly connected to a legislative and political self-determination processes.

According to A. Ronchi, "online participation encompasses several other e-activities: e-Environments, e-Consultation, Information provision online, e-Voting, and others". (A. Ronchi, 2019)

3.3.1 E-Voting

E-Voting can be denoted as a modern application for voting process during an any type of election period.

We can distinguish through 2 types of Voting:

- E-Voting – meaning, a supervision and analysis of a physically presented voting machine, organized and controlled by governmental authorities.

- I- Voting – meaning, a standalone submission of the vote electronically, accessible from any location within a specific period of time.

From one point of view, dealing with elections "electronically" simplifies almost every step to be taken towards preparations for the elections, its processing and results, it definitely cuts the election costs and enhances turnout by engaging electorates, who were

not interested or not able to approach to a polling station. From the other, the presence of machines and especially changes in a voting process entailed many concerns and doubts about relevancy of this application.

People considered that a reliable voting machine must be capable to contest vital requirements associated mostly with security, accuracy, privacy, accessibility and cost-effectiveness. Nevertheless, not everyone appreciated such innovation, most of the countries declined to employ new methods of voting within their systems.

According to an InderScience journal, "Two points of criticism were the loss of control by citizens with the risk of untraceable fraud and humiliation of a great number of electors as 5–10% were not comfortable with the systems. The e-voting machines were also deemed as discriminatory to the sight impaired and 25% of the electors ran the risk of mistaking their candidate or not finalizing their votes". (InderScience, 2008)

From the other hand Adam Forrest in his survey underlines that usage of E-Voting or I-Voting can be considered as more securable and legitimate approach comparing to a normal procedure of elections: "Many countries are accustomed to much more old-fashioned kinds of manipulation and corruption, such as stuffing ballot boxes with phony votes and bribery of officials. It's why the adoption of electronic voting systems has helped strengthen public confidence in the legitimacy of elections in many places". (Adam Forrest, 2018)

During the enlargement of web environment, we have discovered special tools, Web 2.0 applications, which were yet to be fully analyzed, but recently employed to manipulate rapid distribution of data. An example of these tools might be a social network or knowledge-based website.

3.3.2 Web 2.0 applications as participation tool

The main difference between the original worldwide web system and modern application of "Web 2.0" lies in distribution methods of the data. An original approach distributed the information statically, directed towards user's consumption and usability of the proposed contents, while "Web 2.0" enables user's feedbacks or an opportunity of citizens to

generate the content themselves, share it and freely express their opinions.
This discipline also covers a tendency of changing of desired design and usability process of the web pages, regardless of any technical specifications. A good example of this tendency is a shifting process of downloading methodology within, for instance, “Torrent” networks (Web 2.0 application) – due to a change of the protocols connection and usage of P2P, the technical expenses of the network are now automatically shared among the users, while the content becomes more accessible.

According to an InderScience journal, “Any Web user can contribute to create the collaborative content; the community of writers playing the role of editor to ensure a certain quality of the final content. In defense of this collaborative form of content production, a comparison between Wikipedia (Web 2.0) and the reference work Encyclopedia Britannica (Web 1.0), published in the international journal Nature in 2005 and concluding that Wikipedia may be a reliable source of information, is often cited”. (Giles, 2005)

This picture below shows us how incredibly rapid the consumption and production of data developed with the creations of Web 2.0 communications.

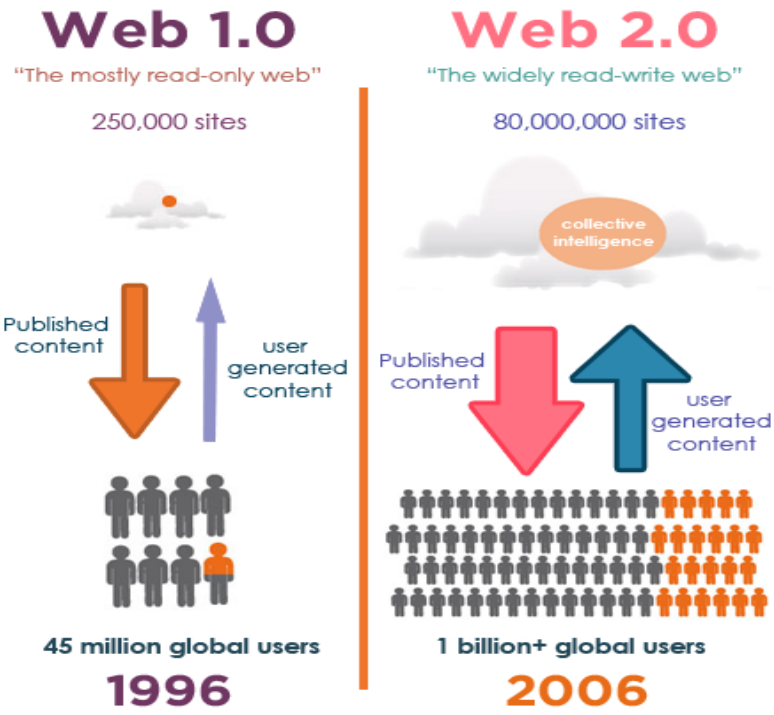


Figure 10: Comparison of Web applications

Source: https://www.znetlive.com/blog/web-2-0/

As it was mentioned above, “Web 2.0” applications can be considered as a tool, which enlarges operating and interest scales of e-Participation‘s usability among citizens, nevertheless, this concept also brings negative drawbacks or complications towards e-Citizenship usage.

According to an InderScience electronic journal, “The role of internet surfers dynamically and desperately changes: from a ‘passive consumer of information’, users become active organizers of online content. Indeed, more and more individuals or groups choose to share their favorite content on interactive and/or collaborative sites. As a consequence, the internet content becomes more decentralized than before, users simply get lost in this giant amount of data. In fact, the decentralized structure of the internet is based on the centralization of information by a limited number of commercial data centers”. (InderScience, 2008)

And indeed, being an active user of the internet or Web 2.0 applications, does not automatically increase his interest in policy making or a desire to participate actively in governmental decision-making. Despite the importance of citizenship and the possibility to systemize it in more convenient and efficient, citizen-oriented way, web surfers mostly prefer to sink in an unconsumable amount of information, considering its value or uselessness.
According to an InderScience, “Many internet sites ignore the interactive possibilities of the network and tend to supply unidirectional information. Internet users are often perceived as customers of public services and not as citizens willing to gain influence in the political process. Information alone does not yet lead to increase citizen participation”. (Constant, 2002)

In the following chapters of this paper we will consider the advantages and drawbacks of another type of Web 2.0 applications, a system that being actively used among business structures and private sector, but not fully applied by governmental organizations – Content Management System. The information about this concept will propose simplification solutions for arrangement of E-Services and E-Participation processes, as well as Government to Citizen connectivity. It will then take place in practical notation, serving as a tool for creation of electronic portal for implementation of E-Services.

