# Elasizer - A Low Cost 3D Space Measuring Elastic Tape for Everyone

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## Abstract

The proposed solution is based on image recognition technology and geometry. The body 3D parameters may be extracted from 2D images.

To extract space body parameters, it is enough to put on a thin, highly stretchable elastic cover, on which, the surface is marked by non-stretchable geometrical objects to capture the image of the body. The size of each geometrical object and its position on the cover are known, which lets the computer system estimate the distance between the objects and build a virtual manikin of the body. The geometrical objects play two roles - as size etalons and markers. The combination of the single markers allows creation of a unique constellation of the markers, which transform the surface into a map or barcode, adding the ability to recognize the certain surface and body parts faster. Because of the markers, we are given the opportunity to use the technology in capturing body motion.

**Key words:** Elasizer, marker, elastic cover, measuring tape, 3D from 2D images, low cost, measurements for free, image recognition technology, body scanning, barcode , biomechanical recording

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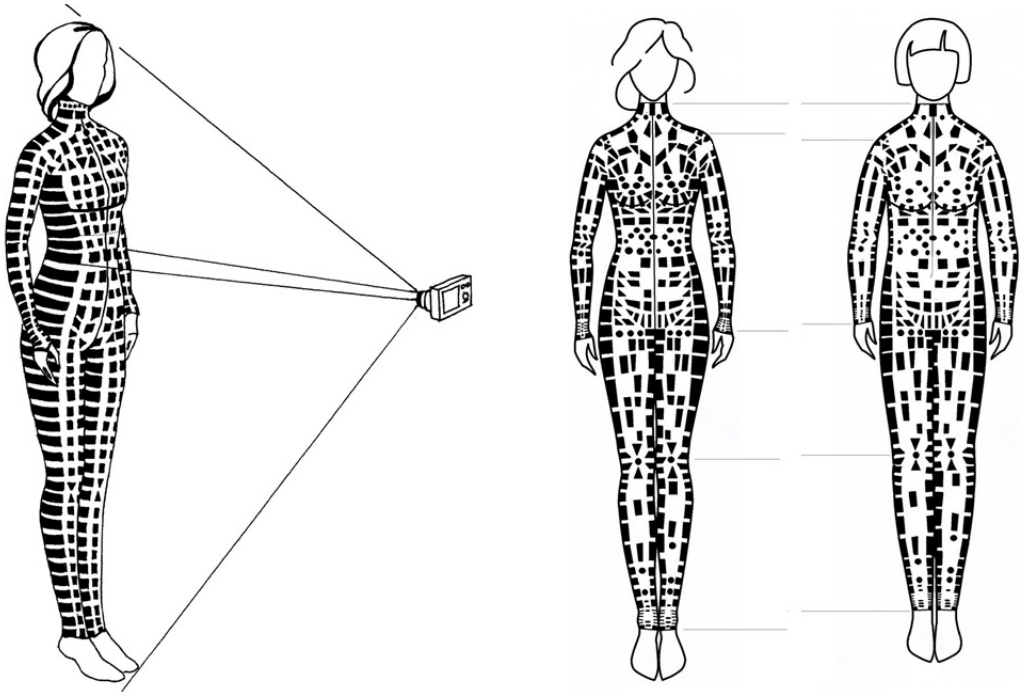
There is a conflict between the cost of the high precision body scanning systems and fashion demand for a mass market. The mass demand for buying clothes online is to have the ability to get body measurements for free. In this conflict, one should find a compromise, where cost plays the most decisive role. The precision in this case comes second after cost. In the process of buying clothes online, a few millimeters lost from chest circumference is negligible compared to the posture and proportions of the body. The proposed scanning system extracts 3D data from 2D images and provides the measurements with acceptable precision for free.

To extract space body parameters, it is enough to put on a thin, highly stretchable elastic cover, on which, the surface is marked by non-stretchable geometrical objects. The size of each geometrical object and its position on the cover are known, which lets the computer system estimate the distance between the objects and build a virtual manikin of the body from 2D images. The geometrical objects play two roles - as size etalons and markers. The combination of the single markers allows the creation of a unique constellation of the markers, which transforms the surface into a map or barcode, adding the ability to recognize the certain surface and body parts faster. The space analyzing computers algorithm, uses a prior knowledge of the elastic cover's structure, to build a 3D surface of the object. Using prior knowledge of geometrical markers, the system may estimate body structure with a single camera image without a depth sensor. The precision of estimation increases by adding synchronized cameras. Also with synchronized cameras, the complete surface-based, motion capture recognition system can be created.

