

3D Foot Scanning System INFOOT - Automated Anatomical Landmark Detection and Labeling

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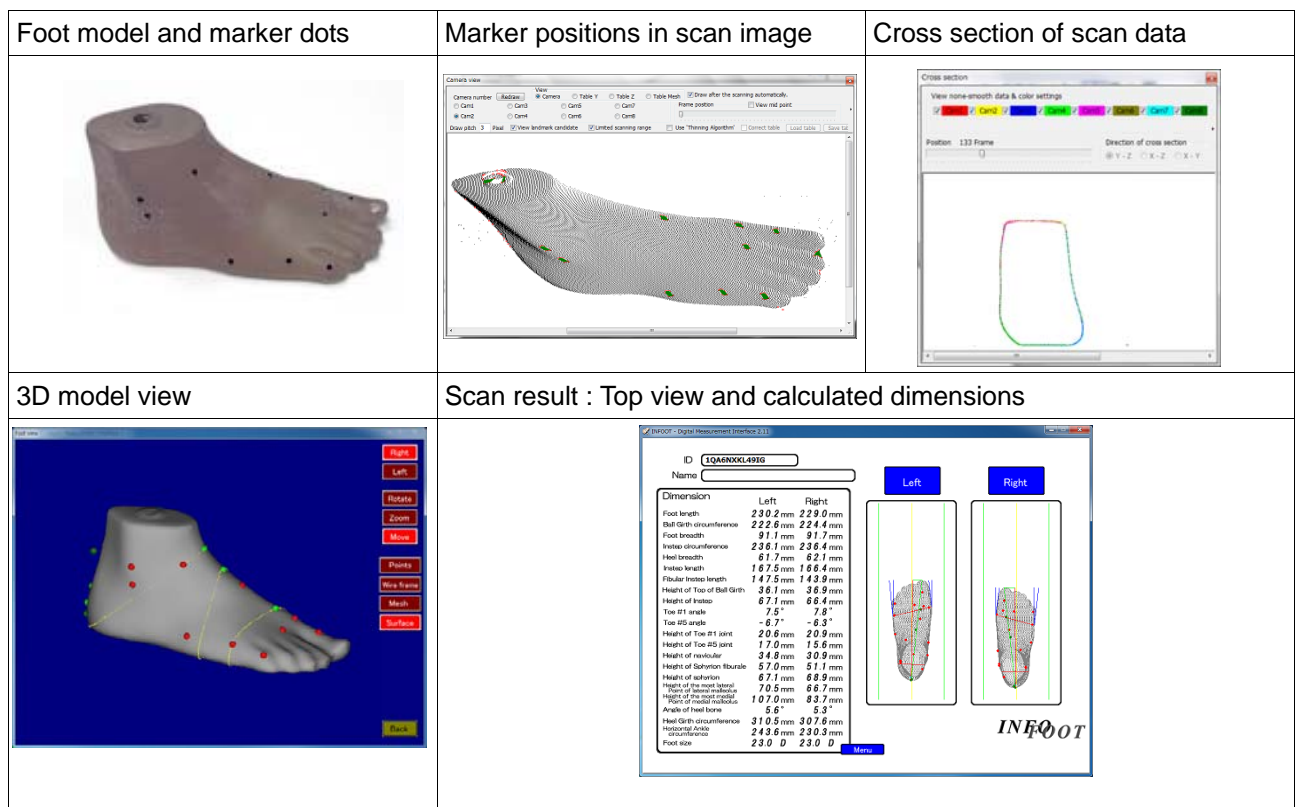
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Introduction

INFOOT was developed out of a collaboration between I-Ware Laboratory Co.,Ltd (hereafter IWL) and Digital Human Research Center(hereafter DHRC). INFOOT is a 3D foot scanning system which obtains 3 dimensional foot shape data and landmark positions to calculate foot dimensions automatically. INFOOT has been used for research purposes and, more recently, used for shoe selection and customized shoe manufacturing.

Scanning method

INFOOT is an optical laser scanning system which consists of 4 laser projectors and 8 CCD cameras which capture a projected line on the foot surface. The system provides 0.5/1.0 mm scan pitch and 30 mm/sec scan speed. It can detect 5 mm diameter marker dots placed on landmarks, obtain their 3D coordinate and label their anatomical names based on a probabilistic database. These processes can all be achieved and completed during the scanning process (Fig. 1).



Axes, Scan area of INFOOT

	Axis	Scan area
X	Foot length direction	400 mm
Y	Foot width direction	200 mm
Z	Height direction	150 mm

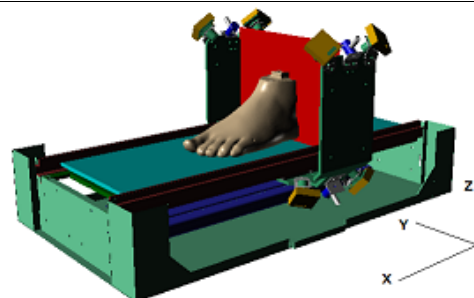


Fig. 1. Marker dots, scanning volume, and measured results by an INFOOT system.