3.4 CMS solutions for E-Democracy web structures

The concepts, which will be described further in this paragraph, serve as a tool for interconnection of citizen's participation and the feedback from their participation activity, as well as the quality and usability of the delivered governmental services. Summarizing, the progress in civic participation and citizenry empowerment directly depends on the distribution of services held by government, but, in fact, the lack of actively participating citizens brings negative feedback towards the creation and distribution of E-Services, simply because the resources and activities allocated to an enhancement of E-Citizenship process won't be correctly applied and consumed. It underlines direct, positive correlation among these two disciplines. This paper will consider Content Management System as a required environment for a productive cooperation of E-Participation and E-Governance, each of which occurs as manifestations of E-Democracy.

The definition of CMS follows as a server-based publishing platform or software designed for creating highly interactive websites with easily distributed contents. It proposes a huge variety of different plug-ins and internal instruments, helping users to easily manipulate with overall structure of the webpage, its design and layouts, distribution of information and permissions for access. Essentially it represents a combination of "Word" mechanics with a variation of editing tools and presets, each CMS usually can be upgraded by various types of extensions, which can affect as functionality and responsiveness, as design and editing process of the web page.

According to K. Patel, "CMS is now preferred choice for those who want to easily change their content, simplify control of large amounts of content, a choice of plug-ins to accomplish a wide variety of tasks; and above all, the ability to do a lot more, a lot easier, and a lot faster than with any other system". (Internat. Journal of Computer Applic., 2011) According to his colleague, V. Rathod, "Unlike in a normal hard-coded website, CMS separates its content from presentation, this dynamic simplifies the workflow of an average user and increases his software interaction compare to a static manifestation of an HTML site". (International Journal of Computer Application, 2011)

Most of the CMS are open source or shareware systems, which provide an access to root codes, library of extensions, allocated database and experience in creating own websites for users all around the world. We can consider CMS as a centralized content storage, sales channel, communication and marketing tool.

3.4.1 Difference to direct web programming

Despite CMS brought a great number of useful advantages to a website building, it would barely substitute hand-coding approach, which obviously requires more experience and knowledge in programming, but provides users with essential access to an advanced programming techniques and methods of web-development. Applied for the same purpose, both approaches have their advantages and disadvantages, while the scale of their usability varies from maintenance of commercial webpages to a target development of specific web platforms or applications.

Essentially, core requirement for the hand-coding web development is an operating knowledge in markup languages (HTML, CSS) and, additionally, several other programming languages, which are mostly responsible for so called “backend” of the website or functionality feedbacks (PHP, SQL).

This approach obviously gives user more control over the developed web environment, nevertheless the layout, functionality, design and responsiveness of the website should be now manually customized and implemented by user. From the developer’s side, the lack of knowledge or required skills during development process stands as an obstacle for his workflow and often causes an incorrect code usability, which inevitably leads to an occurred errors, resolving of which potentially requires more advanced knowledge in an Informatics field.

We can now state, that hand-coding is eventually more complex and natural approach of web-development rather than an application of CMS, and with the advanced knowledge of web development it provides a larger scale of functionality when creating a website from scratch. Here we should definitely mention, that any type of today’s existing CMS was developed using hand-coding approach, so we can observe a CMS as a product of an advanced web development techniques.

From the other hand, CMS simplifies the ways of website development and, thus, makes it more accessible for a regular user, keeping him in touch with the latest tools and updates for advancement of his website. At some point, CMS can be considered as a starting point for creators of websites, introducing the cornerstones of web development in an easy-to-understand way and made to be accessible for everyone.

A table below underlines main differences between mentioned approaches, while operating on web development process:

CMS tool application	Hand-coding approach
Complexity of the website and amount of content	
Applies an ability to create more broad and dynamic websites with frequently established updates.	Requires more effort and skills, creating such amount of content by hand, while updating requires patches or system restart.
Time required for development	
Due to a separation of frontend and backend and availability of integrated menus, modules, articles and permissions requires less time for creation.	Can be generally considered as much more time-consuming process, since everything is being built from scratch.
Environmental Usability	
The environment of CMS is fully developed for simplification and efficiency in usability of provided instruments and extensions. Still provides less functionality rather than direct programming web environment.	A good example of hand-coding environment is “PHP Storm”, where all the required functionality, including debug and assisting AI presents. Requires processing with raw code.
Separation of frontend and backend	
Due to a separation of mentioned features speeds up the process of creation and simplifies the understanding of usability.	Requires an accurate draft of the desired website or future debugging and alteration of the modules one by one. Impossible to execute without operating knowledge of HTML, CSS, PHP and SQL.
Multi-user support systems	
“User” menu is separated from other sections, and serves, in fact, as a start point for creation of website. Stores guidelines for a correct execution of permissions and accessing systems.	Different access levels are implemented with the help of multiple programming languages and further testing of the system. Much more complex in creation, than provided in CMS.
Launched Customization tools	
Stores various templates and pre-prepared environment.	Programming environment system usually collects such instruments as: code editor, code autocompletion, frameworks, etc.

Table 3: Difference between CMS and Hand-coding

3.4.2 CMS applications

Since the advantages and disadvantages of the above-mentioned web development approaches are described, we will now focus on the actual applications and tools, which CMS provides for its consumers. An actual CMS being employed in this paper is called "Joomla", later it will be used in a practical notation as a main tool for alternative realization and distribution of democratic services held in a chosen Czech settlement. Joomla has entered the market in 2005 and was written mostly on "PHP" and "Java Script" programming languages, whereas its updated versions and extensions were occasionally implemented for a better source development.

