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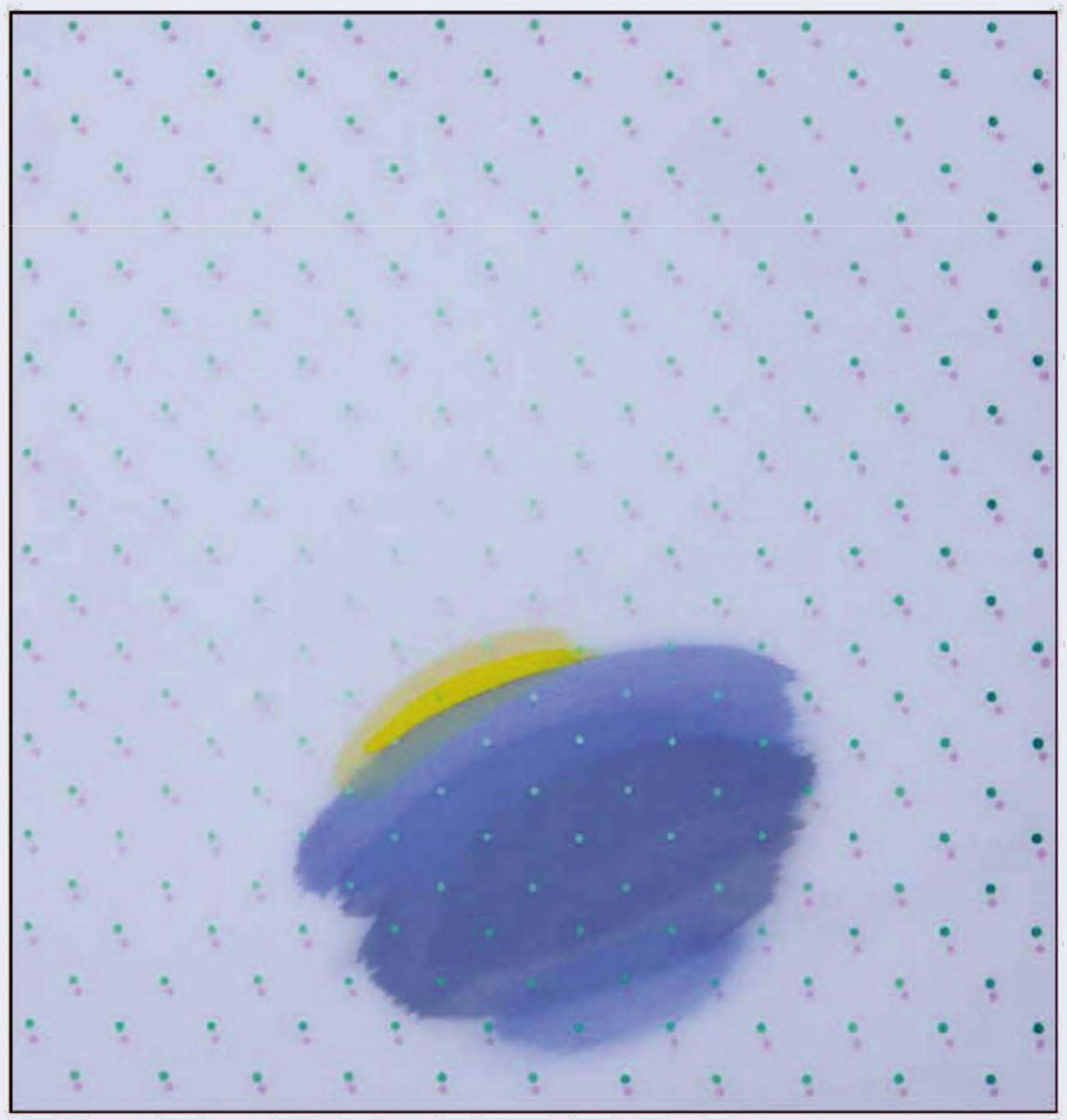

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Contents

EDITOR'S MESSAGE

It has been almost 350 years since the founding of the first scientific journals, the *Philosophical Transactions* in England and the *Journal des Sçavansin France*. Now, there are many diverse publications in various scientific fields which have shown enormous development, both in terms of quantity and quality.

Over time, published scientific papers have heralded the development of societies and global welfare. New scientific findings, innovations and research methodologies have become the determinants of the advancement of humanity. Those publications have surpassed any ownership and crossed over the borders of the places where they were produced and emerged to build solid research in the interest of the advancement of the needs and interests of humankind.

In this spirit, as a result of our willingness to engage in contemporary scientific developments and debates, the academic staff of the Mother Teresa University, the youngest University in the Republic of North Macedonia, decided to establish the International Scientific Journal "South East European Journal for Sustainable Development (SEEJSD)."

The editorial board of the Journal, constituted of researchers, experts and young scholars of various fields relevant to sustainable development, took the responsibility to consolidate and advance the content and quality of the Journal, to increase its scientific credibility and to align it in accordance with the requirements of the Science Citation Index (SCI).

The Journal will be published biannually and will include original peer-reviewed articles, book reviews and short essays, from various areas that have an impact on sustainable development. We believe that our Journal will contribute towards the enrichment of scientific thought and the affirmation of ideas in different fields from established and young researchers. We are also convinced that this scientific platform will affirm the new scientists and enthusiasts of our University to engage in international theoretical and empirical debates.

The editorial board of the Journal is well aware of the great challenges ahead. Undoubtedly, in order to produce a successful and effective Journal and make our contribution to the scientific community, a lot of hard work and commitment is required. I am certain that our board members, teaching and research in various universities and countries, will contribute greatly towards our goal with their experience and willingness to sustain the SEEJSD and its community. I take this opportunity to thank the members of the editorial board and welcome them to their important role.

Lastly, I would like to express my sincere hope that the "South East European Journal for Sustainable Development" will succeed in the realization of its mission to positively contribute to science, education and human development.

Editor in Chief,
Prof. Aziz Pollozhani, PhD

Mathematical Modeling and Simulations of Path Planning and Obstacles of Mobile Robot

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ABSTRACT
This paper is presented a development of a mathematical model of mobile humanoid robot. It is following deductive principle, i.e. to start from a completely general model applicable to a set of tasks. Such a model is further adjusted according to need certain specific situations.
The robot is wheeled humanoid robot as a structure composed by upper human-like body and cart mobile platform. The cart construction is supported by 4-wheels configuration, electric drive on the rear vehicles, and is directed from the front wheels. A general simulation system is realized at movement in a horizontal (2D) plane and the robot is modeled as a 3-DOF system (three degrees of freedom).
We have considers a known environment where fixed potentials were assigned to the goal and the obstacles. It moves successfully within different obstacle configurations (closely spaced obstacles), and it solves the problem with a local minimum occurrence. Researches made in the paper are new opportunities and directions for new researches. As expected, the robot can easily handle low speed cart movements, and intuitively problems appear with an increase in speed. We restricted the consideration to cart motions which are relevant to the humanoid robot working in human-centred environments. A mobile robot is usually intended to work in services; so in homes, department stores, restaurants, museums, hospitals etc. The working conditions of humanoid and semi-humanoid robots directly determine the requirements related to the ability of robots to maintain balance, stay stable, remain accurate and provide the qualities to perform controlling tasks in the given circumstances of functioning.
KEYWORDS
Keywords: *Mobile robots, Guidance and control, Obstacle avoidance. Robustness, Robot Posture.*

1 Introduction

This paper attempts to developed dynamic mathematical model of antropomimetric robot (driven robot) to real motions, particularly in posture stabilization for different situation.

In principle, modeling may follow an *inductive* approach or a *deductive* one. We apply deductive one, and we use the term *flier*. This situation is not uncommon in reality; However, such motions are still less common than those where the system is in the contact with the *ground* or some other supporting *object* in its environment.

The concept of the *flier* approach, derived for humanoid robots, is then applied [3,4]. It originally dealt with a full humanoid (pelvis, torso, arms, legs, head). ECCEROBOT[1] applies only a part of it to the upper-body robot of Fig. 1. In a past few years a new expression has been established –anthropomimetic [2].

Anthropomimetics refers to a new kind of robotics which copies the human body as faithfully as possible with the aim of achieving a level of performances (diversity of motions, maneuverability, etc.) comparable with that of a human.

ECCEROBOT has joints driven by antagonistically coupled DC motors. The two joint motors, the agonist and antagonist, working through tendons, mimic muscles. It pertains to a new class of principle in robot construction, which tries to copy the human body (configuration) as faithfully as possible. The goal is not just to replicate human structure, but also to attain a high level of performances (diversity of motions,

[1] EU FP7 project: „Embodied Cognition in a Compliantly Engineered Robot“ (www.eccerobot.org)

maneuverability, etc.) analogous to human abilities.

This paper has a more concrete focus – it examines the problem of posture and its robustness to external disturbances. So this paper attempts to establish the cart dimensions to obviate overturning and to find the constraints in motion capabilities of the wheeled robot that is presented by the model for an existing anthropomimetic humanoid – ECCEROBOT.

The usual approach to the analysis of dynamic balance is based on ZMP theory.[7-9].The ZMP calculation is used to identify the robot stability. The term and solid mathematical background of the ZMP method is presented in the pioneer work of its authors Vukobratovic and Stepanenko [21], and later by his associates [11]. The main contribution of the ZMP criterion claims that if the ZMP is inside the boundaries of support polygon, then the robot is able to keep the balance.

2. Mathematical modeling

We start from the "classical" dynamic model that considers the joint torques as the controls and relates them to joint motions. The concept of the Flier approach, derived for humanoid robots [17,18]. It originally dealt with a full humanoid (pelvis, torso, arms, legs, head). ECCEROBOT applies only a part of it to the upper-body robot. The system configuration becomes as shown in Fig. 1. The structure of the mechanism used for the simulation in Matlab is presented at fig.2.

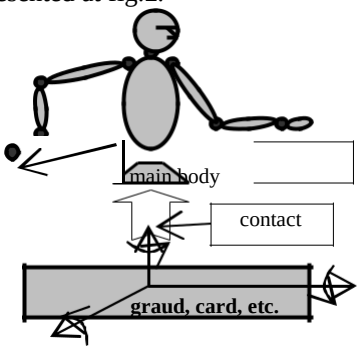


Figure 1. The system configuration

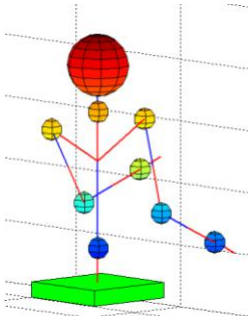


Fig. 2. Simulation model

The idea of the *flier* approach is to consider the humanoid freely flying in space and then to introduce contacts with environmental objects in order to model the imposed motion task. This applies to any motion task: walking and running, manipulation, sporting motions, etc.

Following the flier concept, we start the dynamic analysis from the free-flying model. If robot has *n* single-rotation joints (*n*=20 for the configuration under investigation), then its position is defined by a vector of dimension *N*=6+*n*:

$$Q_{N\times 1} = [X \quad q]^T = [x \;\; y \;\; z \;\; \theta \;\; \varphi \;\; \psi \;\; q_1 \;\; q_2 \;\; q_3 \;\; \ldots \;\; q_n]^T Q_{N\times 1} = (X_{6\times 1}, \; q_{6\times 1}) \tag{1}$$

where $X = (x, \; y, \; z, \quad \theta, \varphi, \psi)$ defines the absolute position of the "main body", the pelvis in this case, while $q = (q_1, \ldots, q_n)$ represent joint angles.

The dynamic model has the matrix form:

$$H(Q)\ddot{Q} + h(Q, \dot{Q}) = T \tag{2}$$

where $T_{N\times 1} = (0,\ldots, 0, \tau_1, \ldots, \tau_n) = (0_{6\times 1}, \tau_{n\times 1})$ is the generalized vector of drives, $\tau = (\tau_1, \ldots \tau_n)$ represents the joint torques, $H_{N\times N}$ is the inertial matrix, and $h_{N\times 1}$ takes care of gravity, centrifugal, and Coriolis' effects.

The contacts (one or more) with the environment are now introduced. Contact refers to a particular robot link and restricts the relative motion of that link with respect to the relevant environmental object. If there are *m* restricted directions, the contact can be expressed as:

$$s^c(Q, \underset{b}{Q}) = 0 \tag{3}$$

where s^c_{mix} is the vector of relative link-to-object position, which depends on the robot position **Q** (of dimension *N*) and the object position b **(**of dimension *k*). By derivation:

$$\dot{s}^c = J(Q, Q_b)\dot{Q} + J_b(Q, Q_b)\dot{Q}_b = 0$$

$s^c = J(Q, Q_b)\ddot{Q} + J_b(Q, Q_b)\ddot{Q}_b + A(Q, \dot{Q}, Q_b, \dot{Q}_b) = 0$ (13) where $J = \frac{\partial s^c}{\partial Q}$ and $J_b = \frac{\partial s^c}{\partial Q_b}$ are Jacobeans of dimensions x and x respectively, and **A** contains second partial derivatives.

Contact introduces reaction forces and moments. Reactions appear along the restricted directions **sc**. Let x1 be the vector of reactions.