An elastic base of the equipment allows unification of the range of size types and reduces the need for too many covers. This in turn, has a positive effect on cost as well. The calculation of the quantity of the size types and following practical experiments with physical 'try on', show that it is enough to have a quantity of 22 standard size types to cover the body types of men, women and children. It is quite a short range and the right size type is easy to determine using a morphological approach. The range of size types can be decreased when the elastic ability of the cover increasing. In the experiment, fabric made from Nylon and Spandex 80/20 respectively and a weight of 100g/pm, with a width of 59" was used. The percentage of the square of the patterns covered by markers was 25% of their surface. The smallest size of a single marker was 10mm in diameter. In this case, elasticity of the marked fabric was 50% plus, in a stable condition. This parameter allows us to use one size type of the equipment with a significant range of users without radically different types of body sizes.

* http://www.elasizer.com/



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When one size type fits different sized bodies, it presses the body parts differently and it should used as an opportunity to estimate the inner feelings of the user. This is, of course, if he or she would like to comment on those feelings. The real power of the tension created on individual bodies, makes it possible to calculate, even in particular parts of the body, discomfort. This relies on the user giving inner physical feedback. This way, we have more customized information about the customer and his or her fit preferences.

The elasticity of the cover decreases as the size and quantity of the markers grows and vice versa. It is important to find the right balance between the precision of estimation and the marker parameters. There should be limits where more markers decrease elasticity, and fewer markers, in smaller sizes cause unacceptably poor precision due, in particular, to the resolution of the camera. In addition, it is clear that the higher the resolution of a camera - the higher the precision of the estimation.

Nowadays, the HD resolution of web cameras exists in the majority of devices such as PCs, tablets and smart phones and the future of web cams resolution is promising, but at the moment the system has to use today's resolution. The Sony Play Station Eye 3, for example, has 640 x 480 pxs resolution and its new generation 1280 x 800 pxs and it is the most common resolution that should accept as given.

In this case, the Elasizer solution may be a compromise between the low precision morphological approach and the expensive, high tech solutions that are unacceptable to mass market demand.

The big difference in cost plays the most decisive role in the system moving into the home. Moving into the home will give the customer the freedom from offline shopping and standard sizes. It should also give new opportunities for online interaction, which is impossible to do, without the physical interaction of a cap or a belt. For example, to adjust a belt into a comfortable position on pants isn't the same as a set waist position on a manikin, or trying on headwear. In most cases it is followed by pressing down hair or positioning and repositioning it on the head. These actions, the customer can only feel physically and a scanning system should give him or her, the opportunity to do so. In this case, Elasizer as a wearable device has the unique opportunity for the skin of the body to sense these particular things.

The market requires a free service for buyers and it is that, that makes Elasizer very attractive, as the retailer or the manufacturer would pay all service costs.

In fact, morphology based approaches are all cost free for the customer and it will be the same with Elasizer. However, what is the real physical cost of the Elasizer measuring cover? The lowest cost for measuring a cap producing over 100 items is $0.30 and for overall starts from $7.00. The cost decreases significantly when the number of items is mass produced. Then costs can be dropped in $ 0.15 and $4.50 respectively for a cap and an overall if those numbers exceed hundreds of thousands of items in production.

This price is quite affordable for every seller and manufacturer. Moreover, a physical object, i.e. the elastic cover mailed to a customer, that a customer can touch and use for a long time, is a direct and constant link between a brand and its customer.

In conclusion, with respect to other scanning solutions, Elasizer has powerful advantages. These are - low cost, portability, simplicity, a long operating lifetime, the design and the ability to use on the move. It saves power of intellectual system resources when recognizing non-accidental markers in non-accidental situations, as in the case, for example, with infra-red solutions. It is the direct link between a retailer and his customers when the customer dislikes to pay for special devices. It is the way to create a personal 3D manikin of the body, customize and ensure purchases of garments with a previous ‘try on’.

Also the system can be used as biomechanical recording and analyzing motion capturing system, which allows the capture of surface movements, save marker placing time and significantly decreases the cost of motion capturing equipment. This lets the motion capturing system become affordable and to use it in medicine, sport, entertainment and other spheres.