According to B. Projapati, "Joomla is a free open source and content publishing system designed for creating highly interactive multilanguage Web sites in short time like online communities, media, portals, blogs and E-commerce applications".
(Internat. Journal of Computer Applic., 2011)

Here is a list of the applications, which are provided by Joomla CMS for its users:

- User Management – a possibility of multi-user integration system.
- Content Management – an availability to create and alter user's contents.
- Media/ Banner/ Contact Management – an ability to insert and edit different types of side information (contacts links, videos, photos, advertising).
- Template Management – integrated support of various pre-prepared templates, forms and modules.
- Search Systems
- Extensibility support – a possibility to add a comprehensive amount of different extensions (text editors, style templates, advanced components, databases).
- Integrated Help System – an addition of online help center, provision of valuable guidelines and explanations of the main features of usability and expandability of user's workflow.

4 Practical part

In this part an analysis of Czech settlement's website will be evaluated, pointing towards searching of any possible drawbacks in its design, functionality, accessible provisions, overall usability and other criteria. We will pick the website of a small town Horomerice as an example of our analysis.

The discovered issues will bring an insight on areas or functions that should be reorganized in the municipal information system. Afterwards, this paper examines a solution of better application of chosen electronic portal, additionally adding a sample of proposed E-Service, fully accessible as for the citizens, as for governmental authorities. Our goal is to develop a secure and responsive 3 levels of access hierarchy for implementation of electronic procedures, such as: online learning, voting or application for business license. The author of this thesis has chosen I-Voting as a matter for development. The solution will be then reinforced by various business notations, theoretical and statistical analysis (CATWOE, FURPS+,) as well as by proposed service implementation.

4.1 Website analysis of Horomerice

Horomerice can be considered as a relatively small town located not far from the northern part of Prague and our University, in particular. Its population is barely approaching 5000 people, while its territory at most expands on 804 hectares. The infrastructure of the town consists of a primary school, kindergarten, post office, health center, pharmacy, library, grocery and car repair stores, hotel, sport facilities, technical control station and a City Hall.

According to the Index Mundi, the statistics of rural population in Czech Republic for the year of 2018 (this percentage is calculated from total population of CR) scores almost 26.3 percent from the total population. (IndexMundi, 2017)

As observed, the supported E-Services in populous regions of CR are distributed and organized in citizenry-oriented, easily accessible way. Governmental structures are delivering different types of provisions towards population, engaging and attracting citizens to their civic affairs, helping recently arrived people or tourists with practical information about the city and conducting a migration policy with current laws.

It's needless to mention, that most of the governmental budget is usually assigned towards

the development of major significant regions or industries (Capitals, Agriculture, HealthCare, Education).
Consequently, due to the lack of resources and limitation of the power, municipal offices of the less populous or rural regions are operating under slightly different conditions.
We have decided to choose a tiny Czech settlement as an object of our analysis mainly because the levels for E-Participation and distribution of E-Services are more difficult to maintain in an extensive volume, rather than in a larger city, where the concentration of legislature representatives is higher.
Observing websites of the bigger cities won't give us such an accurate insights on an actual expandability of E-Democracy on the territory of Czech Republic.
The government`s website of Horomerice town is located under the URL https://www.horomerice.cz/.

4.1.1 Page Structure

A starting page or a "Home" page of the website is implemented with 5 main menu sections: Community, Municipal Office, Life in the Village, Practical Information and Contacts. Those menu items are stored slightly below the emblem of the city, which serves as a logo hyperlink to a starting page. To the right from logo, we can find a small contact section with specified telephone number and an e-mail of the town's mailroom. Further right, there are different side links (YouTube, RSS, Instagram) serving as an additional source of information regarding the city life. This part can be considered as a header, since it is available in each part of webpage.

The main menu sections are designed in a way of tab bar, so when user desires to choose the menu section, the additional information appears right underneath it, providing sub sections to a related menu topic. All of those sub sections store a link to a different part of the website, with the different layout and navigation options.

In this paragraph, we will underline the most valuable or positive features of the website, while in the following paragraph we will introduce the method for estimation of mandatory and non-mandatory provisions within an E-Governmental scale of activity. In consequent paragraphs our attention will be concentrated as on the most important usability issues, allocated on the website, as on the proposal of solution for those issues.

An overall website's structure is fully responsive, ready-to-use on different platforms (PC, mobile phone, tablet), and easy to navigate.

Figure 11. Home page analysis**.**
(**Source**: https://www.horomerice.cz/)

The webpage is styled mostly with white and blue colors, while the light-dark color of font is applied on related categories or articles, blue color of font is used for a text-hyperlinks and white-colored font is used in the menu section since the menu bar is blue-colored.

The website's search section is covered with a background picture, located just under the main menu section, provides users with possible results corresponding to an input phrase within all the materials listed on the website.

The practical usage of the "Home" page includes a collection of multiple topics or sections, related to categories or articles of the different part of the webpage. While these articles are stored in a different menu sections, even though the website does not include access division, they will be still available for the first-time users on the starting page. Most of those articles are located on the bottom part of the webpage, storing latest news and announcements, list of events, calendar and photo gallery.

During an observation, multiple useful functions and design implementations were found:

- Translation Plugin – located on the header of the webpage, gives an opportunity for a user to translate (using Google plugin) all the text on the webpage to a preferred language. In fact, this implemented unit cancels the necessity to have different language versions of the website. Even if translation won't be ultimately correct, it will be still enough for a foreigner to understand and adjust to a website's structure and orientate within its content.
- Supportability of "V obraze" application – a weblink to a quite valuable application was detected in the "contacts" section of Horomerice website. This application can be installed on mobile platforms and it stores the latest updates and general information about the cities in Czech Republic, including Horomerice. A list of provided information follows as: notifications, latest events, official desk and gallery. An application's data is synchronized with the information provided on the website – so a potential user will be always aware of the city life, possibly substituting a navigation through a webpage to a usage of this additional platform.
- Governmental feedbacks – in "Life in the Village" and "Municipal Information" menu sections the interconnection between citizen/tourist and governmental representative is implemented with creation of fields for user's feedbacks, defect reports, E-Registry archives and instructions for related civic affairs. All the available applications are protected with the electronic signature and https protocols encryption. We can state that E-Services are allocated on this website and often being used among population.

