Universidad Continental

FACULTAD DE INGENIERÍA

Escuela Académico Profesional de Ingeniería Civil

Tesis

Design of an automatic landslide and earthquake warning system in rural areas of Peru

Diego Ricardo Cajachagua Guerreros
Shirley Gabriela Cárdenas Quispe
Paul Cristian Guerreros Abregú
Mohamed Mehdi Hadi Mohamed
Sario Angel Chamorro Quijano

Para optar el Título Profesional de
Ingeniero Civil

Huancayo, 2022

PUBLICACIÓN - GUERREROS - CAJACHAGUA - CARDENAS

INFORME DE ORIGINALIDAD

26%	19%	23%	6%
INDICE DE SIMILITUD	FUENTES DE INTERNET	PUBLICACIONES	TRABAJOS DEL ESTUDIANTE

FUENTES PRIMARIAS

1	Sario Angel Chamorro Quijano, Jean Pierre Arce Misajel, Dominick Marco Cruz Esteban, Roberto Belarmino Quispe Cabana et al. "Design of an Automatic System of an Accelerated Biogas Biodigester for Rural Areas in Peru", 2021 IEEE 7th International Conference on Control Science and Systems Engineering (ICCSSE), 2021 Publicación	2%
2	hdl.handle.net Fuente de Internet	2%
3	David Steven Cuicapuza Curipaco, Pedro Luis Godoy Jerónimo, Angel Tacas Diaz, Giovene Perez Campomanes et al. "Coupling of an Automatic Landslide Warning System for Retaining Walls for Road Infrastructure Protection", 2023 9th International Conference on Mechatronics and Robotics Engineering (ICMRE), 2023 Publicación	2%

4	Joseph Junior Rojas Vila, Sandra Fiorella Dionisio Llactahuaman, Roberto Belarmino Quispe Cabana, Mohamed Mehdi Hadi Mohamed et al. "Design of a Thermal Control System for Stables in Rural Areas of Peru", 2022 4th International Conference on Power and Energy Technology (ICPET), 2022 Publicación	2%
5	journal.ump.edu.my Fuente de Internet	1%
6	www.researchgate.net Fuente de Internet	1%
7	www.hindawi.com Fuente de Internet	1%
8	Submitted to University of Witwatersrand Trabajo del estudiante	1%
9	www.isical.ac.in Fuente de Internet	1%
10	Irfiani Triastari, Siti Irene Astuti Dwiningrum, Sovia Husni Rahmia. "Developing Disaster Mitigation Education with Local Wisdom: Exemplified in Indonesia Schools", IOP Conference Series: Earth and Environmental Science, 2021 Publicación	1%
11	revistas.ufpr.br	

	Fuente de Internet	1 %
12	Submitted to University of Sheffield Trabajo del estudiante	1 %
13	Chen Huang, Carmine Galasso. "A comparison of NGA-West2 ground-motion models to recent Chinese data", Soil Dynamics and Earthquake Engineering, 2019 Publicación	1 %
14	"Impact of Engineered Nanomaterials in Genomics and Epigenomics", Wiley, 2023 Publicación	1 %
15	Submitted to Birkbeck College Trabajo del estudiante	1 %
16	Ding-Zhi Hu, Kai Wen, Li-Han Chen, Cong Yu. "Perceptual learning evidence for supramodal representation of stimulus orientation at a conceptual level", Vision Research, 2021 Publicación	1 %
17	Submitted to Universidad San Ignacio de Loyola Trabajo del estudiante	1 %
18	f1000research.com Fuente de Internet	1 %
19	Edidas Edidas, Rusnardi Rahmat Putra. "Designing and building earthquake warning	<1 %

system with Arduino and web-based SES60 SLP sensor", Bulletin of Electrical Engineering and Informatics, 2022
Publicación

20	depositonce.tu-berlin.de Fuente de Internet	<1 %
21	Xiao Gao, Tao Chen, Ruiqing Niu, Antonio J Plaza. "Recognition and Mapping of Landslide Using a Fully Convolutional DenseNet and Influencing Factors", IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2021 Publicación	<1 %
22	ieeexplore.ieee.org Fuente de Internet	<1 %
23	docplayer.net Fuente de Internet	<1 %
24	Tefera Atlabachew, Jermen Mamo. "Microbiological Quality of Meat and Swabs from Contact Surface in Butcher Shops in Debre Berhan, Ethiopia", Journal of Food Quality, 2021 Publicación	<1 %
25	Yehor Malets. "Object approach to the organic molecule representation", American Chemical Society (ACS), 2022 Publicación	<1 %

26	idg.chph.ras.ru Fuente de Internet	<1 %
27	link.springer.com Fuente de Internet	<1 %
28	Kate M. Thomas, William A. de Glanville, Gary C. Barker, Jackie Benschop et al. "Prevalence of Campylobacter and Salmonella in African food animals and meat: A systematic review and meta-analysis", International Journal of Food Microbiology, 2020 Publicación	<1 %
29	Shubing Ouyang, Jiahui Xu, Weitao Chen, Yusen Dong, Xianju Li, Jun Li. "A Fine-Grained Genetic Landform Classification Network Based on Multimodal Feature-Extraction and Regional Geological Context", IEEE Transactions on Geoscience and Remote Sensing, 2022 Publicación	<1 %
30	insightsociety.org Fuente de Internet	<1 %
31	ivy.fm Fuente de Internet	<1 %
32	sirgas.ipgh.org Fuente de Internet	<1 %