The dynamics of the contact motion is now described by the model:

$$H(Q)\ddot{Q} + h(Q, \dot{Q}) = T + J^T(Q, Q_b)R \quad (4a)$$

$$\ddot{s}^c = J(Q, Q_b)\ddot{Q} + J_b(Q, \ddot{Q}_b)Q_b + \dot{A}(Q, \dot{Q}, Q_b, \dot{Q}_b) = 0 \quad (4b)$$

$$W(Q)\ddot{Q} + w(Q, \dot{Q}) = T - J^T(Q, Q_b)R \quad (4c)$$

$$\bar{\bar{H}}\ddot{\theta} + \bar{\bar{h}}(Q, \dot{Q}, \theta^a, \dot{\theta}^a, \theta^b, \dot{\theta}^b) = C u \quad (4d)$$

The model (4) contains the robot dynamics (*N*-dimensional submodel (4a)), the object dynamics (*k*-dimensional submodel (4c) with model matrices **W***k*x*k* and **w***k*x1), and the geometry of contact (*m*-dimensional subsystem (4b)). Equation (14d) describes dynamics of the antagonistically coupled drives including motors and gearboxes. It relates the control inputs (**u**$_{2n\text{x}1}$ antagonistic motors voltages for the robot and **T**$_b$ driving torque for the object) to the motion ($Q_{N\times 1}$, $\theta_{2n\times 1}$ and $Q_{b\,k\times 1}$ for the robot, antagonistically coupled motors and the object respectively) and the contact reactions ($R_{k\times 1}$). The matrices H, h, W, w, $\bar{\bar{H}}$, and $\bar{\bar{h}}$, are robot's inertial matrix; matrix that takes care of gravity, centrifugal, Coriolis' effects, and joint geometry; inertial matrix of the object; similar effects referring to object; two matrices describing dynamics of the antagonistically coupled drives respectively. The vector s^c represents constrained coordinates due to in contact motion, while the J, J_b, and A, are appropriate Jacobians and adjoined matrix.

If we consider motion of the contacted object (in this case mobile wheeled base) as prescribed - Q_b, the object dynamics is omitted and model becomes:

$$H(Q)\ddot{Q} + \tilde{h}(Q, \dot{Q}, \theta^a, \theta^a, \dot{\theta}^b, \theta^b) = J_b^T(Q, Q)R \quad (5a)$$

$$\ddot{s}^c = J(Q, Q_b)\ddot{Q} + J_b(Q, \ddot{Q}_b)Q_b + \dot{A}(Q, \dot{Q}, Q_b, \dot{Q}_b) = 0 \quad (5b)$$

$$\bar{\bar{H}}\ddot{\theta} + \bar{\bar{h}}(Q, \dot{Q}, \theta^a, \theta^a, \theta^b, \theta^b) = C u \quad (5c)$$

The model (5) enables integration of the system and therefore simulation of the anthropomimetic robot on the mobile base. This means that for given control voltages ***u*** and knowing object motion Q_b one can calculate robot motion Q, motor positions θ and reaction forces/torques R.

Therefore, the target configuration of the anthropomimetic robot moving on the four wheeled mobile base is tested, and examination of the cart design and movement limits are carried out using derived model.

The kinematic equations of the four wheeled mobile base are [6]:

$$\begin{aligned} \dot{x}_e &= V\cos(\psi + \beta) \\ \dot{y}_e &= V\sin(\psi + \beta) \\ \dot{\psi} &= \frac{V\cos\beta}{tg\delta\, l_f + l_r} \end{aligned} \quad (6)$$

where: V is velocity of centre of gravity (c.g.) of the vehicle which is at point C, ψ is yaw angle (orientation angle with respect to global coordinate x_e), β is vehicle slip angle, $\chi = \psi + \beta$ is $l = l_f + l_r$. the angle of turn of the vehicle , δ is the steering angle of front wheels, l_f and l_r are distances of points A and B from c.g. of the vehicle, respectively.

Dynamic equations can be derived from Fig. 2.2 and they are:

$$\begin{aligned} m(\dot{V}_x - \dot{V}_y\dot{\psi}) &= -F_f \sin\delta + F_D \\ m(\dot{V}_y + \dot{V}_x\dot{\psi}) &= F_f \cos\delta + F_r \\ J\ddot{\psi} &= l_f F_f \cos\delta - l_r F \end{aligned} \quad (7)$$

where m and J are mass and inertial moment of the vehicle around the mass center, F_D is driving force on the rear axis - along x axis, F_f and F_r are resultant side forces on the front and the rear wheel. The first two equations

in (7) define the forces balance along the system axes B (C ; x , y) , while the third equation in (7), defines the moments' balances around the z axis, normal to the plane Cxy .

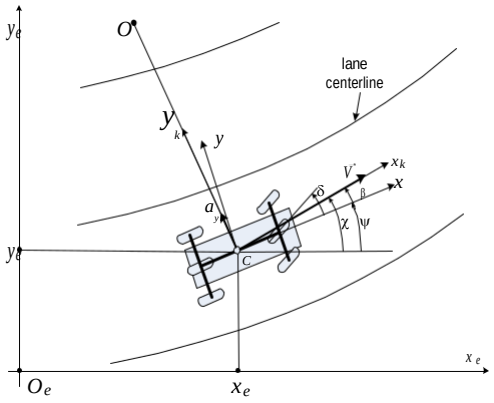


Figure 4. Kinematics of lateral motion

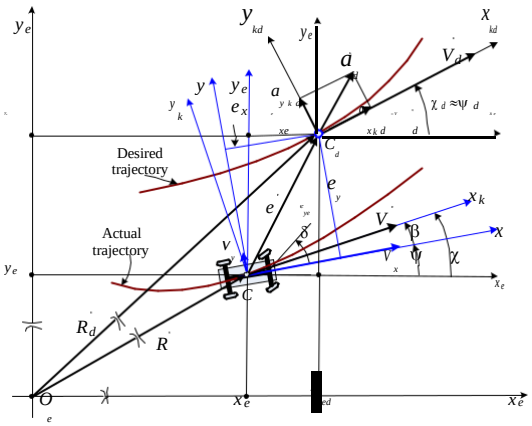


Figure 5. Tracking reference (desired) trajectory with a mobile robot

3. Simulation results

The aim of the simulation analysis is checking to what extent the ECCEROBOT can stand the disturbance resulting from different cart movements and finding the cart dimensions which disable overturning of the robot during some common tasks and obsticles. As it is expected, the robot can easily handle with low speed cart movements, and intuitively problems appear with increase in speed. We restricted the consideration to cart motions which are relevant to the humanoid robot working in human centred environment. Namely, a mobile robot is usually intended to work in services – so in homes, department stores, restaurants, museums, hospitals, etc.

The selection of the robot drives is essential for the simulation results and therefore for establishing the limits of the robot acting The ECCEROBOT uses Maxon products, and for this study following motor and gearboxes are chosen:

- Waist joints use 148877 DC motor RE40 48V and 203116 Gearbox GP42C 15:1
- Shoulder joints use 268193 DC motor RE30 12V and 326664 Gearbox GP32HP 51:1
- Neck, elbow and wrist joints use 118637 DC motor RE13 12v and 110315 Gearbox GP13A 67:1

The typical cart movements are examined.

During these cart movements the robot has task to keep a prescribed position (up-right torso position with bent elbows for 15^0 and outstretched forward arms for 30^0).

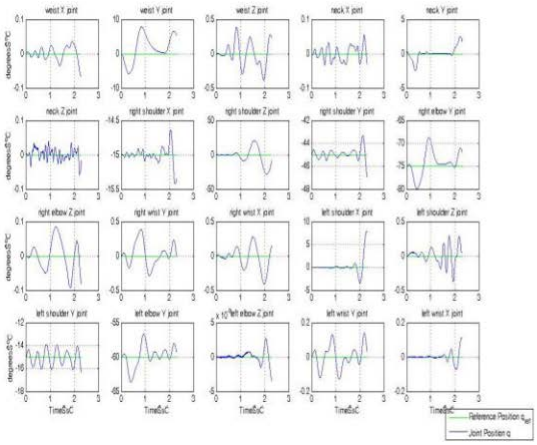
- **Linear (longitudinal) and lateral acceleration** – there are three phases in this motion: acceleration and deceleration take 40% of the total task time (equally divided, 20%+20%) and the rest of the time (60%) the cart moves with constant velocity. So, this is trapezoidal velocity profile.

Table 1: Characteristics of the cart longitudinal and lateral motions

Table Head	Longitudinal trapez. motions	Lateral trapez. motions
Distance (m)	2	2
Time (s)	2.2	2.3
Acceleration (m/s^2)	2.583	2.363
max Velocity (m/s)	1.84	1.45
max x_{zmp} (cm)	0.3 (min); 5.6 (max)	2.2 (min); 2.5 (max)
max y_{zmp} (cm)	-0.9 (min); 0.1 (max)	-2 (min); 2.2 (max)
Cart dim. a (cm)	18.68	18.68

For testing, we used the fixed length of the cart motion – a distance of 2m. Different values of acceleration (and accordingly different motion durations) were checked. Good results (satisfactory robot behaviour) were

obtained for a time of 2.2*s* or longer (i.e. acceleration or less). Satisfactory behaviour means robot stability. If we reduced the time (thus increasing acceleration) the robot would become instable. The consequence of instability is that the robot falls over. An explanation for such an inappropriate robot reaction is that too high acceleration causes strong inertial forces; the drive in the waist Y joint (controller and DC motors) is not sufficiently strong to keep the waist and the torso in the upright position.



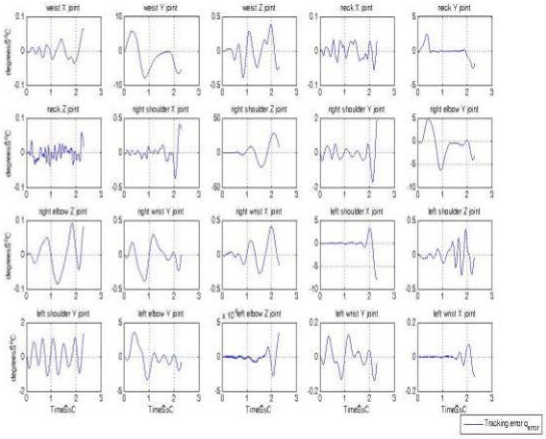


Fig.6.The position of robot joints by longitudinal (linear) acceleration of the cart
Fig.7. The tracking error of robot joints by longitudinal (linear) acceleration of the cart

In Fig. 6 the time histories of the robot joint positions during the linear cart motion are shown. It can be seen that the strongest influence is on the Y joints, as we expected. Robot tracking errors are presented in Fig. 7. The waist Y joint and right elbow Y joint are the most illustrative examples of disturbance influence (max. deviation is approximately -75^0). Still, this is inside of the stability margins. The joints other than Y have a practically negligible problem in tracking references.

- **Oscillations in longitudinal direction (forward-backward).** Now to analyse the movement of the robot platform laterally (oscillating) in the left-right, along the y axis, by the sinusoidal function. The principle of simulation is the same as the previous example of a platform performing a forward-backward oscillation in the longitudinal direction; the difference is in the direction of movement.

From simulations made of oscillatory acceleration it is shown that the robot is within stable boundaries when moving of the platform and has an amplitude of 1m and time of 2,6 s. If the duration of time is shortened, the robot should pass the same distance, increases frequency, and the system becomes unstable.

The robot is within stable margins for an amplitude of 2*m* and time of 3,2s.

The oscillatory platform motion in lateral direction (left-right) has a high frequency size for an amplitude of 1m and T = 2.6s and the mobile robot cannot support additional external disturbances of impulse and long-term forces. Therefore for further testing, period T is increased to 3s.

In the tables, results of the performed tests of lateral oscillating motion of the robot by impulse and long-term are given.

Table 2. Characteristics of the lateral oscillatory acceleration by impulse forces a=1m, T=3s.

A=1 T= 3 s		**Zmp X**		**Zmp Y**	
direction [deg]	$F_{max\ I}$ [N]	min	max	min	max
0	F=1500N	-1,7	2,5	-1,6	1,2
22.5	F=1500N	-1,2	2,5	-1,4	1,9
45	F=1000N	1,3	2,5	-1,2	2,9
67.5	F=1000N	2	2,5	-1,5	5,7
90	F=1000N	2	2,5	-3	7,7
112.5	F=1000N	2,3	3,2	-1,5	5,7
135	F=1500N	2,3	5,3	-5,1	8,5
157.5	F=1500N	2	6,5	-1,5	2
180	F=1500N	2	7,5	-1,8	1,2

Table 3. Characteristics of the lateral oscillatory acceleration by long-term forces a=1m, T=3s.

A=1 T= 3 s		**Zmp X**		**Zmp Y**	
direction [deg]	$F_{max\ T}$ [N]	min	max	min	max
0	F=100N	0,6	2,5	-1,7	1,3
22.5	F=150N	-5,5	2,5	-2	2
45	F=80N	2,1	2,5	-1,4	2,2
67.5	F=50N	2,4	2,5	-1,3	1,9
90	F=50N	2,2	2,5	-1,7	1,2
112.5	F=50N	2,1	2,6	-0,8	1,3
135	F=80N	2,4	3	-1,4	2
157.5	F=120N	2,5	7,3	-1	1,3
180	F=120N	2,5	10,5	-1	1

If we compare with the previous movement for the same size of amplitude of 1m, and a time of 2.5s, the influence of external disturbances does not change. But for 1m, and time 3s the distribution of a quantity of forces is very similar with oscillatory motion in longitudinal direction forward-backward. Characteristics of the lateral oscillatory acceleration by impulse and long-term forces are given in tables 2 and 3.
Referent trajectory in an obstacle environment is generated in the block Reference Trajectory Generator Fig. 8 shows how the mobile robot follows this referent trajectory. Obstacles in Fig.9 are presented by circles.