4.1.2 Provisions on website

In this paragraph we will evaluate E-Government's scale of activity within published Horomerice's webpage, analyzing all the different types of government to citizen (G2C) connections and related provisions. Those provisions will be estimated with the help of business notation, discovered by Witrz and Daiser in 2015, according to which, the classification of E-Government business activities can be spread into four independent models – Information, Communication, Transaction and Integration. This model will help us with understanding provisions, which are correctly established, not fully integrated into the system or simply absent on the chosen webpage.

Each model, therefore, focuses on the its own part of G2C connectivity process:

- Information – how constructively the process of compiling and presenting the content on the own webpage is implemented.
- Communication – how accessible the communication exchange opportunities are implemented.
- Transaction – how the administrative transactions between citizen and government are initiated and processed.
- Integration – how frequently users are being integrated into valuable governmental activities and realization of their civic affairs.

Table 4. Information provision – Horomerice.

Information	
Mandatory information	Non-mandatory information
• List of electronic services established by government • Lists of important documents and contacts • Forms of registration of civic activities or feedbacks • Instructions for correct validation of those forms • List of published regulations	• Statistical data • History of the town • Map portals • Contributory organizations • Calendar • News and events held in town • Photo gallery

Table 5. Communication provision – Horomerice.

Communication	
Dynamic communication	Automated communication
• Call center • Form for reporting defects • Form for electronic registry • Social networks • RSS Newsletter	• Translation Plugin • Search function • Printing function

Table 6. Transaction provision – Horomerice.

Transaction	
Partial online offer	Full online offer
As observed, online transaction provision is absent on the chosen webpage, we can state that governmental authorities haven't yet established G2C administrative transactions	Lack of accessible offer

Table 7. Integration provision – Horomerice.

Integration	
Partial online offer	Full online offer
As observed, online integration provision is absent, we can state that the highest level of G2C connectivity on the chosen webpage is communicational provision - citizens are not yet integrated into valuable governmental activities	Lack of accessible offer

4.1.3 Important Issues

Nevertheless, an overall structure of the webpage is self-explanatory and understandable for users, some of the usability issues were still discovered after a comprehensive analysis of some modules and articles within different parts of the website:

1. Search function does not respond to an input text, written in English language.
   An author of this paper examined multiple variations of input text, including "area", "application", "regulation" and "box".
   "Box" as an input phrase was a special case, which was recognized by system, therefore, a result of searching appeared. Nevertheless, the results on this request were executed because such word is also applicable in Czech language, this underlines incorrectness of the search/smart search system implementation.

   Each of the found issues will be shown on a screenshot from the official website just below the current article:

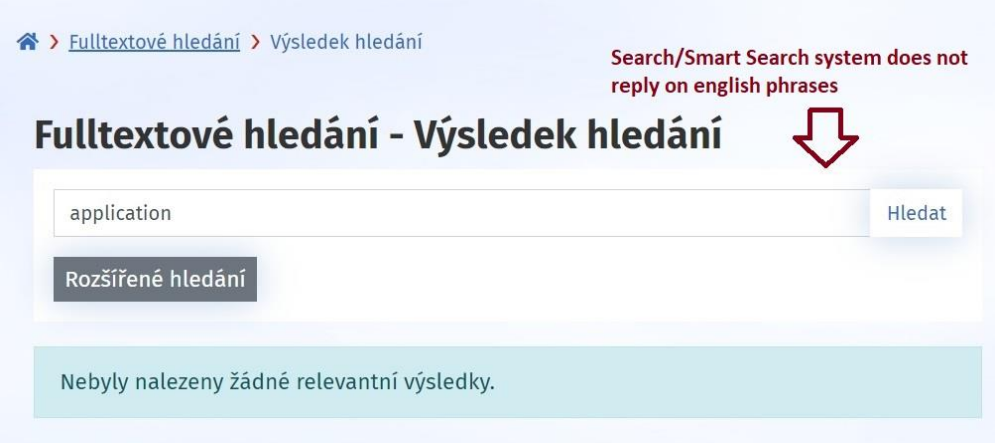


Figure 12: Search function issue

Source: https://www.horomerice.cz/

2. Modules of webpage might be implemented with more accurate design.

Due to the lack of access restriction among users, all the available information stored on this webpage accumulates itself, creating sometimes too much data to analyze and go through. Most of the categories, listed in "Municipal Office" menu, store a comprehensive number of related sub-categories and text fields, which definitely increase the average time users spend on searching for the desired content.

As observed, some of the modules of webpage are filled to the point that it creates some small layout artefacts.

Figure 13: Modules issue

Source: https://www.horomerice.cz/

3. Selection fields in the "Forms" category does not correctly respond to a choice of the selection. It is simply unavailable to choose among listed options, which entails losses of the presented content.

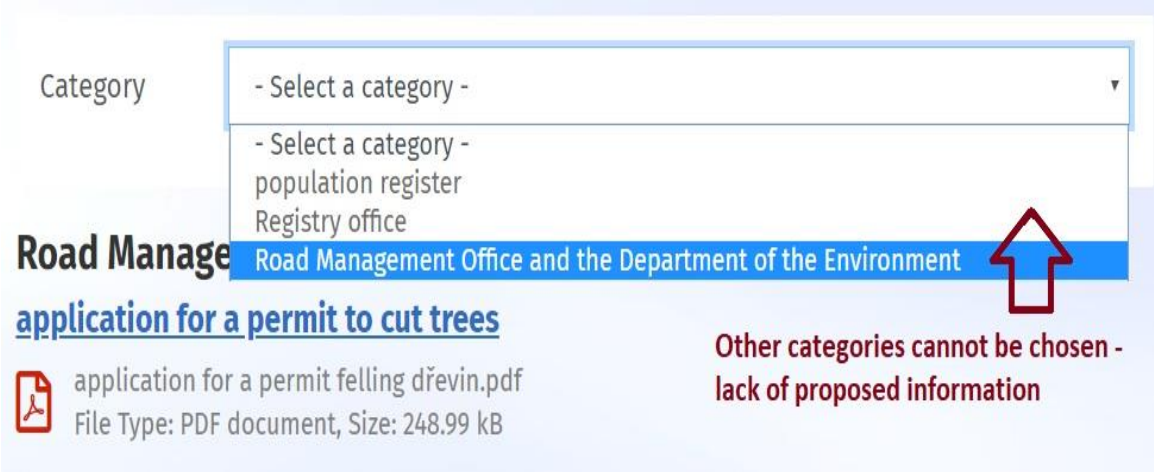


Figure 14: Selection field's issue
Source: https://www.horomerice.cz/

4.1.4 Recommendations for improvement

The following recommendations were created in order to improve transparency and usability of relevant E-Services located on the chosen webpage:

