

List of Figures

1.1	A VNPR System	3
2.1	Phases in VNPR System	17
2.2	The pixel is affected by its neighbors according to the convolution matrix	22
3.1	Issues and proposed solutions to address the selected limitations of existing VNPR systems	41
4.1	VNPR framework	45
4.2	(a)Original Image (b) A_R (c) A_G (d) A_B	46
4.3	Single-level discrete 2-D wavelet transform of A_B . (a) Approximation coefficients matrix (b) Horizontal coefficients matrix (c) Vertical coefficients matrix (d) Diagonal coefficients matrix	47
4.4	(a) Vertical frequency energy curve (b) Horizontal frequency energy curve	53
4.5	(a) Grey image of figure 4.3(a). (b) Grey image of figure 4.3(b). (c) Grey image of figure 4.3(c). (d) Grey image of figure 4.3(d)	54
4.6	Smoothing of: (a) Vertical frequency energy curve (b) Horizontal frequency curve	55
4.7	Plate Location vertically	56
4.8	(a) Energy curve of horizontal frequency energy of figure 4.7. (b) its smoothing curve	57
4.9	Plate Localization	58
4.10	Plate Binarization	58
4.11	Single-level discrete 2-D wavelet transform of figure 4.10	58

4.12	Energy curve of vertical frequency of figure 4.10	58
4.13	Energy curve of horizontal frequency of figure 4.10	59
4.14	Line Split in license plate	59
4.15	Energy curve of figure 4.14 a column wise	60
4.16	Segmented characters	60
5.1	Block diagram of orientation detection & correction	65
5.2	License plate image, I	66
5.3	(a) First half image of I, I_1 . (b) Second half image of I, I_2	67
5.4	Inverted image I' of I	67
5.5	Radon Transformation of I'	67
5.6	Plot of an array A	68
5.7	Image after rotation	69
5.8	Image after noise removal	69
6.1	(a) Translation of Image. (b) orientation in (x,y,t) space	75
6.2	Vehicle License Plate Localization	80
6.3	Motion detection and tracking blobs	80
6.4	(a) Projections on licenseplate space (b) Original image and $\epsilon(x, y)$	81
6.5	ANN for eigenlicenseplate computation	84
6.6	Images of one license plate, 2 under varying lighting conditions and 2 under varying orientation	85
6.7	Recognition performance of eigenlicense plate with varying (a)lighting (b)orientation (c)varying lighting & orientation	86
7.1	Preprocessing operations for image normalization before encoding	89
7.2	Histograms, centre line & base lines	90
7.3	Normalization stages	91
7.4	Snake models of 'U' & 'P' features showing the major mode of variation within $\pm 1.5\sigma$ of the mean	97
8.1	General Block diagram of handwritten character recognition	101
8.2	Normalization	102
8.3	Phases for character identification	103

8.4	Phases of character preprocessing	104
8.5	Vector Contour of 'B'	118
8.6	Circle partition with character 'A'	119
8.7	Sample Text File1	119
8.8	'H' extracted from input text file	119
8.9	Feature extraction (after thinning)	120