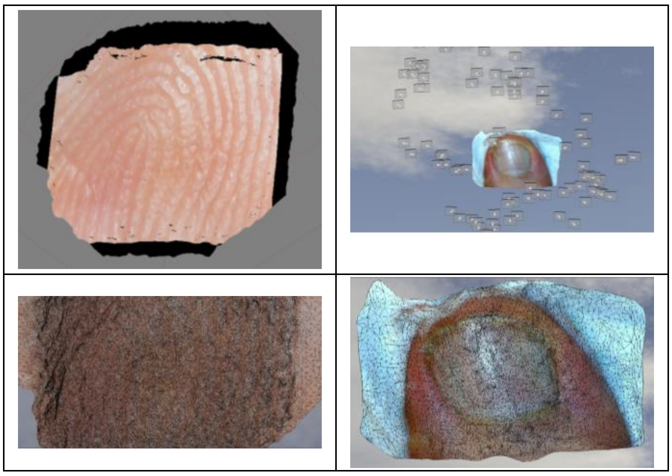
a b

Figure 5. Sample microscopic images obtained for modeling. a) Fingerprint. b) Toenail surface



a b

Figure 6. Textured three-dimensional models generated from the objects under investigation. a) Fingerprint. b) Toenail surface

As observed in the results of the performed modeling, an appropriate density of points with respect to the environment dimensions has been generated along with plenty of details. Extraction of textured three-dimensional models with these details from small-scale objects constitutes one of the unique capabilities of photogrammetry-based methods. Two types of microscopes with different camera resolutions and different magnitudes have been used in this project. The Medic microscope has a more convex lens than the Coolingtech microscope. Therefore, focal length difference is higher in the central parts and around in the Medic images than in the Coolingtech images. Despite their low resolution, the Coolingtech microscope images have greater magnitudes, and generate more resonant images. Based on the measurements made with the help of the microscope micrometer calibration ruler, the details on the environment have been modelled with an average precision of about 0.1 millimetres. The results demonstrate that hand microscopes equipped with inexpensive digital cameras can be used extensively for different applications of modeling small-scale objects.

3. CONCLUSIONS

The capability of handy microscopes equipped with online imaging using videogrammetry method to produce three-dimensional modeling of small-scale objects was implemented and evaluated in this paper. Use of video images eliminated the problem of lack of a single focus in all the environment components in microscopic images to a large extent. Furthermore, image shakes and hazes were observed less frequently in obtained video images than in photography. Use of handy microscopes makes it possible to obtain convergent images at different angles with respect to the environment. It is also possible to use self-calibration method for estimation of the interior orientation parameters to obtain high precisions. To sum up, this technology can be used for modeling and specifying the coordinates of minute object details with a precision of about 0.1 millimetres.

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