DEVELOPMENT OF ROBOTIC MANIPULATOR FOR BASIC OPERATIONS IN GARMENT MANUFACTURING

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by

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DECLARATION

The work submitted in this dissertation is the result of my own investigation, except where otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

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11th February 2011.

I endorse the declaration by the candidate.

UOM Verified Signature

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Abstract

Garment manufacturing is a profitable business for developing countries, but the cost of manufacturing of garments is a major concern in the industry. Around 40% of the total manufacturing cost is involved in labour. The expenses on material and utilities are direct costs and there was no much possibility in controlling them. There were several automations introduced in stitching operations but overall efficiency of manufacturing has improved 3-5% from conventional ways. Due to fatigue in repetitive, stressful work in industry there were plenty of efficiency drops and have uncertainty of efficient production tends to cost variations and loose income.

It is a well known concept of introducing robots in the industry which increase the efficiency and reduces the labour involvement in manufacturing. There was not found such device which effectively employed in garment manufacturing industry in the world. Throughout this project had discussed the development of such robot to effectively employ in the textile and garment manufacturing.

In the apparel manufacturing the raw metrical is fabric and could not segregate them with conventional devices. The highest consideration of this project is given to efficient grasping of fabrics from stacks. In the background study of the project analyzed the theories used to analyze the friction of fabric surfaces. Then decided physical parameters involved in developing the segregating device. Then developed mechanical and control design accordingly. In segregation, three devices used and the most critical one was the griper. The second part was separator to avoid multiple grasping and next part to handle bigger fabric pieces.

Used gantry manipulator concept in development of robot arm. It can cater four DOF motion. Used dynamic analysis of the manipulator for power system development and Kinamatic analysis for position, acceleration and velocity controlling. The sensing system was developed to sense the stack height, penetrating depth, availability of fabric, multiple grip and griper position.

With locally developed two test apparatus found theoretical parameters for eight most common fabric types. These fabrics represent around 80% of basic fabric compositions used in industry. Then tested actual parameters with developed Z module of the robot. At the chapter - results contains the comparison of theoretical values and actual values obtained from the tests. The two different data streams had behave in same way but found some differences in the amounts. It has found the causes for the differences and done corrective actions accordingly.

The device had performed wary well in this test sessions. It had evaluated with eight different fabrics, different stack heights, and different cut sizes. It had not drop any item after set the correct parameters. But the devise needs to test other fabric samples as well. For nit fabrics need some modifications using vision technology to sense the fabric rolling conditions.

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List of Principle Symbols

F_s	-	Frictional force (static)
F_k	-	Frictional Force (kinetic)
F	-	Overall Friction Force
F_f	-	Fabric to fabric friction
N	-	Normal load
A	-	Affective area
k	-	Frictional parameter
n	-	Frictional Index
h	-	Stack height (number of layers × thickness)
e	-	Unevenness of layer occurred height error
k_1	-	Spring coefficient
k_2	-	Dashpot coefficient
R	-	Reaction force applied
x	-	Displacement (compaction)
E	-	Modulus of elasticity of fabrics
t	-	Thickness
T	-	Torque
w	-	Griper width