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"Информатика и прикладная математика",
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Алматы 2019

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Рассмотрены актуальные вопросы в области математики, информатики и управления: математического моделирования сложных систем и бизнес-процессов, исследования и разработки защищенных и интеллектуальных информационных и телекоммуникационных технологий, математической теории управления, технологий искусственного интеллекта.

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DEVELOPMENT OF INNOVATIVE 3D BUILDING TECHNIQUES IN MOUNTAINOUS REGIONS

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Abstract. The aim of this paper is to develop system which implements GIS and different programming technologies as Backend: Python, Django (python), Django RESTAPI, FronEnd: Angular V6 scripting dialects to assess hazard risk of constructions` damaging as the result of earthquakes, as well as computing the casualties of such catastrophic events. The study comprises of several phases which are the designing of disasters` hazard areas and precise database, the evaluation of building`s hazard and developing of optimal evacuation routes in mountainous regions. The results of the study demonstrated that system is able to assess the hazard even in seismic regions and suggest

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the beneficial ways of building construction techniques. Additionally, project allowed planning constructions of residential buildings in mountainous and bumpy grounds.

Introduction

There are numerous mountainous regions in the world. Especially Central Asian region is full of them. The Tien Shan mountain belt of focal Asia was framed in late Paleozoic time and reactivated in Tertiary time following the crash of India with Eurasia, in excess of 1500 km toward the south. Networks in sloping Central Asia are helpless against quake debacles. The ongoing seismic occasions in Kyrgyzstan, Tajikistan, Afghanistan, and Pakistan have demanded a colossal toll on lives, property, and framework. Helplessness research is basic when catastrophic event related mortality figures since 1600 have arrived at a record-breaking high, with mountain-based populaces in the less created world encountering more noteworthy post-seismic tremor weakness because of the remoteness of settlements, trouble of access for philanthropic guide, and absence of assets for remaking in minimized regions.

Understanding the way that the high structure harm figure because of quake and with the targets to decrease setbacks it is required to have an appraisal strategy that incorporate harms evaluation. The appraisal strategy can be utilized as the base of a spatial choice emotionally supportive network identified with the structure harm peril brought about by tremors for the most part led in the evaluation space of structure harm (Alam et al, 2013; Aghataher, et al, 2008) just as the evaluation on the structure harm risk and the effect on financial misfortune legitimately. (Tang and Zhao, 2012; Motamed et al, 2014; Duzgun et al, 2011; Hashemin and Alesheikh, 2011; Molina et al, 2010; Tang and Wen, 2009; Bo et al, 2009; Rosyidi et al, 2008; Yeh et al, 2006).

The strategy which is utilized for the most part by scientists to evaluate building harms is utilizing GIS though a few specialists are utilizing a coordinated framework, for example, incorporates hazard appraisal apparatuses and SIG (Alam et al, 2013), counterfeit astute and SIG (Tang and Zhao, 2012; Choun and Elnashai, 2010; Tang and Weng, 2009), furthermore Fuzzy-AHP and SIG (Aghataher et al, 2008). The goal of this exploration is to build up a coordinated methodology that executes fluffy kohonen grouping system (FKCN) calculation from the FNN model with GIS to survey the structure harm risk brought about by tremor and to assess the effect on monetary loss of structure harms straightfordly utilizing seismic information and building stock in mountainous regions.

There is an overall propensity in expanded number of very populated locales in previously mentioned defenseless regions in light of overall developing number of individuals, prompting the synchronous development of urbanized and industrialized districts. There is a parallel development process, which, in some cases, leaves holes in institutionalization of structures forms (Manfré, L. A., Hirata. E., 2012). Populace in those regions is exceptionally powerless and security level of seismic areas relies upon the readiness of the neighborhood home office and other partners' capability and speed of activities in such crisis conditions. Inside the last 2,000 years' seismic tremors are viewed as inducers of in excess of 8 million passings around the world. Numerous models show alarming repercussion of life misfortunes because of genuine tremors. In 1556 there have been kicked the bucket in almost 1 million individuals in China, while in 20s of XX century in excess of 100,000 Japanese populace were passed on as a result of this cataclysmic

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event. Therefore, being a reason of essential and optional debacle quakes are one of the main sources of colossal human and monetary misfortunes (Badal, J., Vázquez-Prada, M., 2005). Factors growing defenselessness incorporate unpredictability of urban developments, specific and social interdependencies of foundation structures.