1. Reorganize the structure of the layout or the distribution of modules, articles and categories across the menus on the webpage. A huge amount of text fields and sub-categories in different menu sections tend to consume a lot more time when researching for the desired content. This might be improved by linking multiple sub-categories with "tags" or chaining common articles among different menu sections.
2. Improve the operating workflow of search/smart search function. As was mentioned in previous paragraph, this function only reacts on non-English input phrases, otherwise it operates normally. Search function is being widely used among foreigners, so having a supportability of English based input text should be a valuable asset for a website.

3. Include a supportability for registration and maintenance of user's profile. This recommendation is closely related to a concept of separation of access among website's users. Since one of the disadvantages of the chosen webpage is overabundance of the provided information, it can be fixed with the division of users to user groups and assigning different access permissions to them. Obviously, each user will have a right to register, but, for example, many parts of the "Municipal Office" content (communication provision of feedbacks and forms for civic affairs, issued by government) won't be so necessary for a foreigner or a tourist – which means, for this user group the content might be partly restricted. By separating registered users from registered inhabitants of the town, we are also filtering the structure of the webpage, providing more functionality and important information for local people and releasing unnecessary content for foreigners.

4. Establish "Transaction" provision on the website. Transaction provision represents more of a common asset nowadays, simply because online transactions and registrations have become an essential process as for consumers, as for business or governmental holders of the websites. This might be implemented, for example, by adding an online payment function assigned to a fee for a collection of waste on Horomerice's webpage. But, in fact, transaction provision also expands on any type of automatically received and executed application from a user, such as: automated change of postal address or name, etc. This provision is vital for development, because despite on the other provisions, it collects payments for distributed services and redirects it to governmental budget.

4.1.5 I-Voting proposal

In the following paragraphs we will introduce and analyze a service, which was previously discussed in the theoretical part of this thesis, but yet to be fully employed by governmental structures – electronic voting.
An author of this thesis decided to propose an acceptable paradigm of this service, attempting to enhance the levels of E-Participation in Czech Republic, improve government-to-citizen connectivity and distribute the proposed system in a citizen-oriented way.

A proposed E-Service, created with CMS applications, employs an “Integration” provision to Horomerice’s official website and, therefore, seeks to engage citizens to attend political decision-making and contribute to their civic affairs.

Technical assessment of the website did not imply operations with hand-coding and, therefore, ensures the accessibility of employed techniques and conditions for the public’s research.
We will describe several core characteristics of the paradigm, including analysis of stakeholders, technical requirements and operating flowchart of the system.

4.2 Conditions for proposal – CATWOE analysis

Employing CATWOE analysis, we will identify core participants of an E-Service, technological and environmental boundaries, ownerships and factors of influence on user’s experience.

4.2.1 Clients

Since the proposed E-Service introduces an “Integration” provision to the website, the target audience of the service will consist of local inhabitants, who have already registered and managed their personal accounts on the webpage.

This service doesn’t expand on regular registered users of the platform, the application will provide access for a voting right only in case registered user will be recognized as local citizen of Horomerice.

A potential voter will be required to register and login to his personal account on the webpage, choose an appropriate service, place his desired vote and confirm his decision. Afterwards he will receive an automatic conformation of vote acceptance.

4.2.2 Actors

The main actors of the proposed paradigm will be governmental workers and authorities, who will establish a particular time and accessible web-environment during the election period. They will be also in charge of collecting and storing votes from citizens and announcing official results of the voting process to the public.

4.2.3 Transformation

Some of the most significant functions to be added in the implementation of the service:

- Establishing an access restriction during the voting period
- Verification of user's capability to vote
- Establishing online feedbacks from support team to voters
- Establishing instructions for vote submission
- Placing votes online during election period
- Selection of desired candidate
- Submission of user's vote
- Electronic signature/passport for identification of a user
- Notification of vote submission
- Collecting votes in a governmental database
- Providing voting results to a public

4.2.4 Worldview

From a worldview perspective, an introduction of electronic voting will definitely speed up the process of as preparation and organization of voting, as the announcement of the official results by the end of the election period. Moreover, the necessity for allocation of event venue will disappear and, therefore, the amount of potential electorates, who were recently unable to approach to a polling station or were not notified about elections, will be decreased due to an ICT-based proposed environment. For the same reason, the amount of paperwork, as well as the organizational costs of the event venue will be decreased, which leads to an efficiency improvement in allocation of time and resources spent on organization of voting process.

From the user's perspective, the voting process will become much more convenient – potential voters will not be required to approach to a particular polling station, fill out paper forms in order to place a vote, spend their time waiting in queues. This paradigm applies a citizen-oriented way of service implementation, where each customer will place a vote regardless of his locality, obtaining online support if necessary, and confirming his choice electronically.

4.2.5 Owner

The owner of I-Voting paradigm will be the government of Horomerice and, particularly, all the branches of governmental office which are responsible for carrying out the organization of election period.

4.2.6 Environment

This paradigm implies multiple boundaries or requirements, without of which it will be impossible to correctly implement the structure and the outcome of the proposed E-Service.

Firstly, since the operating workflow of the service requires a prepared web environment, an allocation of multiple servers will play a significant role in organizational process of online elections. First server will receive and traverse votes from electorates to the second server, where these votes will be calculated and presented to the public by the end of election period. Obviously, first server will be used as a firewall – it will verify the eligibility of a user to place the vote, while the second server will be used as a storage base for collected votes and as a database with final results, which will be accessible for the public.

Secondly, since a particular time will be established for the election period, an engagement of citizens should be a matter for correct organization of event. A server for placing a vote will be available within a certain amount of time – therefore, local inhabitants should be notified about an event and their contribution to a political decision-making.

