GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS (47)
ADVANCE MACHINE VISION AND APPLICATIONS
SUBJECT CODE: 2724711
M.E. 2ND SEMESTER

Type of course: Engineering Science

Prerequisite: N.A.

Rationale: This subject gives understanding about the various acquisition and enhancement techniques of image processing in mechatronics domain.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	0	2#	4	70	30	20	10	10	10	150

Content:

Sr. No.	Contents	Teaching Hrs.	Weightage (%)
1	Introduction Digital image fundamentals; sampling and quantization; gray level transformation; histogram processing; image enhancement using logical operators and spatial filtering; Image enhancement using frequency domain (Fourier transform; smoothing and sharpening filters in frequency domain); image restoration	10	24
2	Colour Image Processing Colour models; colour transformations; smoothing and sharpening; colour segmentation; noise in colour image	5	12
3	Wavelets and multi-restoration Background; multi-resolution expansion; wavelet transformation in one dimension; fast wavelet transform; wavelet transformation in two dimensions	6	14
4	Image compression Fundamentals; error-free compression techniques (variable length coding; LZW; bit plane coding) lossy compression	6	14
5	Morphological Image Processing Background; dilation and erosion; opening and closing; basic morphological algorithms (boundary extraction, region filling, convex hull, thickening, thinning, etc.)	5	12
6	Image Segmentation Detection of discontinuities; edge linking and boundary detection; thresholding; region based segmentation; segmentation by morphological water shade	5	12
7	Representation and description Representation techniques; boundary descriptors; region descriptors	5	12
	Total	**42**	**100**

Reference Books:

1. Digital Image Processing Rafael C. Gonzalez, and Richard E. Woods, Pearson Publication
2. Digital Image Processing using MATLAB Rafael C. Gonzalez, and Richard E. Woods, Pearson Publication
2. Fundamental s of Digital Image Processing Anil K. Jain, PHI Learning Pvt. Ltd.
3. Principles of Digital Image Processing Wilhelm Burger, and Mark James Burge, Springer Publication

Course Outcome:

After learning the course the students should be able to:

1. Find the scope of machine vision in manufacturing automation.
2. Judge the role of machine vision to increase the productivity in terms of quantity and quality of product.
3. Develop a logical programming methodology using relevant software for digital image processing.
4. Role of machine vision as multidisciplinary technique for mechatronics engineers.

List of Practical

1. Learning of Image processing software (2 turns)
2. Practical related to image sharpening (spatial and frequency domain)
3. Practical related to image blurring (spatial and frequency domain)
4. Image enhancement by contrast stretching
5. Histogram equalization and matching
6. Intensity transformation by various transfer function
7. Arithmetic operators
8. Logical operators
9. Fourier transfer of gate function
10. Noise removal
11. Demonstration of application with digital camera

Design Based/Open Ended Problem:
Student may be given a task to exhibit the knowledge of the course studied during the academic year.

Major Equipments and Softwares:

1. MATLAB or LabVIEW or any other equivalent software
2. Digital camera

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.