Almost 80% of seismic tremor related human losses are brought about by the breakdown of structures (Coburn and Spence, 2002). It is demoralizing to take note of that enormous divisions of the total populace still abide in ineffectively developed and non-designed habitations which have high vulnerability to separate in the midst of seismic territories. What's more, with growing urbanization half of total populace by and by lives in urban regions (Joined together Countries, 2001), and half of these urban focuses are found in seismic tremor inclined locale (Bilham, 2004). The desperate execution of most structure stocks in the midst of seismic breakdown remains a basic societal concern. Notwithstanding this dismal history and more disheartening future examples, there are no extensive overall structure inventories of adequate quality and degree to enough address and describe future seismic tremor adversities. Such a stock is basic both for tremor hardship balance and for catastrophe response purposes (Manfré, L. A., Hirata. E., 2012).

The underlying hours after a disaster happens are particularly riotous and irksome, yet maybe the chief indispensable for successfully tending to the results of sparing human lives and diminishing damages in private and open properties. In this period, the best possible estimation of the present condition is exceptionally critical. In addition to the misty situation, various particular on-screen characters from assorted fragments (fire detachment, police, paramedics, areas, and so on.) with clashing essentials are incorporated into regulating the condition. Since various of the tasks they must be perform are or possibly unmistakable than their step by step work routines, an incredible cooperation and coordinated effort between various gatherings is of fundamental importance. There is a complex of obstructions should have been taken in thought, for example, absence of powerful correspondence among those segments, the nonappearance of one regular programming and stage to give quick and brief data trade between gatherings, just as inadequate examination and low quality outcomes evaluation with unclear representation, which lead to the challenges taking post-quake wellbeing measures (Scholten, H., Fruijter, S, 2008).

As an answer of these issues, researchers and designers began to utilize current accessible instruments as Geographic Information System (GIS) and Global Navigation Satellite System (GNSS) strategies to make models to anticipate hazard and debacle the board. Be that as it may, there is a need in accessibility of information about topographical, hydrological and climatic states of specific seismic territory to support orchestrating, alleviation and quick response inside the quake (Manfré, L. A., Hirata. E., 2012).

Remote-detecting procedures and GIS and GNSS gadgets are routinely used in applications for fiasco control in pre-and post-calamity conditions. Pre-catastrophe applications are connected with control and availability activities. Balance suggests practices that abatement the lack of protection of social requests to the effects of a calamity, though preparation implies practices that urge making arrangements for responding to a quake when it occurs (Mansourian, A.; Rajabifard, A, 2005). Post-debacle applications are connected with response and recovery activities. Response is identified with the speedy and momentary effects of a seismic tremor, while recovery insinuates practices that restore

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networks to pre-catastrophe conditions. There have been completed a few activities to make a 2D prescient model, yet contemporary mechanical advances offer a chance to make a forward advance to fabricate a 3 dimensional prescient model using distinctive accessible aviation information. 3 dimensional maps include the data about primary attributes of scenes and topographic articles, for example, streets, developments and so on; the essential depiction of the maps' condition shown by uncommon images, hues and just as sign of trees and different plants; and extra data containing the subjective and quantitative portrayal of delineated items (Bandrova, T., Zlatanova, S, 2012).

In 2013 looks into focused on the appraisal on just structure harms brought about by tremors and a spatial choice emotionally supportive network (SDSS) in two distinct urban areas which is Kelowna, Canada and Teheran in Iran, utilizing seismic information and building stock that is composed by joining the databases that has been checked with the aftereffect of documented overview. The two scientists utilized GIS as the principle device to break down where each is consolidates utilizing various strategies, which is Risk Assessment Integration instruments (RADIUS) and GIS apparatuses is helpful in the exceptional investigation process as the base in a successful choice help and recognizing hazard region (Aghataher et al, 2008 and Alam et al,).

Artificial intelligence (AI) as independent just as incorporated with GIS is utilized by Tang and Wen, 2009; Choun and Elnashai, 2010 and Tang and A.P Zhao, 2012 to evaluate building harms and furthermore ascertain the impact on financial misfortune because of structure harms brought about by tremor legitimately. Tang and A.P Zhao, 2012 utilized that technique to build up a choice emotionally supportive network explicitly to alleviate the danger of calamity brought about by quakes. Rather than the other two scientists, Choun and Elnashai, 2010 simply utilized AI in explicit the reproduction of Montecarlo way to deal with build up an estimation strategy to address the issue of the vulnerability estimations of the engendering by changing the quantile math technique to limit calculation process. The most recent rendition of the open source programming SELENA (v4.1) which is to figure the hazard brought about by seismic tremor is created by Molina et al, 2010. The examination is utilizing deterministic and probabilistic model utilizing close continuous information and received the rationale tree calculation method. The system created is independent terms of examining particularly for the count of certain structure typology harm level and incorporates the estimation of financial misfortune brought about by seismic tremor just as the quantity of losses.

