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Mapping and Measuring the Microrelief of Slope Deformations Using Modern Contactless Technologies and Practical Application in Territorial Planning

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Slope deformations are risks limiting economic land use potential. A national database system keeps records of slope disturbances and deformations, however, it is important to update the information mainly from the point of view of practical territorial planning, especially in the high-risk areas presented in the study. The paper explains the possibilities of applying modern methods of mapping the microrelief of slope deformations of a lower extent (up to several hundreds of m2) and using not very well known contactless technologies, which could be applied in practice due to their low-cost and low-time consuming nature. In order to create a digital model of the microrelief used to carry out the measurements we applied the method of terrestrial photogrammetry, terrestrial scanning using Lenovo Phab 2Pro. It is the first device available for users that uses the Google Tango technology. So far there have been only prototypes of devices available for the developers only. The Tango technology consists of 3 partial technologies – “depth perception” (measuring the distance to objects, nowadays it uses mainly infrared radiation), “motion tracking” (tracking the position and motion of the device using embedded sensors) and “area learning” (simply learning the area, where the device looks for same objects within already existing 3D models and real space). Even though the technology utilisation is nowadays presented mainly in the field of augmented reality and navigation in the interior, there are already some applications for collecting the point clouds in real time, which can be used in a wide spectrum of applications in exterior, which was also applied in our research. Data acquired this way can be processed in readily available software products, what enabled a high degree of automation also in our case. After comparing with the reference point field that was measured using GNSS and electronic tachymeter, we reached accuracy of point position determination from a digital microrelief model from terrestrial photogrammetry of mxy = 1.2 cm and at height of mv = 1.5 cm. The accuracy of models acquired using the Lenovo Pab 2Pro (scanning) is being evaluated. The created digital models of microrelief were compared with each other (photogrammetry, scanning), as well as with the reference measurement using the geodetic (tachymetric) measurement. The advantage of the presented economically available terrestrial data collection is the possibility of its utilisation under the stand canopy, which is very often difficult, sometimes even impossible, when using aerial data collection. Moreover, it is not possible to achieve the required density of points per m2 if the financial costs are to be bearable; therefore digital models created this way are not as accurate and detailed as the models created by the terrestrial data collection used in this research. The exact measurement procedures can be applied also in greater time span (creation of time series), what enables the researchers to monitor the changes in microrelief that can identify the imminent danger of sudden or large slope deformation, as was published in previous studies.