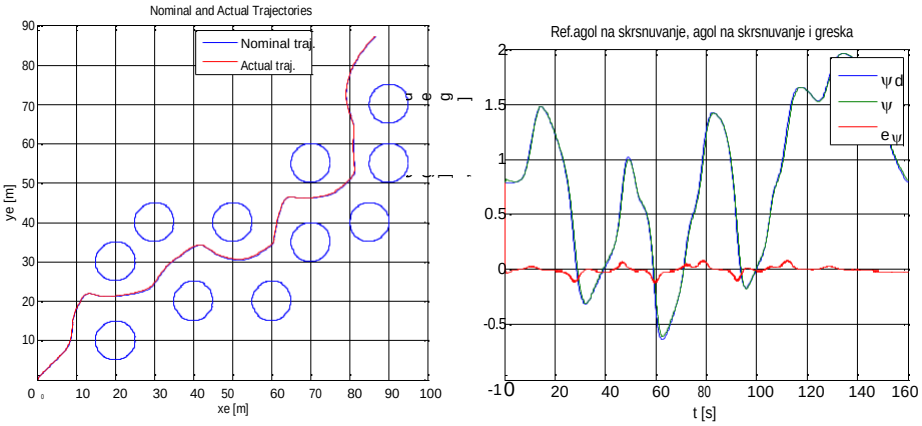


Fig.8. Referent trajectory following ψ_d - nominal angle, ψ - real angle, e_ψ tracking error

Fig. 9. Robot course angle following during the movement along referent trajectory

4. Conclusion

Finding the boundaries of the proposed control algorithm and establishing the cart dimensions to avoid the mobile robot (during different cart motions) from tipping-over was the topic of this research. Bearing in mind that the robot has compliant actuation (expandable tendons) makes it more sensitive to external influence. Any disturbance can cause oscillation accompanied with a specific and potentially highly risky situation – the resonance. The cart motion (acceleration or deceleration, turning left or right, moving uphill/downhill, rolling, etc.) strongly influences the robot behavior. Therefore, robust robot control was absolutely necessary to enable examination of the complete anthropomimetic robot behavior on the mobile base, and check its behavior in such disturbances.
Also in this paper we have researched and simulated the mobile robot guidance and control in the environment full of obstacles. The mobile robot has 4-wheels configuration, electric drive on the rear vehicles, and is directed from the front wheels. We have simulated a movement in a horizontal (2D) plane and the robot is modelled as a 3-DOF system (three degrees of freedom).
Our experiments have demonstrated that tip-over stability of the robot can be preserved for some “reasonably” fast movements of the cart, relying on the appropriate cart design. The obtained results are encouraging and it proves that a compliant anthropomimetic mobile robot could be used to work in services - in homes, department stores, restaurants, museums, hospitals, etc., despite of its very complex structure and demanding control requirements.
Since adding legs still would be very challenging task, the future work would consider the cart testing in some realistic situation involving friction, slip and contact forces between wheels and ground.

ACKNOWLEDGMENT

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NEW NONSTANDARD METHOD FOR MEASURING PHYSICAL PROPERTIES OF HOMEMADE POLYMER FILAMENTS FOR FFD 3D PRINTING

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ABSTRACT

As desktop fused deposition modeling 3D printing becomes an everyday occurrence and 3D printing filament extrusion, a DIY makers practice, establishing a method for physical characterization of parts using only small amounts of homemade filament is of interest. Here is presented a new method for measuring change in physical properties of 3D printed parts, printed with less than 1g of filament. Changes are observed due to material change (ABS, PLA, PET, recycled PLA 3D prints, recycled PET 3D prints, recycled PET), change in 3D printing procedures, changes in filament extrusion properties and changes in the thickness of the part. It was found out that the results obtained with this method are in correlation with the results from the standard tests used in everyday practice. This is of interest because it allows fast characterization of exotic filament blends with very little material for research purposes, reducing the costs of production, and the possibility to implement fast changes in the filament blends.

The idea of 3D printing is the last word of technology and becomes a current challenge when speaking about sustainable development in the area of technology and science. This research is focused on finding new solutions regarding to 3D printing, which is one of the main goals of nowadays science and technological development.

KEYWORDS

3D printing, 3D filaments, extrusion

Introduction:

FDM (Fused deposition modeling) has 3D printing as its main concept of functioning and performing. It is a special, novel and creative additive manufacturing technology that creates objects through digitized model without traditional expensive cutting machines or casting machines. Appears in different fields: biomedicine, aerospace, automotive engineering, civil engineering, food industry and so on.

It's performed through different techniques, of which four are the most important: stereolithography (SLA), fused deposition modeling (FDM), selective laser melting (SLM) and selective laser sintering (SLS). SLA is liquid-based technique, while the three others are solid-based. [1]

Material and Methods

In the FDM process, objects are built layer by layer, leading to their anisotropic mechanical properties. First step is extrusion of the raw material into the nozzle and its transformation to semi-liquid state from the original filament state. Afterwards, the semi-liquid material is deposited on the previous layer and cools, solidifies and integrates with the surrounding materials.

Generally, the properties of parts produced by the FDM technique are apparently dependent on process parameters.

When the whole layer is deposited, the platform supporting the object moves down by the height of one layer and the next layer will be printed. Standard methods used for investigating the physical properties of 3D printed parts require a big sample or large amount of filaments and time, which makes the process difficult while the destructive tests show a decrease of their physical performances.

This is actual with certain samples of PLA and ABS which are are printed in different angles, leading to different density of their structure. The objects printed in this way can be considered as transverse isotropic materials and their behavior differs for different angles.

The uniaxial samples which undergo an uniaxial tensile test, appear to have fractures at different points of their body, depending on the angle of printing. [1]

Homemade prototype filaments usually are produced in small amounts. The idea is what happens if it's added an amount of another material within the filament like: silver nanoparticles, carbon nanotubes, cork particles?

Do the physical performances of those materials get better or worse by adding the materials mentioned above? How to work if there are used exotic and expansive materials?

Answer to those questions will give the new researches, when will be used homemade prototype filaments mixed with particles from certain materials.

First step of experimental work is the process of 3D printing of samples, which considers the use of 3D printer of type PrusaMK3 with a brass nozzle of diameter 0.4 mm. Filaments used for this purpose are : PLA (polylactic acid), ABS (acrylonitrile butadiene styrene) and PET (polyethylene terephthalate). Samples produced are in shape of semi-circles.

The modeling of samples is realized using the software Solidworks and then are sliced in to printable GCode with PrusaSlicer. Samples prepared for this work have no infill; a layer of sample is created simply by three passes of the tool upon the bed of the printer.

Working temperature of used materials varies, respectively: PLA – 215 ^{o}C, PET – 230 ^{o}C, ABS – 255 ^{o}C. Bed temperature is 60 ^{o}C for PLA, 75 ^{o}C for PET and 100 ^{o}C for ABS, respectively.

Bed is the plate on which the samples are printed. Printing parameters: layer height 100μm, 150 μ m, 200 μ m.

All widths are devisable with layer height.

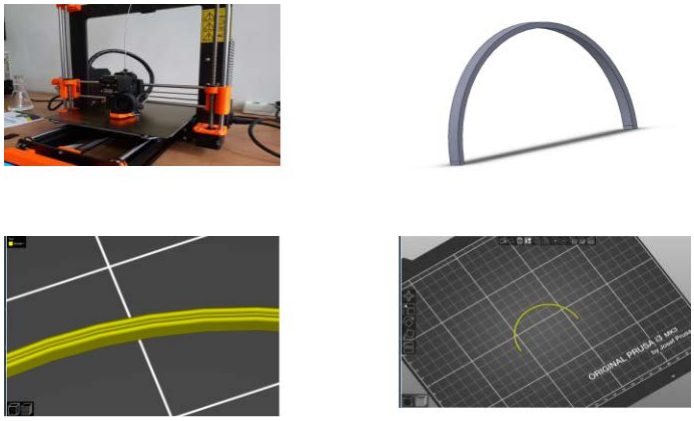

Figure 1: The process of 3D printing (1st picture) and the preparation of 3D samples (semi-spherical shaped sample, the plate on which samples are printed; 2nd, 3rd and 4th picture)

The samples created in this way undergo a test process on a texture analyzer of type TA.XTplusC. They are put on a specially designed and printed holder for used samples that limits the work to two dimensions (not allowing bending and twisting of sample). Maximum compression of samples is 2 mm in order to stay in the linear part of the response according to Hooke's law.

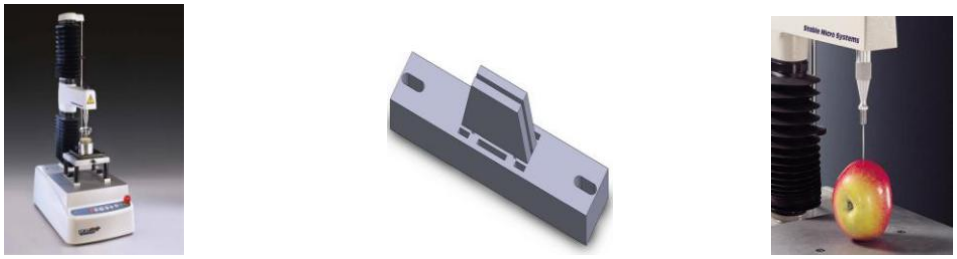

Figure 3: The texture analyzer, the sample holder (3D printed) and the mechanism of load apply

Inside the walls of the sample holder, the sample is placed. With the mechanism of load apply of the texture meter, upon the sample is applied stress. Each sample undergoes up to ten tests on a row, thus analyzing the behavior through short and long time intervals.
The walls of the sample holder are adjustable, and they can be arranged for all the sample widths of this work's interest.

RESULTS AND DISCUSSION

Stress test applied on the samples shows that the dependence $F(x)$ appears in polynomial shape (2nd order) for longer testing time, while for short intervals it's linear. This is seen in the following graphics.

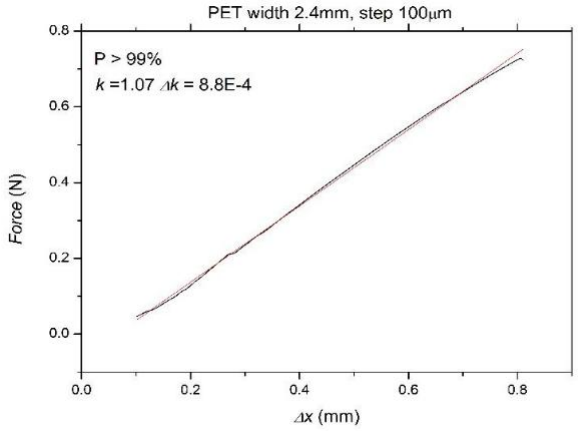

Figure 4. The linear response to the applied stress for short time interval (here is represented a PET sample with width of 2.4 mm, and a printing step of 100 μm)

The elasticity coefficient of PET, PLA and ABS tested samples increases linearly with the width of the sample. This is relatable to the behavior of a spring; these samples act like springs while applying load. When comparing the elasticity coefficient of all three types of the filaments, it appears that PET has the lowest elasticity compared to PLA and ABS.

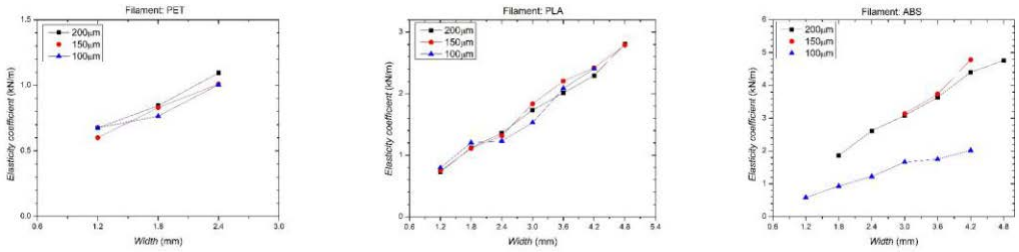

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Figure 5. Dependence of the elasticity coefficient from the width for each type of filaments

It is seen from the graphics that the elasticity coefficient of those filaments increases linearly with the width of the samples, and while comparing it to Hooke's law, it can be assumed that these samples behave like springs. But, what is more interesting about this is the comparison of elasticity coefficients between each three types of filaments: ABS, PET and PLA.

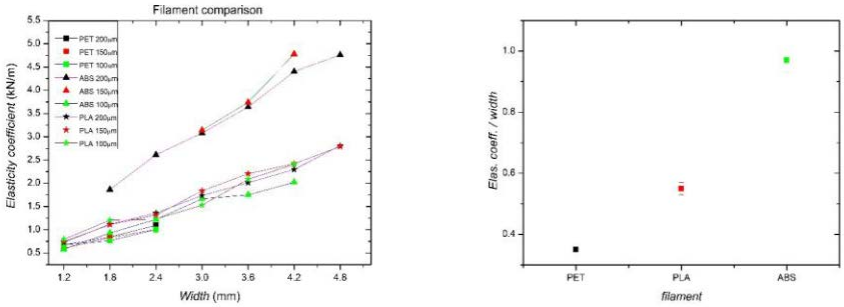

Figure 6. Comparison of elasticity coefficients for three types of filaments

Experimental data show that samples of PET are less elastic than samples of PLA and ABS. And while comparing those results with theoretical ones, it appears to be a small mismatch between them. In the table below, are given some parameters that describe the behavior of PET, PLA and ABS as polymers.