To fabricate a quake's prescient model in our investigation we picked specific district of Almaty city, which situated at the foundation of Zaileeskii Alatay which is a piece of the northern Tien-Shan mountains and viewed as one of the biggest seismically dynamic zones (Campbell, G. E., Walker, R. T, 2015).

We estimate that improvement of 3D prescient system will add to better development arranging and if there should be an occurrence of event of seismic tremor will add to execution of quick crisis exercises. In this manner, the point of the examination is improvement of 3 dimensional frameworks for structure development dependent on accessible aviation data and information of specialized visas of neighborhood developments.

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Methodology

This exploration is utilizing two sorts of information which is the information to create seismic tremor peril zone that is made out of the pinnacle ground quickening (PGA) information, lithology, and topographic zone and the structure stock information in Almaty, Kazakhstan. The examination strategy contains four stages which is the advancement of structure harm risk zone, the improvement of structure stock, evaluation of structure harm peril and the appraisal of the effect on financial misfortune brought about by structure harms. The structure information comprises of 37,203 structure unitsin the type of polygon and the shapefile (shp) design with the quality information that comprises of highlight ID, shape, include code, object name, and the territory of structure singular unit. The database is created utilizing social database in a GIS work area. In our examination we built up a prescient 3D model for tremor results using the information from aviation maps as google maps, yandex maps, google earth and online maps, just as information about principle attributes of nearby structures utilizing specialized travel papers of those developments. Primary forecast result is the likelihood of annihilation of fundamental and neighboring structures relying upon the scene qualities and extent of quakes. Programming the 3 dimensional web application was directed by utilizing Backend: Python, Django (python), Django RESTAPI, FronEnd: Angular V6 scripting dialects. As study model we utilized the seismically dynamic locale of Almaty city, which situated at the base of Zaileeskii Alatay Mountains. Utilizing these projects containing Python have various focal points considering high wide expansion of libraries for spatial and transient demonstrating, exact perception and lasting propelled accessibility to include changes of condition, just as free authorizing access (Bandrova, T., Zlatanova, S., 2012).
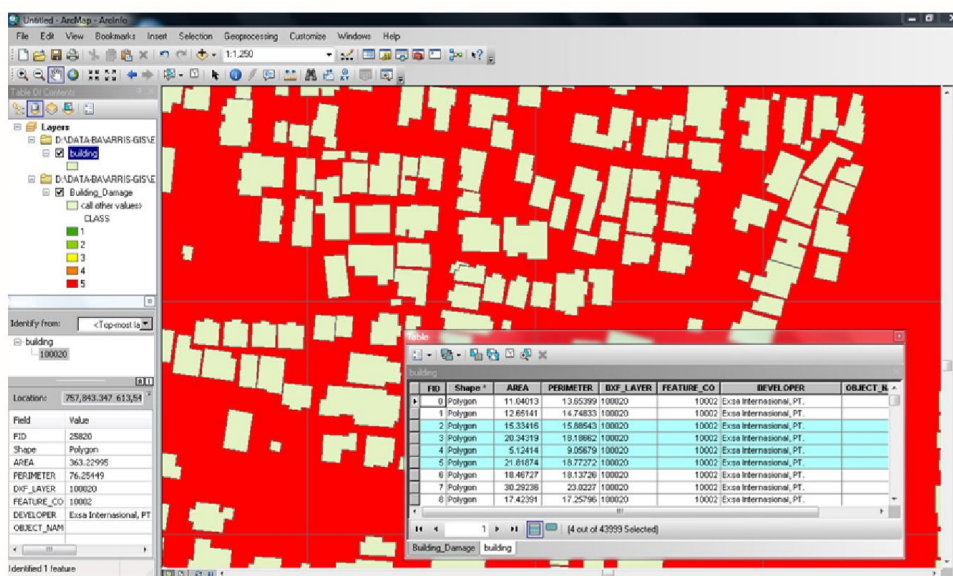
Results

Figure 1. Web App for apparatus to foresee and evaluate the dangers and misfortunes of various power quakes on Richter scale

The virtual 3D web application is exceptionally helpful apparatus to foresee and evaluate the dangers and misfortunes of various power quakes on Richter scale. The application involves the particular scene information by advanced pictures and succinct perception. The following are outlined fundamental pieces of the made demonstrating.