Thirdly, when working with user's requests, it is important to maintain privacy and legal protection of personal data. Moreover, the governmental servers should be also monitored and protected from the hacker's attacks, gathered data by the end of the election period will be considered as a governmental property.

4.3 I-Voting service paradigm

The service was proposed as a government-to-citizen solution for enhancement of levels of civic participation in political decision-making. Based on research done in previous paragraphs we can state, that with the expansion of ICT, the best way to attract user (in our case civilian) to his participation in governmental activities is to distribute government-to-citizen connectivity in an accessible web environment.

A chosen website of Horomerice is structured in a comprehensive way, providing basic connectivity between citizens and governmental parties, but its spectrum of provisions

expands only on 2 out of 4 possible provisions, accepted on websites of other different states and cities. A proposed E-Service covers an “integration” provision, allowing citizens to be electronically integrated into valuable governmental activities and decision-making.

This paradigm emulates an election period placed in town of Horomerice but proposes an electronically based solution towards the organization of listed event. In order to allocate this event in web environment, several requirements regarding security, accuracy, privacy, accessibility and costs of the proposed services should be considered.

4.3.1 Workflow Diagrams

An author of this thesis decided to depict the operating workflow of the proposed service with the help of flowchart and a use-case diagrams. First diagram will be focused on the hierarchical separation of access to a voting application. Second diagram will describe technical implementation of network, while the third diagram will technically describe the operating workflow of the online voting process from user’s and administrator’s points of view. An explanation of the diagrams will be provided.

The hierarchy of distribution of access levels is implemented with an addition of multiple users, user groups, access levels and permissions. Each of these features are interconnected between each other, providing an accessibility rights for a proposed content.

Users created during an implementation of system: Registered User, Registered Citizen, Governmental Authority, Super User (Administrator).

User Groups created during an implementation of system: Tourists (public access), Registered Users (registered access, a possibility to login to a website), Registered Citizens (a possibility to login to a website and access I-Voting paradigm), Governmental Authorities (granted with an administrator/ super user access) and Super Users (author of the thesis).

Access levels created during an implementation of system: Public (visible to all user groups), Registered User (available for Governmental Authorities and registered users), Registered Citizen (available for Governmental Authorities and registered citizens), Special (available for Super Users and Governmental Authorities) and Super Users.

Just like a particular user will be assigned to a user group, access levels are distributed among user groups, while permissions for access can be applied on website's components, such as: categories, articles, modules, etc.

The following data is required in order to access to I-Voting paradigm:
login: citizen
password: 5678

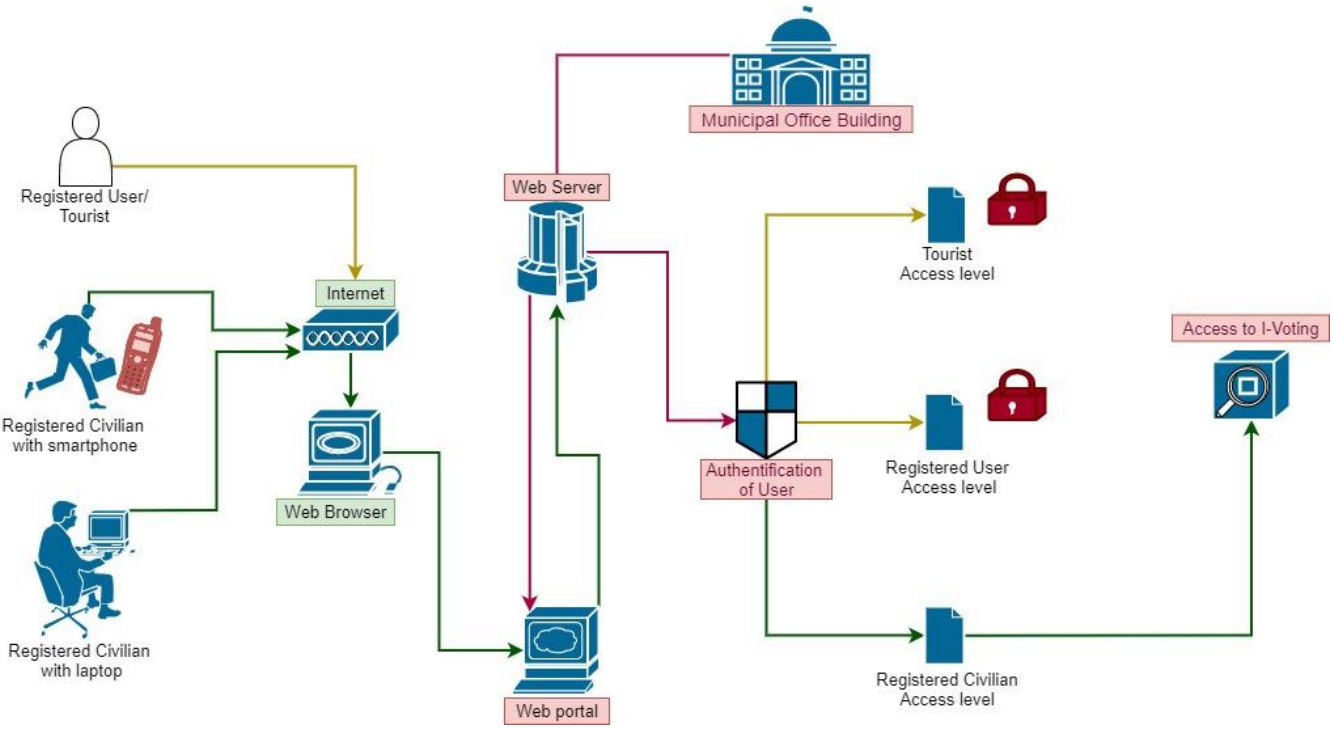


Figure 15: Access levels
Source: https://app.diagrams.net/

A technical assignment of the proposed paradigm should ensure the quality and correct organization of election period, placed in web environment. The whole website operates from a web server, controlled by governmental authorities with addition of security matters: an establishment of a reverse proxy and two firewalls – both on input and output of the proposed network. This security matters are included in order to prevent attacks or malware activity directed towards governmental or user's personal data. By the time user will enter the portal, the system will forward no sensitive information (User ID, postal code) to the server, so that it will be automatically assigned to a user group, therefore, he

will be granted with a special level of access. Each user might have only one login and password to access the web portal. After an authentication will be executed by the system, it will let or restrict the access of user for this particular menu section or service.