PROPERTY	PLA	ABS	PET
Glass transition (^{0}C)	60	80	100
Melt temperature (^{0}C)	160	140	230
Density (g/cm^3)	1.30	1.29	1.10
Elastic modulus (GPa)	3.5	2.2	2.0
Tensile strength (GPa)	50	53	41

Table 1. Theoretical parameters for PLA, ABS and PET [2]

By theoretical data, one can conclude that PLA has the highest elasticity coefficient, while PET has the lowest, which is controversial to experimental data for ABS.
This research is in its first attempts to describe the behaviour of those polymers, and the question about ABS is something that has to be cleared on the upcoming studies, but can stand an assumation like this: perhaps the raw polymer behaves differently from its 3D printed condition and shows different elasticity in both situations.

What makes 3D printing technology interesting nowadays for sustainable development are some criteria. One needs less time for operating with this technology, less costs because just a small amount of filament can give a considered number of samples, less time of production, less errors objects are controlled layer by layer and one can stay ahead of competition, because the 3D printing is becoming an everyday occurrence and people and companies are challenging themselves intending to bring out the best of this technique. [3]

ACKNOWLEDGMENTS

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Introducing traffic calming measures and increasing traffic safety in the school zones – “11th Octomber” primary school in Skopje

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ABSTRACT

Calming traffic through the application of engineering tools can encourage drivers to reduce their speeds. At lower operating speeds, drivers are better able to react in time to avoid collisions. This is particularly important around children, who may behave erratically or may not be alert to traffic. “Traffic calming” is the installation of physical measures that alter driver behavior and improve conditions for non-motorized street users.

This paper presents a concept of introduction of traffic calming measures and increase of safety in the zone of the "11th October" primary school in Skopje. Traffic solutions are envisaged that will contribute to increasing the safety and calming of the traffic in the school zone, in order to protect the most vulnerable category of traffic participants, pedestrians or children. In addition, traffic solutions are focuses on physical changes to roadways to achieve traffic calming, specifically to achieve improved safety and accessibility routes for children. All measures should be properly designed, with appropriate spacing and use of signs, striping, lighting, and vertical elements where necessary to improve visibility.

KEYWORDS

Traffic calming measures, Traffic Safety, Traffic signalization and equipment

1 Introduction

In the last century, roads have been replaced for vehicles and became widened and straightened. These changes help vehicles go faster but make the condition more dangerous for other activities such as walking or cycling. The safety of school children walking to and from school is a major concern to parents, teachers, law enforcement agencies and the general community. Identifying problems and implementing improvements from the bulk of activities at relevant agencies in their effort to reduce child pedestrian injuries around schools. This includes traffic engineering approaches such as traffic calming measures, to improve the safety of school children walking along or crossing busy streets around school areas. Traffic calming has been used extensively in residential and commercial areas but it is generally unknown how effective traffic calming is in school areas. With all the effort done in implementing traffic calming around school area, there are still occurrences of accidents involving school children around the vicinity of schools. This paper looks into the potentials of introducing traffic calming onto urban roads in the vicinity of schools from traffic planning perspectives. Traffic calming aims at the total enhancement of road safety, improvement of traffic condition and betterment of the overall urban environment through vehicle's speed

reduction.

Traffic calming refers to interventions designed to control traffic speed. It is most often implemented in urban areas and can be used to reduce the number of car-borne commuters using residential streets and the speed of the remaining traffic.

Traffic calming, as defined by the Institute of Transportation Engineers (ITE) Subcommittee on Traffic Calming, 1997 is:

"The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users."

The term "Traffic Calming" is a direct translation of the German "Verkehrsberuhigung." It refers to a system of design and management strategies, developed in Europe and widely practiced there, that aims to incorporate vehicle traffic into communities in balance with other uses on streets (Litman, 1999). Traffic calming is a way concurrently addresses transportation and quality-of-life issues in our communities. It covers the needs of all users of the roadway. Streets are places for people to walk, meet, play, shop and even work alongside but not dominated by cars. Traffic calming involves identifying the street as a public space shared by pedestrian and vehicles and rethinking the physical design of streets. This helps have an environment friendly to people on foot and decrease accident rates. Other benefits of traffic calming improve neighborhood identity, increase transportation facilities, decrease air pollution and improve transit access (Reardon, P.E, & Madey, 1997).

Child pedestrians are unprotected users of the road vulnerable from the speeding vehicles and powerless of making mature judgments to minimize their risk of harm from traffic. While modifying the environment can enhance the safety for child pedestrians (Morris, Wang, & Lilja, 2000). The findings of this study are important to help create a safe road and environment for children to journey to schools. Because nearly all children are pedestrians and none are drivers, a child's journey to school is the natural place to start reversing these overwhelming trends away from active transportation. In order to encouraging children to walk to school means ensuring that when communities are built, they are designed appropriately to allow short, safe walks from home to school and other destinations.

2 Traffic Calming

Three decades of experience have shown that traffic calming can solve many but not all traffic problems. Reductions in speed, accidents, noise, pollution, and congestion have been achieved, as have more liveable neighborhoods, vibrant shopping streets, malls, and improved conditions for bicyclists and pedestrians.

"The purpose of traffic calming is to restore streets to their intended function".

The primary purpose of traffic calming under this policy is to reduce high traffic speeds within residential neighborhoods and thus improving safety for pedestrians and area residents.

Traffic calming is the deliberate slowing of traffic in residential areas, mostly with the use of physical measures including speed bumps, roundabouts, and raised intersections. Non-physical elements are also a measure used in traffic calming efforts. Traffic calming is used as an effort to reduce accidents by altering driver behavior. The main benefit is improved safety for pedestrians with the added benefit of added driver safety. The goals of traffic calming are to increase the quality of life and ensure the needs of people in the area who may be working, playing or living on the street or at an intersection. Added benefits of traffic calming include reducing pollution and heavy sprawl, aiding the flow of pedestrian traffic, improving public transit or cycle use and aiding in keeping streets tidy and attractive.

As mentioned above traffic calming is a self-enforcing traffic management approach that forces motorists to modify their speed or direction of travel. The purpose of traffic calming is to improve safety, especially for pedestrians, and to improve the environment or livability of streets for residents and visitors. Problems with the physical environment around schools such as damaged or missing sidewalks, lack of traffic calming measures or unsafe crosswalks prevent children from walking safely and easily to and from school. These problems can be dangerous enough to cause child pedestrian injuries and fatalities. Clearly, a safe physical environment is necessary for enabling children to walk to school.

2.1 Types of Traffic Calming

Traffic calming treatments can be broken into the following four categories, each having their strengths and weaknesses.

Vertical impediments; designed to make fast driving uncomfortable. These treatments are the most effective for reducing vehicle speeds, but they also get the most complaints from residents who have to drive over them multiple times per day.

Horizontal impediments; designed to make a driver turn the wheel and reduce the sight lines of unending pavement, which usually results in slower speeds.

Road narrowing; via striping, parking, or curb to reduce the drive lane widths, which slightly lower speeds. These treatments have the additional benefit of shortening pedestrian crossings, which lead to a safer multi-modal environment.

Closing the through road partially or fully to disrupt travel patterns. These treatments may not change vehicle speeds but are effective at lowering volumes along certain roads. The drawback is that the vehicles are then rerouted, sometimes onto other residential streets instead of out to an appropriate collector street.[1]

2.2 Advantages and Disadvantages of Traffic Calming

Traffic calming if used properly will address identified operational traffic issues. Listed below are some of the advantages and disadvantages created or caused by traffic calming measures:

Advantages:

2 Reduced vehicle speeds

3 Reduced traffic volumes

4 Reduced number of cut through vehicles

5 Improve neighbourhood safety especially for pedestrians

6 Reduced conflicts between roadway users

7 Increase compliance with regulatory signs

Disadvantages:

8 Potential increase in emergency vehicle response time

9 Could make it more difficult to get into and out of your neighbourhood every day

10 May result in expensive solutions (time and resources)

11 May shift or divert traffic onto neighbouring roadways

12 Increase maintenance time and costs

13 Add visually unattractive warning signs to a residential area

14 May splinter neighbourhood with strong ‘for and against’ traffic calming opinions

Traffic calming measures objectives:

15 Achieving slow speeds for motor vehicles

16 Reducing collision frequency and severity

17 Increasing the safety and the perception of safety for non-motorized users of the streets

18 Reducing the need for police enforcement

19 Enhancing the street environment

20 Increasing access for all modes of transport

21 Reducing through motor vehicle traffic.[2]

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[1]Traffic Calming, Auto-Restricted Zones and Other Traffic Management Techniques-Their Effects on Bicycling and Pedestrians, Federal Highway Administration, Publication No. FHWA-PD-93-028, January 1994

3. Traffic Calming Policy For Existing Neighborhoods, London, Canada.

3 METHODOLOGY

The research utilized qualitative research method and data for the research are collected through observation method. Survey crews conduct sidewalk studies to evaluate walking conditions. The processes conducted for collected data can be summarized as follows:

Survey for existing conditions around the school: speed, number of pedestrian using and not using the crosswalk in the vicinity of school, pedestrian walkway usage, and safe crossing gap.

Propose remedial measures according to the survey results.

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3.1 Scope of research

The primary school 11th October is located on the territory of the City of Skopje in Municipality of Centar. Elementary School "11th October" goes out on one side of the boulevard Krushevska Republic, i.e. Street Prolet, and from other side goes out to the Street Mirce Acev in Skopje, shown on Figure 1.
Subject of research is introduce measures to reduce traffic and increase safety in the zone of the Primary School "11th October" in Skopje.
Purpose is to define the driving of traffic within the school zone with the required level of traffic service, in accordance with all legal regulation.

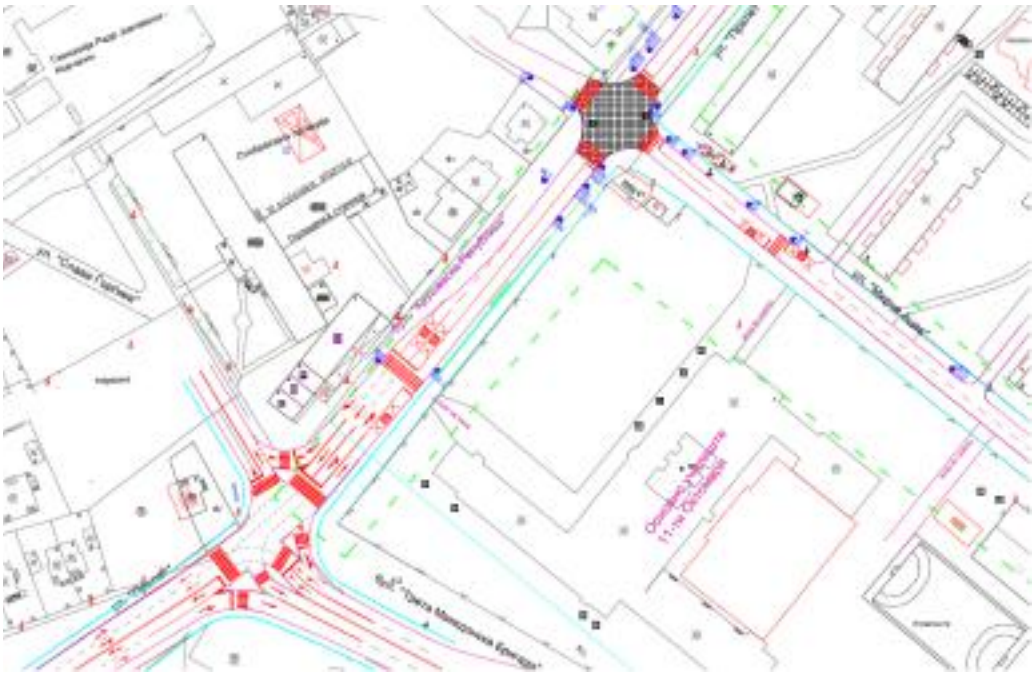


Figure 1: Existing situation of primary school

4 TRAFFIC SOLUTION

for create a traffic solution have been prepared a work base in digital form, the subject area covered by this research is elaborated. The subject area is processed from the traffic-technical aspect and according to the legislation. Adequate traffic signalization is needed be posted for timely notification of traffic participants. Special attention is paid to the most vulnerable group of traffic participants, pedestrians and children. In the zone of the “11th October” primary school on the boulevard Krushevska Republic, ie Street Prolet front of the entry in the school is set up pedestrian ahead bumps, the same solution is proposed for second entry for the school on the street Mirce Acev. On the street Mirce Acev has also been introduced area of traffic

calming which will significantly contribute to the protection of children in the school zone. Appropriate traffic signs and horizontal markings for school zone signs are posted. Protective elastic poles can be installed along the walkway on the street if necessary.

The location of the traffic signs and poles is specified and precisely defined by chainage. The traffic mode, respectively, the designed horizontal and vertical signaling, is given in the Figure 2 and chainage is given on Figure 3.