33	Yang Lu, Feng Xiong, Huiqun Yan, Qi Ge. "Dimensional analysis of dynamic interaction between adjacent SDOF buildings to forward directivity and fling step pulses", Soil Dynamics and Earthquake Engineering, 2021 Publicación	<1 %

Excluir citas	Apagado	Excluir coincidencias	Apagado
Excluir bibliografía	Apagado		

PUBLICACIÓN - GUERREROS - CAJACHAGUA - CARDENAS

INFORME DE GRADEMARK

NOTA FINAL

/0

COMENTARIOS GENERALES

Instructor

PÁGINA 1

PÁGINA 2

PÁGINA 3

PÁGINA 4

PÁGINA 5

Design of an Automatic Landslide and Earthquake Warning System in Rural Areas of Peru

Diego Ricardo Cajachagua Guerreros
Department of Civil Engineering
Universidad Continental
Huancayo, Perú
74686647@continental.edu.pe

Shirley Gabriela Cardenas Quispe
Department of Civil Engineering
Universidad Continental
Huancayo, Perú
73074114@continental.edu.pe

Paul Cristian Guerreros Abregu
Department of Civil Engineering
Universidad Continental
Huancayo, Perú
45136828@continental.edu.pe

Mohamed Mehdi Hadi Mohamed
Department of Civil Engineering
Universidad Peruana Los Andes
Huancayo, Perú
d.mhadi@upla.edu.pe

Sario Angel Chamorro Quijano
Department of Mechatronic Engineering
Universidad Continental
Huancayo, Perú
72721011@continental.edu.pe

***Abstract*—** This research presents the automatic design of a warning system for the prevention of landslides and earthquakes with mechatronic systems with IOT communication to speed up the evacuation process. The development of the project shows that the application of force sensors, optical sensors and the type of communication are feasible in each process since it is divided into 3 levels where the values of both teachers are contrasted to issue an alert. The alert emission stage comprises 2 processes, first when the collapse signal is detected and verified by both sensors, it will be communicated from the installed part and the nearby community by IOT communication, it will be powered by solar panel and/or batteries and second when there is seismic movement, the bases will detect these signals and emit another type of noise for the evacuation. Being Peru a highly seismic country with many rural areas with steep slopes, every second counts in these natural events.

The design of the proposed system will help prevent the events that occur in case of landslides and earthquakes; which are material damage and loss of life, with the type of power it will remain active during the day and the friendly design will facilitate its understanding.

***Keywords*—** Actuators, automation, slopes, mechatronic systems, prevention.

I. Introduction

Globally, the increase of seismic movements has been increasing due to causes such as geological faults, bringing damage to structures, loss of lives due to the movement that causes the collapse of buildings and the desperation of people to evacuate, putting their own lives at risk [1] [2]. Landslides can cause economic losses and casualties especially in mountainous regions, to mitigate landslides there are different ways to do this such as doing risk management, soil studies, soil type; after executing this solution such as planting vegetation, placing retaining walls or the use of technology as proposed in this research [3]. In a review on the existing types of landslides and/or the most concurrent are rotational, translational, lateral, rock flows and avalanches, this can occur by a rupture on the surface or the initiation of a fault [4].

Currently, the method used for prevention is deterrence with coercive measures, technical codes and land use planning [5]. To avoid the hazard, the total elimination of landslides, the modification of the level of the project or the subgrade of a road and the use of bridges viaducts over movements [6], For control, the use of berms, ditches, retaining structures and protective covers are mostly used on roads [7] and as a method of stabilization, slope shaping, surface dressing can be done by sealing surface cracks or vegetative cover, surface and groundwater control, the use of retaining structures and soil improvement through electro-osmosis, injections or the use of chemicals and magnification [8][9].

During the last years, countries such as Mexico, United States, Peru, Chile, Ecuador and China have increased their seismic activity among the differences from one country to another that influence the degree of damage after this event are social responsibility, culture and the use of technology, in the countries of America and the Caribbean there is a deficient action of prevention and post seismic event [10] [11].

In Peru, according to the national census conducted by the National Institute of Statistics and Informatics (INEI) revealed that the population in rural areas amounts to 6 million 70 thousand inhabitants representing approximately 21% [12], according to the Ministry of Agriculture and Irrigation presents the Diagnosis of the Livestock Plan 2017- 2021 where it mentions that the main activity of the Peruvian territory in relation to rural areas is livestock farming representing 87% in these areas [13]. According to the UNESCO report on rurality and remoteness in Peru, in rural areas there is monetary poverty affecting 44.4% of the rural population and extreme monetary poverty affects 12.8%. On the other hand, basic services such as electricity almost 81.4% of rural homes lack this service and the policies of resource allocation to these areas is not sufficient to meet basic needs [14].

Peru is a highly seismic country and earthquakes are very common, according to the Geological Society of Peru (SGP), which mentions that the main problem is the disorderly growth of cities on high-risk soils (slopes, ravines, mountains in rural areas) and the construction of houses that cannot withstand the high levels of ground shaking. [15].

II. Materials and Methods

The proposed system has 3 stages for the prevention of landslides and telluric movements in rural areas. In the first stage, there is the activation of the lower sensors, in this stage the force sensors and infrared sensors are used, the sensors verify the continuity of landslides, notifying the community through an IOT communication.