Definition of measurement

Foot measurements are defined by M. Kouchi and M. Mochimaru according to the definitions by Martin and Knussmann [1], as well as demands from the shoe industry, orthopedists and biomechanists as shown in Fig. 2 below.

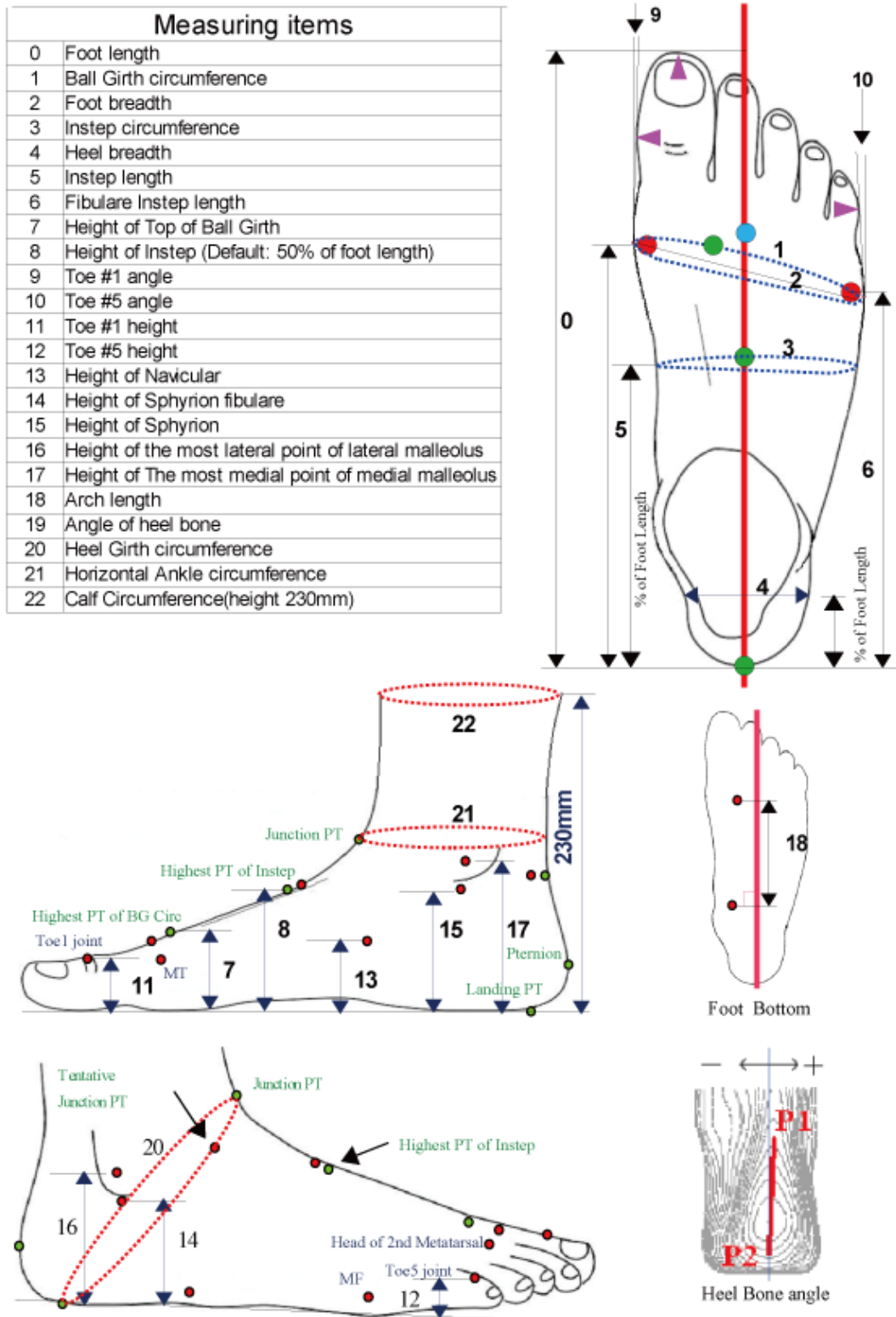


Fig. 2. Foot dimensions obtained by an INFOOT system

Applications

Foot data scanned by INFOOT is used for analysis/evaluation of an individual foot, morphological and dimensional foot statistics, shoe design, shoe selection and shoe and insole customization for local shop/clinical use, as well as via networks as follows:

Purpose	User/Supplier	Application
Foot evaluation	Shoe maker	Dimension-based foot evaluation
Foot analysis	DHRC , IWL	Di+: 3D foot modeling and average
Foot reforming	IWL	Foot Reformer of scanned foot data
Shoe design	Shoe design software suppliers	Shoe last design
Shoe selection	Shoe maker	Shoe size selection from scan result
Shoe customization	Shoe maker , Orthopedist	Custom shoe design
Insole modeling	IWL, Insole design software	Insole modeler from scanned foot data
Insole customization	Shoe maker , Orthopedist	Custom insole design

References

1. Martin, R. and R. Knussmann (1988) Anthropologie, Band I. Gustav Fischer, Stuttgart