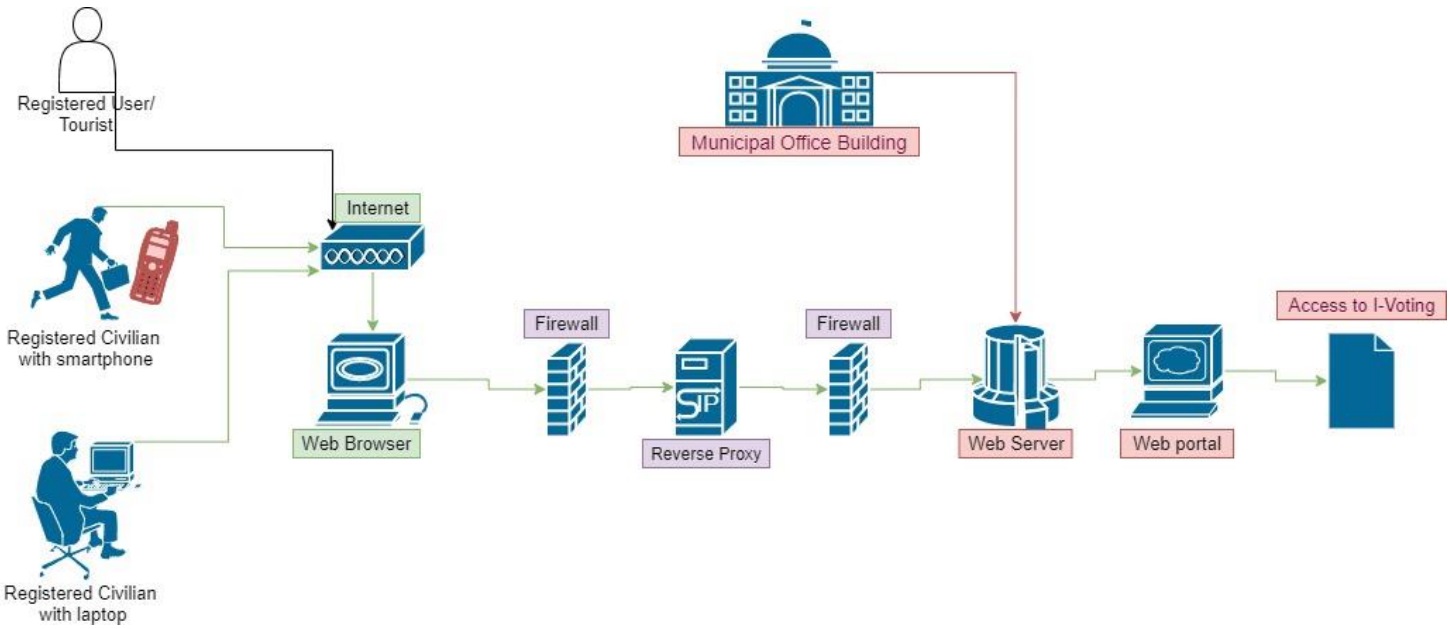


Figure 16: Implementation of network

Source: https://app.diagrams.net/

After a user will be assigned to a particular user group – he will be accepted to place his vote, the system will require an authorization of identity before letting him in. During voting process each user may vote anonymously, or he can add an electronic signature to his application. In case the access for the service will be denied - user will be redirected to a home page and he will not be allowed to access this section anymore. In case his vote was successfully accepted – he will receive a notification of acceptance of his vote.

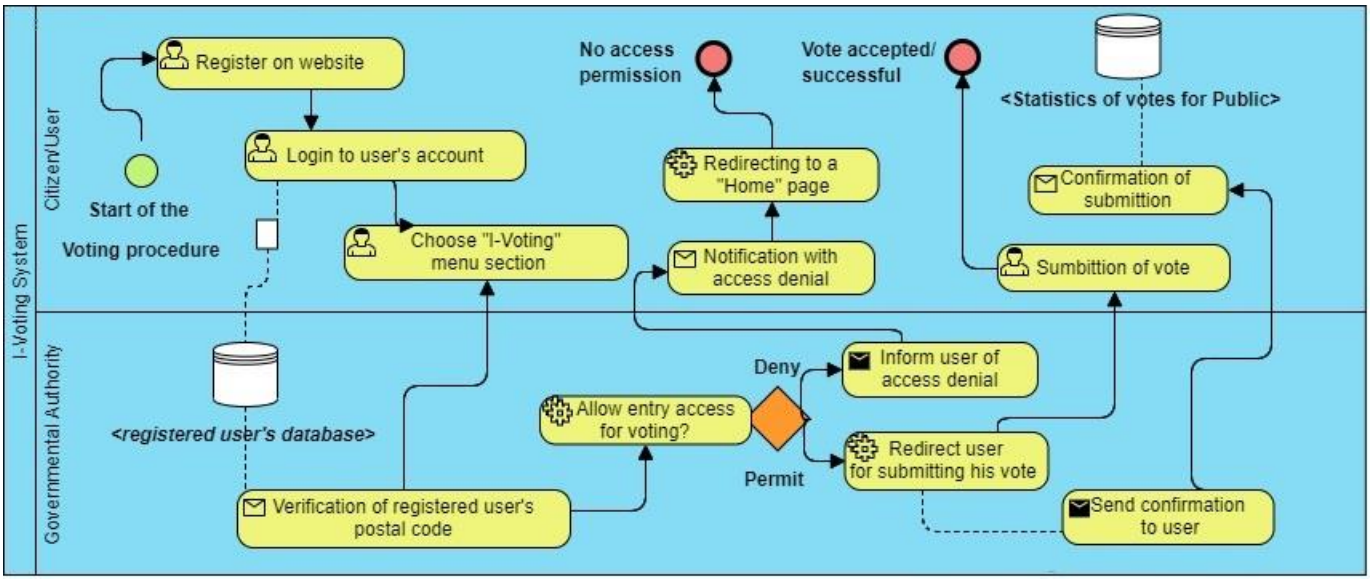


Figure 17: I-Voting Authentication method

Source: https://app.diagrams.net/

4.3.2 FURPS+ analysis

This analysis was employed in order to classify the quality of the proposed service and to analyze all the core requirements for implementation and maintenance of the system.