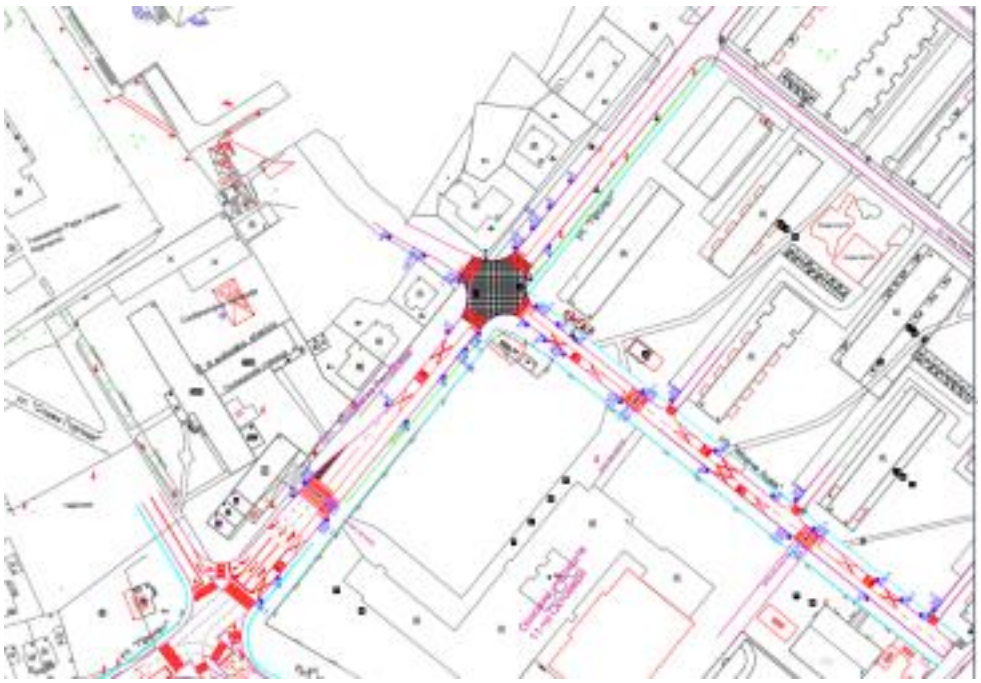


Figure 2: Traffic solution for primary school "11th October"

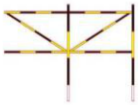
Figure 3: Chainage

For designed traffic solution are envisage to place traffic signage and equipment in the school zone (Table 1 and 2).

Table 1: Vertical traffic signalization

CODE AND SYMBOL OF SIGN		NAME OF TRAFFIC SIGN	CODE AND SYMBOL OF SIGN		NAME OF TRAFFIC SIGN
108.1		Bump ahead	302.1		Pedestrian crossing
124		Children on road	306		Priority road
201		Give way	318.1		Calming zone
202		STOP	318.2		End of calming zone
235(30)		Maximum speed 30 km/h	354		Dead end of street
236		No stopping or parking	302.1		Marked pedestrian crossing (Two-way console traffic sign with own light source)

Table 2: Traffic equipment

Traffic equipment	
	Pedestrian ahead bumps
	Protective pedestrian fence

School zones need to be set up properly and the methods of communicating with road users about the zone need to be clear and understandable. Warning signs such as “school zone”, “pedestrian crossing” and regulatory signs like speed limits need to be properly installed. Traffic calming objects, such as pedestrian refuges, reduced roadway width resulting in vehicle speed limit in front of the sensitive or core areas is important.

5 CONCLUSIONS

The designed solution is prepared in accordance with the legal regulation. Activities proposed in the research area enhance the safety and cause a reduction of traffic accidents in school zones. According to our research, traffic signs and markings have greater effect on safety than just their appearance. Each school is unique so the activities undertaken will differ for each school depending on the issues identified during the survey. In addition it is important to keep in mind that each one of these tools has its own specific applications, and not every one of them will fit every circumstance. Some of them will be more effective if used in combination with other traffic calming tools or with some of the place making tools.

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Transformation of border towns in the Republic of North Macedonia into sustainable urban centers through development of strategic and action plans

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ABSTRACT

The cities in Republic of North Macedonia are facing a number of problems and challenges. The most drastic changes, in this period have the small border towns in the country, where there is a decline in population, economic downturn, population migration, urban stagnation and more.

The subject of this paper is the study and analysis of border towns and settlements with their areas and the identification of current situations in which urban stagnation is caused. The purpose of this paper is to propose solutions for sustainable urban transformation that will allow adaptation and gradual development of border cities to contemporary flows of urban functioning, through previously performed analyzes and methodological approaches.

This topic involves finding and offering solutions in the short term, but as cities are urban and social communities, strategic planning in the medium term should also be offered.

The application of integral urbanism can identify the problems of the city and identify the means and capacities for solving those problems. Integral urbanism addresses the shortcomings and opportunities for urban renewal.

An important part of elaborating on the topic is the relationship between the border towns of the Republic of North Macedonia with the border towns of the neighboring countries, and their cooperation. One of the objectives of the paper is to define and present the values of the different European regions, their diversity and the apparent interstate borders between the Member States and the candidate countries of the European Union.

KEYWORDS

Border towns, urban transformation, sustainable development, strategic and action planning

1 Introduction:

Spatial and urban planning have a growing impact on the functioning and maintenance of neighborhoods and cities. According to prof. Andrew Wade, "it becomes clear that cities are a source of problems and solutions to modern life that require a deep level of research and understanding". Cities offer different social and economic opportunities; they offer social mobility and a variety of resources. Each city offers a complex level of understanding, each with its own combination of social, political, economic and environmental problems. The most creative solutions to building a city come from observing and exploring a variety of solutions - planned and multi-faceted.

Cities in Republic of North Macedonia (RNM) faces a number of problems and challenges. The most drastic changes in this period have been the small border towns in the country, where there is a decline in population, economic downturn, population migration, urban stagnation and more.

1.1 Subject of the research

The subject of this paper is to study and analyze border cities and settlements with their areas and to examine the current state of architecture and urban planning. RNM is a small country with an area of 25,713 km2. It borders with EU member states and EU candidate countries. Other major cities can be

transformed into new conditions of social order, while the characteristic small border towns with a smaller population are much harder and still unable to cope with that transition, and because they have a small population, more quickly are identified the problems they have for their normal functioning.

1.2 Aim of the research

The aim of the research is through analysis and methodological approaches to propose solutions for urban transformation that will allow adaptation and gradual development of border cities to modern urban functioning flows.

[2] Development and implementation of action planning

This topic involves finding and offering solutions in the short term, but as cities are urban and social units, strategic planning in the medium term should also be offered. Once existing problems that can be resolved immediately are defined, detailed action plans that can be implemented immediately, such as resolving smaller scale infrastructure problems, introducing immediately applicable legal measures, and will apply to the daily work of the citizens and the functioning of the local government. Whereas in the medium-term strategic plans should be foreseen the planning of the space, the assignment of new functions or the revitalization of the existing urban functions of the cities which will enable the implementation of the full vision of urban transformation of the covered urban settlements.

According to the action planning process where the problem is defined and the purpose is known, it is necessary to find and define a solution to achieve the objective. The development of the action plan will be elaborated in several stages:

- Problem Recognition - The cities under study face a range of unresolved issues in various areas: spatial - urban - urban stagnation of city life, sociological - demographic - such as population migration and population decline, and economic - economic - decline in urban areas. economic capacities that bring economic slowdown.

If the symptom is: sociological and demographic, where migration and population decline occur, is the problem of not functioning the city as an urban system? However, when the symptom is of economic and financial aspect, will the problem be the migration of residents from one city? This, in turn, leads to the main problem - malfunctioning of the city from a social, economic and urban point of view. (fig.1)

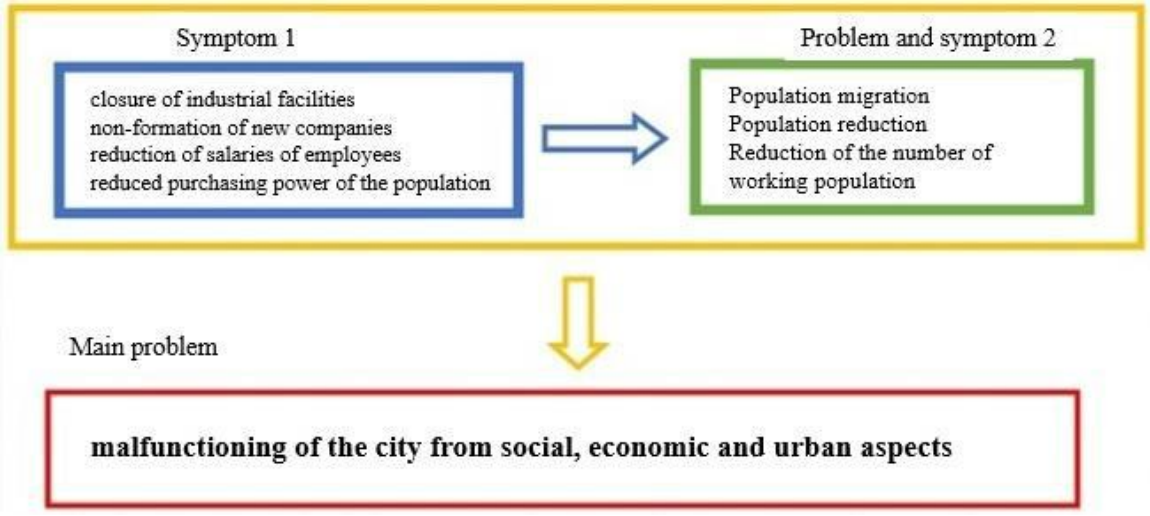

Figure 1: Diagram of symptoms for causing city problems

22 Priority Problems - After analyzing the problems and their data, a ranking is performed and a priority problem is identified. This prioritization of problems is based on several criteria that must respond to the

importance, urgency, control and feasibility of the solution.In this particular case, it is extremely important for citizens, current residents of border towns, to solve the problem both in the community as residents and for personal prosperity. The importance of the problem and the reach of a large number of citizens emphasize the urgency of problem solving through short-term and medium-term action plans. The final solution will depend on the involvement and capacity of the central and local government and strict adherence to plans and finances.

4. Problem definition - five questionnaires need to be answered for a specific problem definition - What? Why? When? Where? Whose?

What's the problem? - The problem is the city's failure to function socially, economically and urbanaspect.

Why is that a problem? - The city is a system that functions daily with all its functions. If one function stops, it reflects on the whole system. The reversal of economic and economic function in suburban cities has contributed to an imbalance in other functions (housing, education, culture, health).

What consequences will cities have if the problem is not resolved? - In these cities, the symptoms problems have not been approached by the central and local government in the past few years and therefore the problem is increasing. Failure to solve the problem can lead to unintended consequences, even to the utter neglect of these cities.

Under what conditions and where does this problem occur? - This problem arose during the transition period from one social arrangement to another, of the countries of the former Yugoslavia and even in the countries of the Balkans. This, in turn, has triggered new economic relations where numerous industrial enterprises and factories have cut back on their production and stopped working. It employed a large number of the inhabitants of the above-mentioned cities.

Whose problem is that? - Residents of the border towns feel the problem directly and indirectly the whole country as well because of migration and uneven economic and spatial development.

5. Formulating goals - The goal to be achieved is for each city to start functioning as a system with all its functions sufficiently developed. Research will show which cities, based on their specifics, will be transformed into cities that will have their primary function and specificity as eg. industrial center, tourist center, sports - recreation, health, cultural center, and a combination of these functions is possible.

6. **Identification of activities** - In order to achieve the goal of developing and transforming border cities into cities that will function as urban systems, the action plan should identify who will be the participants or performers of that plan. Since cities are cities - as systems that contain complexity in functioning, both local and central government should have coordinated participation. The local government with the preparation and implementation of local economic development plans, and the central government for achieving balanced regional development which will contribute to overall economic development. This should include the role of non-governmental organizations that, through their programs and cross-border cooperation with other cities in the neighboring country, will fit this whole system of action.

7.**Identification of resources** - Implementation of the entire action plan requires the budgets of local municipalities to be earmarked for this purpose, for both short-term and medium-term tasks (5 to 10 years). These financial plans should not be diverted. Central government funds will also play an important and decisive role, which will directly participate in the development of these municipalities through their capital investments. The central government, its commitment to the development of these regions, needs to be recognized through a set of laws and legal solutions. Pre-accession funds from the European Union intended for EU candidate countries will also be very important. Through European studies and strategies, the EU should enable the interconnection of border cities from two or three countries to become micro-euro regions. At the same time, the financial part of the realization of this plan should also develop the human resources that will be responsible for the management, realization and control of this plan. Teams need to be established both locally and at the level of the neighboring countries acting in coordination.

8. **Indicating progress through indicators and monitoring** - Measuring the achieved outcome by stages and monitoring them should be ensured in the process of implementing the action plan. This enables feedback and correction of the future process of plan realization. This is done according to predefined indicators for that action plan.

r **Evaluation** - The evaluation of the action plan for border towns will be an objective analysis that will determine the significance of the action plan. The evaluation process will provide information that will allow the application of the plan to be updated to keep up with current new knowledge and processes.

Research concept

3.1. Existing condition of cities

Picture no. 2 (fig. 2) shows the border towns in the RNM to be covered in the research topic: border towns with R. Bulgaria - Kriva Palanka, Makedonska Kamenica, Delcevo, Pehcevo, Berovo and the municipality of Novo Selo. With R. Greece - Dojran, Valandovo, Bogdanci municipality, Gevgelija, parts of the municipalities of Kavadarci and Prilep, municipality of Novaci, Bitola and Resen. With R. Albania - Ohrid, Struga, Municipality of Vevcani, Debar and Gostivar. With R. Serbia - Kumanovo, municipality of Staro Nagoricane and Rankovce and Kriva Palanka.