Discussion

Advancement of 3D foreseeing model for quake results is viewed as more mind boggling than a customary model structure forms and require intensive information the executives, on account of need in linkage between existing enormous information and programming components (Campbell, G. E., Walker, R., 2015). All things considered, in the closest future 3D application will be in the essential significance in numerous spots of the world if there should arise an occurrence of tremor breakdown, which will obtain exact perception of any potential outcomes of quakes and will offer responses to the inquiries of the catastrophe greatness, area of primary crisis streets and passages, the vital number of various kinds of crisis staff and the most defenseless regions of the neighborhood scenes, comprising of modern land, topographical and geomorphologic information (Karssenberg, D., de Jong, K., 2007).

History of seismic tremors and different kinds of various risky fiascos demonstrated that spatial prescient advancements are valuable in checking, control and investigation of data in dire basic leadership forms. Creators of one specific examination in Turkey effectively utilized it to screen volcanic action (Voinov, A. and Cerco, C., 2010). Another comparative device was actualized in Taiwan and Japan to foresee the avalanches developments after seismic breakdown. These are genuine instances of execution of aviation information in basic leadership forms in profoundly helpless regions to give debacle the board exercises (Jaiswal, K., and Wald, D. J. 2008).

Subsequently Python scripting language was considered as perfect device to 3D avalanches qualities and displaying impacts of earthquakes.GIS libraries were appropriate to move geospatial data to Python scripting language and make prescient model (Hastaoglu, K. O., and Sanli, D. U., 2011) As generally realized natural prescient instruments exist, the greater part of them don't confront all necessities to get full picture of occasion: programming dialects, for example, MATLAB don't give transient demonstrating, while Geographical Information Systems make just two-dimensional representation. The few different reasons of utilizing this product incorporates the efficient arrangement of information trade, brief time of information digestion and ideal representation of nearby developments, just as plants' reality (Giardino, M., Perotti, L., 2012). Also, result of the coding information is clear and justifiable for expert of different spaces, which make it simple to examine the prescient information between them. Be that as it may, there are a few impediments such need in institutionalized 3 measurement's universal necessities and guidelines for making models of tremor breakdown practically identical with other seismic areas of the world to expound worldwide institutionalizations in 3D mapping (Argent, R. M., Voinov, A., 2016).
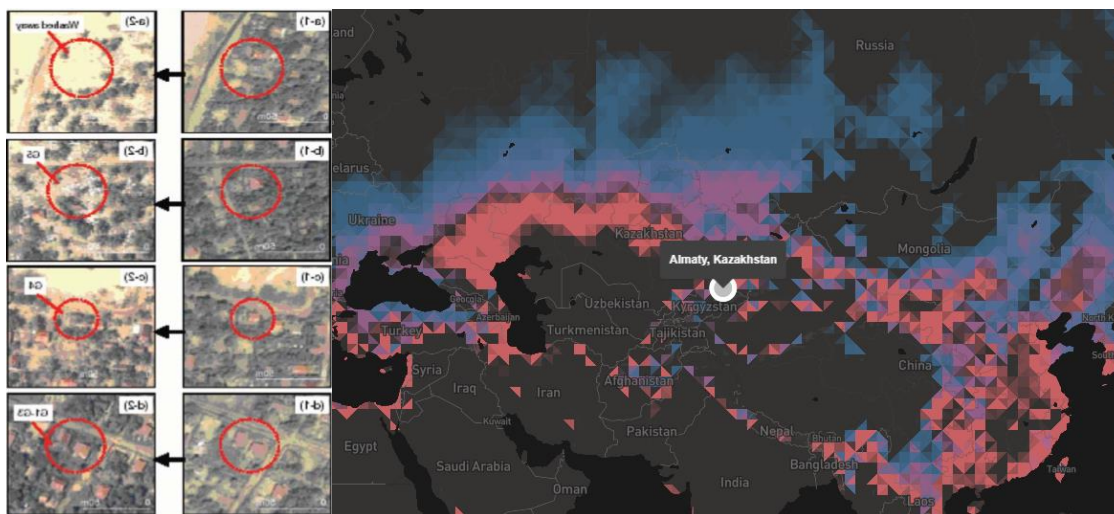
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Figure 2. Evaluation of building damage (washed away a-2, totally collapsed b-2, partial collapsed c-2, slightly damaged d-2) after various power quakes

The executives of when calamity exercises might be improved even provincial regions where the hazard appraisal advancements are need to create reasonable crisis measures. This aviation information will be promptly moved to the framework and improve the adequacy of intercooperation of principle gatherings of crisis exercises (Jolma, An., Ames, D. P, 2008).

To finish up, advancement of prescient 3D model for anticipating the impact of tremors utilizing accessible aviation information is basic in larger part of seismic locales to avoid human and financial misfortunes by improving readiness and better structures arranging exercises.

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