Functional requirements

The following functional requirements for integration of paradigm were listed:

- Registration – allowing users to register and login to a website. Since the content of the webpage will be partly restricted, the registration will allow user to observe additional content, that won't be visible for a regular visitor of a website.
- Authentication – in order to prove that electorate is capable for placing his vote, security management server ensures that postal code of civilian matches a postal code of Horomerice. If electorate is allowed to place his vote – his authentication number will be stored in portal repository in order to avoid attempts of multiple sessions connected to one user' account, so if the user is granted with access for placing his vote – it will be available only for him and will expire as soon as he confirms his choice.
- Notifications – the system will send an automatic conformation of acceptance of vote after the user will place a vote for his candidate.

  It will also notify civilians about the progress of voting procedure and the outcomes of elections by the end of election period.
- Language supportability – the main language listed on webpage is English, however, a logged in user will have a chance to switch language layout to Czech.
- Online support – during the election period it is important to ensure that potential electorate will understand the provided content and will easily navigate through core functions of the website in order to place his vote - additional support towards electorates will improve user experience and citizenry engagement.
- Web servers – in order to maintain procedure and outcomes of the elections in cloud, we will require 2 web servers, connected to each other and generating web portal of Horomerice. The second server will be used as a storage base of accepted

votes, while the first one will play a role of authenticator and assign access to various types of the users.

- Electronic signature – this technology can be considered as essential for electronic distribution of voting systems. By the time registered user will access the service, before he is about to confirm his vote, it is really important to verify persona's identity in order to assign his vote to his website's account, and, thus, exclude possible falsifications of votes or deny the access for a voting right. An alternative solution for an electronic signature might be a "photo upload" or "electronic passport" functions.

Usability requirements

The user interface should be clear and ready-to-use. The webpage should be fully responsive and available for different mobile platforms – IOS, Android. The layout and design of the webpage should be pleasant and self-explanatory, user support and integrated instructions should be assigned for improvement of electorate's navigation through the service.

Reliability requirements

The maintenance of the website and servers should be monitored by governmental personal and a certain number of technicians. The website and governmental servers should be vitally protected – a comprehensive option might be an establishment of 2 firewalls and a reverse proxy for a webserver filtering and a blocking of robot access to exclude possible malware of spam attacks from hackers.

Performance requirements

In order to access the service, user will be required to stay connected to an internet. While navigating a website and an E-Service, he/ she can choose between different devices in order to observe the proposed configurations – laptops, tablets, smartphones. Since our service is being proposed in web environment, the performance requirement for our system will be a supportability of web browsers and internet connectivity on the user's devices.

Supportability requirements

The webpage should be fully responsive and available for different mobile platforms – IOS, Android. To access the service, user should be connected to the internet and

navigate within the website using browser.

Non-functional requirements

The electronic service satisfies all legal requirements issued by the government of Czech Republic. An online submission of vote, as well as electronic signature/ proof of identity, should respond to an international copyright and intellectual property regulations.

5 Results and Discussion

A result of the proposed work is represented by an implementation of web portal, created with alternatively provided piece of software, a product of Web 2.0 applications and a possible substitution for hand-coding approach – Content Management System. This system allows users without programming background to get used to the principles of web development and access basic management and configurations systems of the webpages in order to make changes to it. With its help we were able to organize a multiple access level system, which will attract citizens to their civic affairs and simplify the methods of government-to-citizen connectivity, including the distribution of governmental services and its delivery towards public. A multiple access level system became essential for our sample of proposed E-Service, called “I-Voting”, used as an implementation of electronic voting, held in web environment. By placing a vote, each electorate will be integrated to a core governmental operations and decision-making, while during organization of elections, a lot of resources and time will be saved as by citizens as by governmental representatives.

The outcomes of the proposed CMS can be considered as an alternative way for governmental parties to organize and distribute important information and services for a public.

From a consumer’s point of view, the levels of civic engagement and participation in governmental decision-making should be enhanced. By allocating civic affairs or governmental events in web environment, it will be easier to keep citizens aware of the latest updates and important events, held in the town.

6 Conclusion

A partial objective of this thesis was to gather and prepare a comprehensive literature review of the area of E-Democracy with a special focus on Czech Republic. An author of this thesis considered a matter of E-Democracy to be interconnected to several other electronically developed political sub-disciplines, which altogether form a system of decision-making and provision of services towards public.
After an analysis of democratic sub-instances was provided, we have compared 2 main approaches of realization of online distribution of services – direct web programming and Content management systems as a part of partial solution for an enhancement of citizenry empowerment and allocation of governmental provision.
Then, an author has chosen to propose an alternative version of municipal information system for Czech settlement of Horomerice using Content management system (Joomla) and its templates.

Following part of this thesis is a Practical notation, the electronic government portal of Horomerice was carefully analyzed from various perspectives and assessments. One of the partial objectives of the thesis was to verify if there are any possible gaps in the distribution of democratic services. After careful consideration, some of the visible gaps on the webpage were found. Then a few recommendations were listed in order to improve the quality and accessibility of services, listed in municipal information system.
Just before the recommendations for improvement were proposed, we have discovered the current state of provisions, listed on the website. Following the research, an "integration" provision" was absent on the webpage, so we have decided to implement an integration provision to a website by adding a sample of E-Service, presented as an additional web-portal for electronic voting.

The main objective of this thesis was to analyze and implement a web-based Information System for a Czech settlement directed towards E-Democracy purposes. This municipal information system was implemented with a hierarchical separation of access and, thus, restricted visibility of several website's menus or articles. As an additional objective of thesis, the concepts of hierarchical separation of access were included in a proposed service paradigm – I-Voting, were the users will stand a chance to participate in elections electronically.

The objective was implemented with the help of CMS and its templates and a number of

proposed diagrams, describing the operating workflow of the paradigm, requirements for the network and an access separation among user groups.

As a part of the practical notation, CATWOE and FURPS+ analyses were included in order to classify the validity of the proposed service and requirements for the implementation of the system.

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8 Appendix