Characteristic cities that will be taken into consideration in this research will be the cities of Eastern Macedonia bordering the R. Bulgaria, as the most prevalent in these cities, is the migration of population and the slowdown in urban development.

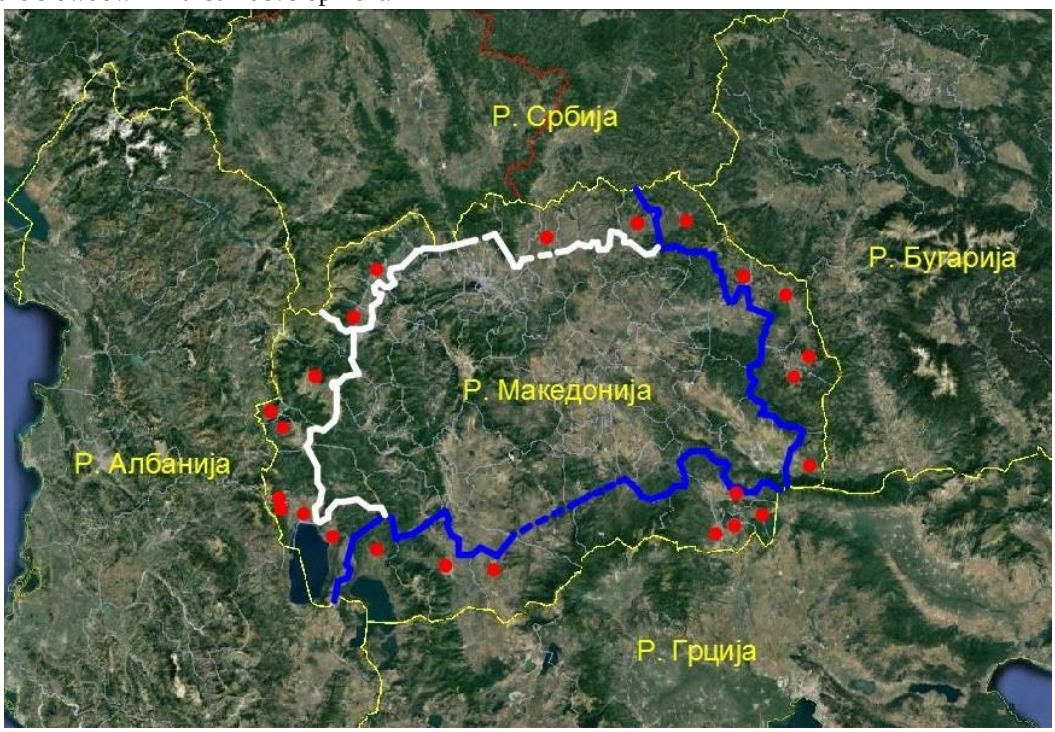

Figure 2: Border cities of RNM with the neighboring countries

The border cities included in this survey represent a contact area with the European Union. It is very important what that contact zone will be like. If cities are not transformed, that contact zone can be a contrast to the "junction". Therefore, the transformation of the cities in the contact zone is needed in order for that zone to be a connecting element in spatial planning in two different systems from different countries that will in the future be in a common spatial system.

3.2. Economic, sociological and demographic characteristics of border towns

The process of transformation of border towns bordering European Union member states is extremely important for smaller border towns versus large cities as the migration of the population taking place in the

RNM is directed from the smaller cities to the larger ones and directly to the capital. Larger cities have made the transition to their functioning, while the cities under study can never get out of that transition and have no plans for further development. It is a problem in their functioning.

Cities such as Kriva Palanka, Makedonska Kamenica, Delcevo, Pehcevo, Berovo, Dojran, Valandovo, Gevgelija, Bogdanci and Resen face these problems. According to statistics from the Statistical Office of the Republic of North Macedonia, the total number of inhabitants in these cities is 121.800 [1]. The tendency of population decline is more pronounced in this period.

With the exception of a few industrial facilities, all commercial facilities in these cities are closed and operate at the level of small plants. Low wages and the politicization of the institutions are one of the main reasons for the emigration of residents to the east of the country. Research shows that as many as 20 percent of residents have moved abroad permanently[1]. It should be noted that the young working age population leave the cities en masse, and it is particularly notable that young people who finish their education in Skopje do not return to their cities at all. According to research, a quarter of young college graduates have moved away. In this way, the overall social, economic and cultural development of these cities is stagnant and backward. Thus, even at regional level there is uneven development in this day of the state.

Opportunities for transforming border cities into sustainable and healthy cities

Worldwide, there is a growing interest in planning sustainable cities. Every city, small or large, offers opportunities, through detailed study, analysis and mapping of problems, and then with careful and thoughtful design to transform into a vibrant, healthy, safe and sustainable city. These cities are primarily concerned with citizens. Jan Gell (Gehl, 2018), points out several key things that need to be provided in order to revitalize and rebuild the city:Едноставна градска мрежа, која дава кратки рути и значајни простори

- Space for pedestrian traffic
- Recreational and social activities
- Well-defined city spaces
- Traffic reorganization, design of pedestrian and bicycle lanes
- Providing diverse and complex city life
- Social sustainability
- Security and protection of city spaces
- Using renewable energy sources

Small border towns in the RNM, in line with the action plan outlined above in the paper, and integral theory, will need to be transformed to ensure a quality life. The process of transforming them into vibrant and sustainable cities will take place in the medium term through strategic plans, and in the short term through an action plan that is designed to achieve rapid results. Emphasizing the transformation of the urban morphology and typology of each city individually, as well as the reorganization of the traffic network to design more pedestrian and bicycle paths and provide conditions for the use of renewable energy sources in cities will contribute to the realization of some of the the aims of this research.

Public space in these small towns will be carefully designed according to plans to support processes that enhance city life. The number and density of the population is one of the parameters that will be an important factor in dimensioning public spaces in these cities, with dimensions adapted to the inhabitants who will use the space, and which will represent gravitational fields to attract people, thus popularizing them. city space. Encouraging city life in small border towns will be possible by designing compact, straightforward and logical routes, modest dimensions of space and a clear hierarchy that knows which spaces are most important.

[23] Истражување на невладината организација „Ини“ - Виница

The cities that are the subject of this research, because they are small - by area and population, offer the opportunity to increase pedestrian and bicycle traffic. When planning new space, pedestrians and cyclists should be given high priority. It is an important element in the overall sustainability policies of cities. "Pedestrian and bicycle use less resources and less environmental impact than any other type of transport" [2]. In these cities, the climate and structure make it simple and inexpensive to introduce and enhance this traffic, thereby enhancing the sustainability and health of the city.

Social sustainability is a comprehensive concept and has a significant democratic dimension"[3]. Emphasis should be placed on different groups in society (the city) and provided with equal opportunities to participate in city life. Due to the problems in the economy and economy, these small towns should be given priority in addressing social sustainability. To address this problem, efforts must be made in all spheres - social, educational, cultural, sufficiently available, visionary local policy and timely space planning

All this work done by these authors and theorists of sustainable urbanism is a good basis for clearly defining and realizing project objectives, but it should be noted that in the project of transformation and development of small border towns, economic development needs to be integrated and coordinated. and economic factors to enable the first job for the inhabitants, economic development of the municipality, and also through private initiatives and public-private partnerships to make the municipality financially successful. In this way, young people will not leave cities and migrate for economic reasons, but the co-ordination of a sustainable city and economic factors will make a whole where integral planning will lead to specific goals.

5. Conclusion – Integral urbanism

Integral urbanism (Ellin, 2006) is a practice that aims to bring together city functions such as living, working, circulating, recreating, but also integrating objects with nature, center with periphery, local character with global forces, various professions involved in urban growth and development, and people of different ethnicities, incomes, ages and abilities. "The result of this practice is a reorientation in the theory and practice of urban design, ranging from small interventions to regional plans, that is, restoring the health and well-being of the modern city by offsetting the negative impacts of environmental spreading and degradation" [4]

The application of integral urbanism can identify the problems of the city and identify the means and capacities for solving those problems. Integral urbanism addresses the shortcomings and opportunities for urban renewal. "Instead of neglecting, abandoning or erasing urban heritage, integral urbanism preserves the objects, neighborhoods and natural landscapes that are valued; it rehabilitates, rebuilds and renovates what is underdeveloped, and then adds new elements through effective community involvement3" [5]

In the project of transformation and development of small border towns, economic factors must first be increased to enable the first work for the citizens of those towns, to create economic development for the municipality, and also through private initiatives and public private. partnership to achieve that the municipality can exist financially independently. Border cities - as systems that contain complexity in functioning, for the successful realization of these goals, both local and central government should have coordinated participation. The local government with the preparation and implementation of local economic development plans, and the central government for achieving balanced regional development which will contribute to overall economic development.

An important part of elaborating on the topic is the relationship between the border towns of the RNM with the border towns of the neighboring countries, and their cooperation. One of the objectives of the thesis is to define and present the values of the different European regions, their diversity and the apparent interstate borders between the Member States and the candidate countries of the European Union. It is important to see how border areas and cities grow into common Euro regions with shared potentials. Cross-border planning encompasses the co-operation of spatial planning, regional and local planning and urban and rural development and helps to overcome the negative impacts of administrative boundaries as part of European spatial development policy.

The transformation of the border towns in the RNM into open urban centers of new micro-Euro-regions is a contemporary topic and important not just for the Republic of North Macedonia, but also for all other countries that are candidates for EU membership. This approach will also achieve territorial cohesion and a balanced development of urban and rural where together they will represent a whole of the planned space. It is of particular interest to the RNM, which as a continental country may have a spatial connective character with the other neighboring countries within the wider European Union.

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Using Python Programming For Assessing And Solving Health Management Issues

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ABSTRACT

In general , data analytics and data science have changed the way we treat, analyze and exploit information in every field. Healthcare is one of the most exciting fields where it can be implemented to make a difference. One of the most advantageous facets of healthcare is type 2 diabetes analytics. Healthcare analytics have the ability to minimize medical costs, handle resources better, and forecast shortages. Therefore, the research focuses on the treatment of health conditions with an emphasis on type 2 diabetes and explores a model for improved management. Predictive models can make human decisions more productive and make an entire decision-making process more highly automated. The automation of the healthcare industry is moving toward processing and accessing vast health records for study, and this will improve the healthcare in general. The Artificial Neural Network (ANN) model was evaluated, adapted from Sristava and further developed by adding and evaluating the attributes with additional impact factors. There is debate and argumentation of perspectives, advice and guidance.

CCS

Applied computing > Life and medical sciences >Health informatics

KEYWORDS

data analytics, healthcare, comparative analyses, diabetes, python programming

1 Introduction

Data science is interdisciplinary, incorporating elements of statistics, data mining, and predictive analysis, and focusing on processes and systems that extract knowledge and insights from data. It is also known as “analytics transformation” because the goal is to “transform” raw data into usable insights. It has also been called “industrial analytics” because the context is industrial rather than scientific – to analyze data for

competitive or quality improvements that can be gained by having a better understanding of one's customers, potential customers, service model, and almost any aspect of the organization that can be represented in bytes. Data science has been a term in the computing field since around 1960 when it was first floated as a substitute for the term "computer science". Over the next twenty years or so, it gradually came to mean that blend of statistics and methodology that specifically pertained to data analysis. However, it was not until the much more recent emergence of Big Data and its role in organizational development and direction, that data science began to be a fundamental requirement of any organization working out how to analyze such massive amounts of data.

2 LITERATURE REVIEW

Data analytics in health sector provides stakeholders new insights that have the potential to improve personalized treatment as well as patient outcomes and avoid unnecessary costs. To date, health care industry has not fully grasped the potential benefits of data analytics.

In 1959, Arthur Samuel defined machine learning as "a field of study that gives computers the ability to learn without being explicitly programmed" (Panesar, 2019, p. 78). In essence, computers can learn to recognize patterns without being programmed to perform specific tasks (i.e., systems that learn without being explicitly programmed). As a result, learning is driven by data – with the intelligence acquired through the ability to make effective decisions based on the nature of the learning signal or feedback (Panesar, 2019). Machine learning focuses on the development of algorithms that learn to adapt to new data. It exemplifies the principles of data mining but is also able to infer correlations and learn from them to apply to new algorithms. The goal, then, is to mimic the ability to learn by experience like humans and achieve tasks without, or with minimal, external (i.e., human) intervention or assistance (Panesar, 2019).

There are many approaches employed by machine learning including memorization, extraction of information, and learning by example. It differs from traditional software engineering as instead of providing instructions about the function f (as in traditional software engineering), the computer is provided input x and output y and is expected to determine or predict function f using what has been provided (i.e., Y = f(x), which can be understood as Output = function(Input)). Machine learning programs learn through reasoning to solve a problem from examples, rules, and information. It can also learn to generalize and help with issues of uncertainty with the use of statistics and probability-drive techniques. Models can also learn from previous computations or experiences to produce reliable and repeatable decisions and results (Panesar, 2019).

