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**FRUIT VOLUME ESTIMATION BY DIGITAL
IMAGE PROCESSING**

A PROJECT REPORT PRESENTED

BY

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to the Board of Study in Statistics and Computer Science of the

POSTGRADUATE INSTITUTE OF SCIENCE

in partial fulfillment of the requirements

for the award of the degree of

MASTER OF SCIENCE IN COMPUTER SCIENCE

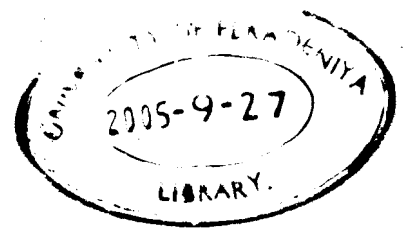
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UNIVERSITY OF PERADENIYA

SRI LANKA

2004

580467



Abstract

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This dissertation presents development and implementation of a digital image processing system to estimate the volume of odd shaped objects. The possibility of using three longitudinal digital profile images of fruits or any food item of irregular shape to estimate the volumes of these items was examined. An algorithm, which graphically derives cross-sections from three images of a fruit, calculates its area in terms of number of pixels as part of the volume estimation and outputs the results, was developed. Deriving cross-sections has two steps. As a first step, a polygonal cross-section was formed by joining six vertices of three diameters of the images in three picture boxes. As the final step in deriving cross-sections, the polygonal cross-section was turned into something, which reflects the shape of an actual cross section with some pixels added to the edges through a process described as "compensation". In the latter part of the project, data sets of actual fruit volumes and digital images of the fruits, captured from a digital camera were obtained. Shape features were extracted from the digital profile images using various digital image processing techniques that involve geometrical methods and other mathematical calculations. Methods adopted are discussed in detail with diagrams.

The final algorithm was capable of estimating the volume of an irregular shape with satisfactory accuracy. A method of incorporating actual dimensions in place of pixel counts was also developed. Some sample tests were carried out first with objects of known volume such as cylinders and spheres and then with objects of unknown volume. The results were tabulated. Future directions have been presented with in mind the hardware, which supports them and which might change in favor of this fruit volume system.

These findings can result in future developments of digital image processing systems for volume estimation of odd shaped objects. As part of it, hardware can be set up such that three cameras can be placed to capture images of a conveyer system of fruits or odd shaped food items in such a way that these cameras or any modern devices of that nature lie with an angle of 120° apart. Furthermore, three images are sent from the cameras to the image processing system in a flash, which then does the calculation part, prints the results and waits for the next set of three images to be processed.