Machine learning usually involves seven steps including (1) specifying the problem as a learning task(s); (2) preparing the data; (3) choosing the learning method; (4) applying the learning method; (5) assessing the method and results; (6) optimization; and (7) reporting the results. The following is a practical example of machine learning in the field of healthcare: disease diagnosis x is the properties of the patient f(x) is whether a patient has a disease (Panesar, 2019). Basically, it begins with input data provided as examples, direct experience, or instructions in order to identify patterns within the data and make better decisions in the future based on the data provided. As previously mentioned, the rationale of a machine learning program is to enable the program to learn automatically without human intervention or assistance. It should allow for adjustment of rational actions accordingly (Panesar, 2019).

There are various types of machine learning techniques and some of which include supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning, and neural networks (Indoria and Rathore, 2018; Panesar, 2019). An example of how this can be applied in the field of healthcare is through the use of a supervised learning problem in the form of classification. Classification can predict the outcome based on a training dataset where the output variable is in the form of distinct categories. In this case, the model is built through inputting training data in the form of prelabeled data. It will then define decision boundaries and include support vector machines, naïve Bayes, Gaussian Bayes, k-nearest neighbors (KNN), and logistic regression. An example of a real-world application of this is in

determining if an individual is sick or unhealthy based on a set of symptoms (Panesar, 2019). Another example is through the use of association for unsupervised learning problems. The association technique is able to discover the probability of the co-occurrence of items in a collection wherein any attribute can be predicted in association. For example, this can be used in calculating for percentage of likelihood of developing any form of cancer when one is diagnosed with poorly controlled type 2 diabetes (Panesar, 2019). Another example is through the use of neural networks, specifically artificial neural networks.

Artificial neural networks are made of perceptrons (i.e., mimicking biological neutrons where dendrites receive an input; it has a bias similar to b of the linear function y = ax+b) and contain one or more hidden layers (Panesar, 2019). It has several topologies with the simplest being a feedforward method. Backpropagation is the method used for determining the error or loss at the output and propagating it back to the network. Artificial neural networks will be important in a subsequent paragraph and will be discussed in-depth then.

Machine learning tasks are usually conducted using various programming languages such as R, Python, Matlab, SQL, Java, and C (Panesar, 2019). This paper focuses on the use of Python. Python is a language that is well suited to machine learning. It is a general-purpose interpreted, object-oriented, and high-level programming language released by Guido van Rossum in 1991 (Sambyal, Javid, & Bansal, 2018). Extensions such as NumPy and SciPy are particularly useful for machine learning and data analysis (Panesar, 2019). It should be noted that Python is open-source and would therefore cost nothing when procured (Sambyal, Javid, & Bansal, 2018). In Sristava et al.'s (2018) study below, this is the programming language they employ along with the artificial neural network (ANN) approach.

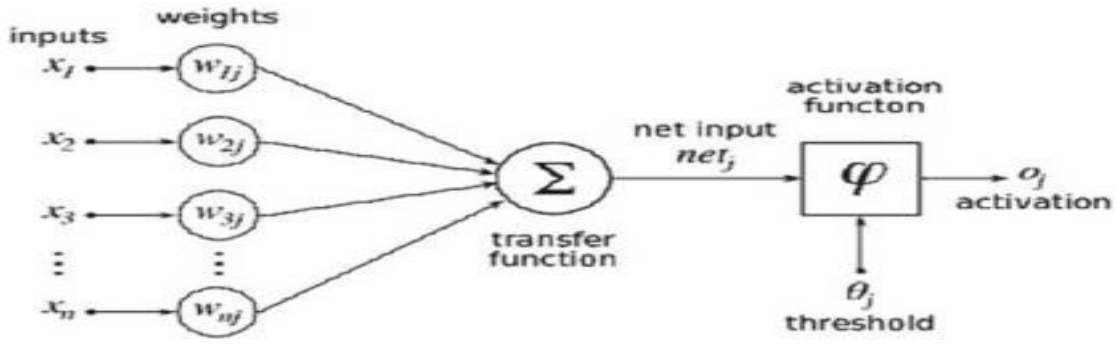

Figure 1. Artificial Neural Network (ANN) model. Adapted from Sristava et al. (2018).

Diabetes mellitus, often referred to as simply diabetes, is a disease that is increasing in prevalence on a global scale. The World Health Organization (WHO, 2018) estimated that the number of individuals with diabetes has risen to 422 million worldwide in 2014. In the United States, the Centers for Disease Control and Prevention (CDC, 2019) estimated that more than 7.2 million individuals have undiagnosed diabetes. On a global scale, it causes more than 2.2 million deaths yearly. It costs $327 billion dollars in healthcare expenses and decreased productivity in the United States alone (CDC, 2019). Tests that could be used to diagnose diabetes include fasting plasma glucose (FPG) and hemoglobin A1c (HbA1c) or the average blood glucose level for the past two to three months (Sambyal, Javid, & Bansal, 2018). While these tests are widely available, it is often only useful when the individual is already manifesting symptoms of diabetes, meaning it is too late for these tests to be considered an effective screening tool (i.e., at that point, the patient will receive treatment for diabetes instead of following ways to prevent it) (Sambyal, Javid, & Bansal, 2018). With today's technology, the amount of data that has been collected from patients over the years, coupled with machine learning, can reliably and non-invasively predict individuals at risk for diabetes. This paper will discuss the real-world application considerations for devising new machine learning algorithm for the detection and prediction of diabetes using Python.

Diabetes is a chronic condition that causes abnormally increased levels of glucose in the blood (Sristava et al., 2018). There are three types of diabetes – the first is type 1, the second is type 2, and the third is gestational diabetes. Type 1 diabetes refers to the autoimmune disorder wherein the pancreas is

unable to produce insulin because its beta cells are being attacked by the body's own immune system (i.e., hence, making it an autoimmune disorder), therefore causing high blood sugar (i.e., hyperglycemia) (Indoria and Rathore, 2018). The second type is type 2 diabetes, the most prevalent type, and also the type that most individuals refer to when they mention 'diabetes.' Type 2 diabetes is the result of the body's ineffective use of insulin, most commonly due to excess body weight and physical inactivity (WHO, 2018). The third type is gestational diabetes; and as its name suggests, it occurs during gestation or pregnancy. It is associated with increased blood glucose levels and can cause complications during pregnancy and during delivery. The WHO (2018) added that children born from mothers with gestational diabetes are at risk of developing type 2 diabetes in the future. It is imperative that these three types of diabetes are predicted and detected as soon as possible as it can cause complications such as cardiovascular disorders, stroke, foot ulcers, kidney failure, and even death (WHO, 2018).

While there are a host of methods currently employed to predict and detect diabetes, they can only most often diagnose diabetes when an individual is already manifesting symptoms such as frequent urination, increased thirst, and increased hunger (Indoria and Rathore, 2018). This therefore calls for a more efficient and effective method of predicting and detecting diabetes so it can be addressed before symptoms and other possible complications begin to manifest. Indoria and Rathore (2018) explained that computer-aided diagnosis is increasingly being employed in the medical industry and that recent researchers have found machine learning promising in accurately perceiving and diagnosis diabetes. Various types of machine learning techniques are available including supervised, unsupervised, semi-supervised, and reinforcement (Panesar, 2019).

3 Analyses of a Model using Python Programming

Sristava et al. (2018) proposed a model to predict diabetes wherein the model is built in core Python using ANN algorithm.

Attribute name	Mean value
Number of times pregnant	3.8
Plasma glucose concentration	120.9
Diastolic blood pressure (mm Hg)	69.1
Triceps skin fold thickness (mm)	20.5
2-hour serum insulin (mu U/ml)	79.8
Body mass index	32.0
Diabetes pedigree function	0.5
Age (years)	33.2

Figure 2. Mean value of attributes. Adapted from Sristava et al. (2018).

Before discussing the machine learning technique and programming language used, it is important to discuss how data was collected as it is a core component of the development of a machine learning program. Data was collected through a platform for predictive modeling and analytics competition in which companies and researchers post data for research purpose. Attributes were assigned with numeric values and the following were included: (1) number of times pregnant; (2) plasma glucose concentration at 2 hours after administration of oral glucose tolerance test; (3) diastolic blood pressure; (4) triceps skinfold thickness; (4) 2-hour serum insulin; (5) body mass index (BMI); (6) diabetes pedigree function; (7) age; and (8) class variable. This dataset contains Missing Attribute Values handled in the preprocessing stage of methodology. An example of the attributes is seen in Figure 2. They explained that they chose Python due to its efficient high-level data structures and simple but effective approach to object-oriented programming. ANN was employed due to its ability to estimate or approximate functions that can depend on a large number of inputs and are unknown. ANNs are presented as systems of interconnected "neurons" which exchange messages between each other, and their connections have numeric weights that can be tuned

based on experience (i.e., enabling its capability to learn). Sristava et al. (2018) explained that three types of parameters define an ANN: (1) interconnection pattern between the different layers of neurons; (2) learning process for updating weights of interconnections; and (3) activation function that converts a neuron's weighted input to its output activation. The model can be seen in Figure 1. Sristava et al. (2018) included the following components written in Python as a function to call and execute: (1) Read_CSV(); (2) Assigning Random weight(); (3) NeuralNetwork(); (4) feedforward (); (5) backPropagate(); (6) sigmoid(val); (7) ErrorCal(); (8) Graph_Plot(). The specifics of these components can be seen in Figure 3. Attributes that will be included can be seen in Figure 4, listed according to priority.

1. **Read_CSV()**: Training data file Diabetes_TrainingData.csv and converting in array to read by python. Using Pandas package [18] and related function array can be formed to easily supply as input Training values.
2. **Assigning Random weight()**: INPUT_NEURONS variables used to weight for input Hidden (WiH), Then HiD (Hidden input Neurons) to HIDDEN_NEURONS for assigning weight. Finally, transfer HIDDEN_NEURONS weights to OUT-PUT_NEURONS.
3. **NeuralNetwork()**: First define number of epoch, which is epoch = 0 for initial and give training rate, which is TRAINING_REPS should always be greater than epoch. TrainInputs[ ] is an array which stores weight and input neurons values, trainOutput[ ] stores output hidden neurons values and learn for new values.
4. **feedForward()**: First Neurons values are transferred to hidden layer neurons, where these values for each neurons are multiplied and stored in actual variable, which is the sum of all the multiplied neurons and weight value.
5. **backPropagate()**: Backpropagation is a method to calculate the gradient of the loss function with respect to the weights in an artificial neural network [19]. It is commonly used as a part of algorithms that optimize the performance of the net-work by adjusting the weights. Here, backpropagation call the sigmoidDerivative function and define LEARN_RATE (Initially lower value), then calculate error in each sigmoid layer.
6. **sigmoid(val)**: The sigmoid function is a type of activation function for artificial neurons. The most basic activation function is the heaviside (binary step, 0 or 1, high or low). The sigmoid function (a special case of the logistic function) and its formula looks as shown in Fig. 4.
7. **ErrorCal()**: Here, the final error shows the model accuracy and Actual and Predicted values, which is finally 8% at the end of building model and get prediction.
8. **Graph_Plot()**: This shows the result in graphical format. Package MatPlotLib used to plot the graph of actual and predicted values [20]. This graph shows under result section.

Figure 3. Components written in Python as a function to call and execute. Adapted from Sristava et al.(2018).

Also for the model it is very important to assess the priority of the attributes that are going to be measured and defined as impacting factors. Below is given assessment of the attributes.

Attribute name	Priority[a]
Diastolic blood pressure (mm Hg)	1
Number of times pregnant	2
Age (years)	3
Triceps skin fold thickness (mm)	4
Diabetes pedigree function	5
Body mass index (weight in kg/(height in m)^2)	6
2-hour serum insulin (mu U/ml)	7
Plasma glucose concentration a 2 h in an oral glucose tolerance test	8

[a]means lower weight, 8 means higher weight

Figure 4. Attribute priority. Adapted from Sristava et al. (2018).Conclusion

The main purpose of the research study was to investigate data analytics and its applications in healthcare using machine learning and python programming. Primarily the focus was on diabetes as one of the biggest silent killers of patients. There are many approaches employed by machine learning including memorization, extraction of information, and learning by example. It differs from traditional software engineering as instead of providing instructions about the function f (as in traditional software engineering), the computer is provided input x and output y and is expected to determine or predict function f using what has been provided (i.e., Y = f(x), which can be understood as Output = function(Input)).

Analyzed was the Sristava model to predict diabetes wherein the model is built in core Python using ANN algorithm. We have modified the provided algorithm by employing attribute priority and changing the number of impacting factors.

In conclusion, the developed machine learning model for the prediction and detection of diabetes is important as the condition continues to increase in prevalence worldwide while simultaneously increasing its economic burden. There are various considerations that need to be made when developing a machine learning program including the machine learning technique of choice and programming language to use. Another important consideration is the source of data.

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The status on the implementation of the right to address public authorities in Northern Macedonia

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Abstract

The right of the citizens to address authorities for redress of grievances without fear of punishment or reprisals lies at the cornerstone of modern democratic states, tracing back its origins as far as the "Magna Carta Libertatum" from the XIII century. This right is recognized in the basic treaties and the Charter of Fundamental Rights of the European Union, further advanced through the work of the Committee on Petitions in the European Parliament.

The right of the citizens of Republic of North Macedonia to address and elicit action from public authorities is guaranteed by the Constitution and the Law on Acting Upon Complaints and Proposals. An inquiry on the implementation of the Law has revealed many shortcomings ranging from inexistence of several crucial bylaws, lack of the envisaged network of officers responsible for processing the addressing from the citizens on behalf of every state and other public entities, absence of record of the addresses from the citizens referred to the state and other public entities or the Office of the Ombudsman, as an instance of appeal.

Taking into consideration the legal framework for exercising the right to address the institutions of the European Union and the experience of the Committee on Petitions in scrutinizing and advocating on behalf of individual cases in conjunction with the legal framework and practice in implementation of the right to address in Republic of North Macedonia, the authors of this paper in the concluding section are offering a set of suggestions as a way forward toward revitalization and consistent implementation of the legislation pertinent to unimpeded practicing of the right to address the state and other public entities by citizens of Republic of North Macedonia.

Key words: right to address, participatory democracy, democratic practice.

Historical perspective on the right to address public authorities

Predominant number of modern day Constitutions are defining the citizens as bearers of sovereignty of the state (Galligan, 2013). The citizens are exercising their sovereign power through electing their representatives or through direct forms of democracy such as the referenda or the Swiss Landsgemeinde type of direct democracy where all members of the local community are discussing certain issue and finally taking a decision with a majority vote (Schaub, 2012).

Apart from exercising their sovereignty through participation in various forms of indirect or direct democracy as part of the collective, on many occasions citizens are compelled to address the state as individuals and expect the state to respond and act with regards to the issue in question.

The right of the citizen to address the state and its affiliated institutions is most commonly referred to as “the right to petition” or simply “the right to address”.

The right to petition government for redress of grievances is the right to make a complaint to, or seek the assistance of, one's government, without fear of punishment or reprisals. Numerous distinguished historians have traced back the role of petitioning in English constitutional history as far as the “Magna Carta Libertatum[1]” from the XIII century (Mark, 1998). The right to petition was recognized by the local assemblies in colonial America, preceding the enactment of the First Amendment to the Constitution of the United States of America in 1791 reading that: “Congress shall make no law … abridging … the right of the people … to petition the Government for a redress of grievances.” (Higginson, 1986). Ever since, the right to petition the government is omnipresent in various national and international legal documents. In Europe the right to petition exits in most jurisdictions at local, regional and supra national level (with rare exceptions, such as Cyprus, Estonia, Finland or Sweden), (Tiburcio, 2015).

[4] Magna Carta Libertatum (Medieval Latin for "the Great Charter of the Liberties"), is a charter of rights agreed to by King John of England on 15 June 1215. First drafted by the Archbishop of Canterbury to make peace between the unpopular King and a group of rebel barons, it promised the protection of church rights, protection for the barons from illegal imprisonment, access to swift justice, and limitations on feudal payments to the Crown.

The right to address public authorities in the European Union

From a perspective of the European Union (EU), the right to address EU institutions and receive an answer belongs to every citizen of the European Union including the right to petition the European Parliament. In addition, every natural or legal person residing or having its registered office in an EU member state has the right to address a petition to the European Parliament on a matter which comes within the Union's field of activity and which affects the person directly[2] (Treaty on the Functioning of the European Union, 2016).

The right to address the institutions of the European Union and petition the European Parliament is additionally reaffirmed in the text of the Charter of Fundamental Rights of the European Union (2016), whereby the right to address the institutions of the EU and receive an answer is recognized to every single person[3], while the right to petition the European Parliament is valid for the citizens of the Union and natural and legal persons residing or having registered office in a member state of the EU[4].

For the purpose of realization of the above mentioned right to address and receive an answer from the institutions of the European Union, the European Parliament has established the Committee on Petitions, which is one of the 20 specialized standing committees in charge of instructing legislative proposals, proposing amendments, conducting negotiations with the Council on EU legislation. The Committee on Petitions also adopts own-initiative reports, organizes hearings with experts and scrutinizes other EU bodies and institutions (European Parliament, n.d.). The work and the authorizations of the Committee on Petition are laid out under "Title IX" and "Annex 5 item XX" of the Rules of Procedure of the European Parliament (2015). The work of the Committee on Petitions begins with assessing the admissibility, because petitioners often tend to confuse competences, responsibilities and possibilities for action and redress with those of Member States and other international organisations and bodies (Marzocchi, 2019). Following the admission of a petition, the Committee on Petitions may decide to ask the European Commission to conduct a preliminary investigation on a petition and

30 See article 20 section 2 item d, article 24 and article 227 of the Treaty on the Functioning of the European Union.

3 See article 41 from the Charter of Fundamental Rights of the European Union. 4

See article 44 from the Charter of Fundamental Rights of the European Union

provide information regarding compliance with relevant EU legislation, refer the petition to other European Parliament Committees for information or further action, or contact the appropriate institutions or authorities or intervene through the permanent representation of the Member State concerned to settle the matter. Should the Committee decide to place a petition on Committee's agenda for discussion, representatives of the petitioner, the European Commission and the member state(s) concerned are invited and given the opportunity to join the discussion. The Committee on Petitions may decide to hold a hearing or a workshop, conduct a fact-finding visit to the country or region concerned and adopt a mission report containing its observations and recommendations, or prepare and submit a full report to be voted on by Parliament in plenary. It can also decide to submit oral questions to the Commission and/or the Council and to hold a debate in plenary. If a petition relates to a matter of general interest revealing incorrect transposition or application of EU law, it can lead the Commission to take action with the Member State in question, including through infringement proceedings. Petitions submitted to the European Parliament will become public documents. Summaries of petitions are published in all official EU languages on the Petitions Portal[5] of the European Parliament (Rules of Procedure of the European Parliament, 2015).

The petitioner is informed in writing of all decisions of the Committee concerning his/her petition and of the reasons for these decisions, and provided with relevant information and documentation where appropriate once the decisions become available (Ibid.).

The Committee on Petitions is issuing an Annual reports on the deliberations of the Committee on Petitions including information on the number of petitions received, their format, status, outcome, country, language, nationality and subject, relations with the Commission, Council and Ombudsman, fact-finding visits, public hearings, studies commissioned and further key issues. As highlighted in the Report on the outcome of the Committee on Petitions' deliberations during 2018: "[the European] Parliament has always considered petitions as a key element of participatory democracy. It has also underlined their importance in revealing instances of incorrect transposition and implementation of EU law by Member States" (Wikström, 2019). Finally, aiming toward greater and improved publicity and transparency of petitions, as well as interaction with and the participation of citizens with the EU, in 2014 the European Parliament

15. http://www.europarl.europa.eu/committees/en/peti/home.html#

launched the Petitions Web Portal[6] and in 2016 a Petition Network was established, ensuring greater cooperation among committees dealing with petitions, and cooperation and dialogue with national parliaments and authorities, as well as with other EU institutions.

Legal aspects of the right of the citizens to address public authorities in the Republic of North Macedonia

The right to address state bodies and other public services is guaranteed by article 24 of the Constitution of the Republic of North Macedonia "Every citizen has the right to submit complaints to the state bodies and other public services and to receive a reply thereon" (Constitution of Republic of North Macedonia, 1991). A citizen cannot be called to account or suffer adverse consequences for viewpoints expressed in the complaints, unless they entail committing of a criminal offense (Ibid.). From a legal standpoint the right to address and receive an answer from the state bodies and other public services is further regulated under the provisions of the Law on Acting Upon Complaints and Proposals. The Law is defining any written or oral addressing of the complainants, that is, the proposers to the bodies acting upon complaints, that is, proposals, for the purpose of protecting and exercising their rights and interests, the public interests established by law, or for raising another initiative of public interest, as a legitimate request for action from the state or the public entity to whom the address was directed (Law on Acting Upon Complaints and Proposals, 2008). The entities acting upon complaints and proposals should keep records of the received complaints and proposals and provide answer in 15 days or up to 30 days for complex issues. The acting upon complaints and proposals shall include collection of data, information and opinions on the facts and circumstances significant for their assessment, direct examination, analysis and recording of the events and reasons for their submission, and taking the necessary actions and measures for the purpose of exercising the rights of the complainant, that is, the proposer (Ibid.).

If in the course of acting upon the complaint, that is, the proposal, it is established that the right of the complainant, that is, the proposer has been violated or a damage has been caused by an act, action or measure, that is, the public interest established by law has been violated, the entity acting upon the complaint shall bring it to the attention to the competent body and shall request to take the necessary measures in accordance with law for elimination of the violation of the

[s] https://petiport.secure.europarl.europa.eu/petitions/en/home

right, that is, the caused damage. If the complainant, that is, the proposer does not receive an answer to the complaint, that is, the proposal, he/she may address the Ombudsman of the Republic of North Macedonia and request protection (Ibid.).

Finally the Law on Acting Upon Complaints and Proposals (2008) contains misdemeanor provisions envisaging fines for non-compliance with the provisions of this Law.

Findings on the factual implementation of the right of the citizens to address public authorities in the Republic of North Macedonia

The factual implementation reveals a lot of flaws with regards to the implementation of the Law on Acting Upon Complaints and Proposals. The Minister of Information Society and Administration has failed to prescribe the regulation on the manner of acting upon complaints and proposals in accordance with article 13 of the Law (Tegovska, 2019). The state and other public entities acting upon the provisions of this Law thus far have failed to submit semiannual reports to the Ministry of Information Society and Administration, on the data referring to the actions taken upon received complaints and proposals[7]. The Minister of Information Society and Administration hasn't prescribed the content, the manner and the form of keeping the records of the data referring to the actions taken upon received complaints and proposals, as stipulated in the third paragraph of article 19 of the Law on Acting Upon Complaints and Proposals (Ibid.). The Office of the Ombudsman of the Republic of North Macedonia does not keep a separate record of the received complaints based on citizens' dissatisfaction from the implementation of the provisions of the Law on Acting Upon Complaints and Proposals (Годишен извештај за степенот на… заштита на човековите слободи и права, 2019). The interview with an official from the Office of the Ombudsman revealed that the present methodology for registration and classification of the complaints is based on classifying the complaints according to the area in which the breach of civil rights has occurred (Bajramovska, 2019).

The Administrative Inspectorate does not keep a record of the issued misdemeanor payment orders, in fact one of the inspectors claims that the Administrative Inspectorate has never fined anyone for failing to comply with the provisions of the Law on Acting Upon Complaints and Proposals (Sekulovski, 2019).

The review of the web pages of the Parliament of the Republic of North Macedonia as well as

[7] Obligation from Article 19 from the Law on Acting Upon Complaints and Proposals.

the Ministries and several state agencies clearly reveals that none of this organizations has assigned any authorized persons or formed an internal organizational unit who shall act upon the complaints and proposals, as stipulated in article 7 of the Law on Acting Upon Complaints and Proposals (2008).

Recommendations

Findings concerning factual implementation of the right of the citizens to address public authorities in the Republic of North Macedonia undoubtedly reveal that the Law on Acting Upon Complaints and Proposals has some serious omissions that need to be corrected.

To begin with, the Minister of Information Society and Administration should enact the regulation on the manner of acting upon complaints and proposals in accordance with article 13 of the Law (Law on Acting Upon Complaints and Proposals, 2008). The enactment of this regulation will result in precise defining of the rights of the complainants i.e. proposers when addressing state and other public entities.

Every state and other public entity should appoint authorized persons or form an internal organizational unit that will act upon the complaints and proposals, as stipulated in article 7 of the Law (Ibid.).

The Minister of Information Society and Administration should also enact regulation on the content, the manner and the form of keeping the records of the data referring to the actions taken upon received complaints and proposals, as stipulated in the third paragraph of article 19 of the Law (Ibid.).

Once the Minister of Information Society and Administration enacts the regulation from the previous paragraph, all state and other entities should begin with the observance of the provisions of the second paragraph of article 19 of the Law and start submitting the semiannual reports to the Ministry of Information Society and Administration (Ibid.).

The Office of the Ombudsman of the Republic of North Macedonia should amend the content of the Annual Report on the Degree of Protection of Human Rights and Freedoms in direction of introduction of a separate category concerning registration and reporting on received complaints based on citizens' dissatisfaction from the implementation of the provisions of the Law on Acting Upon Complaints and Proposals (2008).

The Administrative Inspectorate should begin exercising its authority concerning sanctioning the

noncompliance with the provisions of the Law pursuant to article 21-a of the Law on Acting Upon Complaints and Proposals (2008). Though it is difficult to talk about sanctioning prior to the enactment of all required regulations and the establishment of the network of authorized persons or internal organizational units that will act upon the complaints and proposals on behalf of state and other public entities.

The right to address public authorities is one of the basic rights of the citizens' in exercising democracy and holding the state and other public entities accountable for their actions. Taking into account the legal and the political environment expressed in the EU treaties and the work of the Committee on Petitions of the European Parliament, we find it odd that the European Commission didn't mention the ill implementation of the Law on Acting Upon Complaints and Proposals in the North Macedonia 2019 Report (2019), as one of the areas that need improvement with regard to the quality of implementation of the existing legislation.

We wouldn't rush recommending that the Parliament of North Macedonia should copy the practice and establish a standing committee similar to the Committee on Petitions of the European Parliament, but nevertheless the Parliament of North Macedonia should at least organize a public hearing scrutinizing the reasons for the inconsistent and incomplete implementation of the Law on Acting Upon Complaints and Proposals.

Our final suggestion is that a working group comprised of representatives from the Ministry of Information Society and Administration, the Office of the Ombudsman, the Administrative Inspectorate, the academia and other interested parties, should gather under the auspices of the Minister of Information Society and Administration and devise a plan with timetable on enactment of the missing regulation and suggesting other necessary steps toward achieving complete and functional implementation of the Law on Acting Upon Complaints and Proposals.

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