Vol VI ¤ Jan 2014

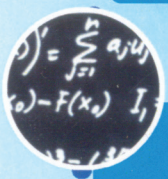
ISSN No. (Print) : 2277-8411

Aviskaar

A Xaverian Journal of Research

A MULTIDISCIPLINARY JOURNAL OF RESEARCH

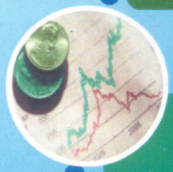
Computer Science



Mathematics

Statistics

Commerce

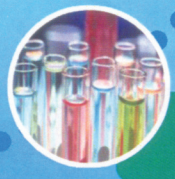


Economics

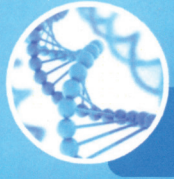
Arts & Literature

Political Science

Mass Communication



Physical Science



Biological Science

St. Xavier's College
(Autonomous)

30 Mother Teresa Sarani (Park Street)
Kolkata 700016
Website: www.sxccal.edu

Aviskaar : A Xaverian Journal of Research

Vol VI : 2014

Editor : Dr. Arup K. Mitra
Assistant Editor : Dr. Sudipto Roy
Manuscript Editor : Mr. Biplab Bhowal
Advisor : Rev. Fr. Dr. J. Felix Raj, S.J.

❖ ***Research Committee*** ❖
Rev. Fr. Dr. J Felix Raj S. J.
Rev. Fr. Dr. D. Savio S. J.
Dr. Tapati Dutta
Dr. Jhimli Dasgupta
Dr. Sanjib Ganguly
Dr. S. Ghosh
Dr. B Bhattacharya (J. U.)
Dr. Arup K Mitra
Dr. M. Mukherjee
Dr. S. K. Basu
Dr. Siddhartha Saha
Dr. S. Raha (Bose Institute)

❖ ***Published by*** ❖
St. Xavier's College (Autonomous),
30 Mother Teresa Sarani (Park Street), Kolkata 700 016
Website : www.sxccal.edu

Cover Page Design : Mr. Victor Banerjee

TABLE OF CONTENTS

The Principal
ST. XAVIER'S COLLEGE
(Autonomous)

30 Mother Teresa Sarani, (Park Street)
Kolkata - 700 016

16 December 2014

MESSAGE

I am very happy to learn that the 6th volume of "Aviskar - The Xaverian Journal of Research" is being published with contributions from staff and students, both in the hard version and also in e-version.

The participation of different teachers is noteworthy. There are articles contributed by Professors from the different departments of the College. The topics also cover different domains of science, arts, commerce and education. There are some interesting articles on fuzzy logic, cell-phone controlled home automation.

This venture can be even more successful if more Departments contribute articles and encourage the participation of the students, so that the journal becomes a true representative of the entire College.

I congratulate the Editor and the Editorial team for their wonderful job and I strongly believe that this good work will be carried forward in the years to come.

Rev. Dr. John Felix Raj, S.J.
Principal
St. Xavier's College
(Autonomous)
Kolkata-700 016

From the Editor's Desk

It gives me Immense pleasure in writing about the contents of the volume VI of Aviskaar-A Xaverian Journal of Research. This Journal is being published by the college both as hard bound issue and also the e-version. It has been a wonderful experience in editing this journal over the period of last six years. I gratefully acknowledge the papers contributed by the Professors from different Departments. This volume contains seven different papers from different domains like Microbiology, Education, Management, Comnputer Science, Electronics and English Literature. Some of the papers have featured the names of students, which really indicate the level of interest generated by the Professors amongst the students. I really appreciate the papers based on original work done by the students under the guidence of the professors. Though in this volume, there are only four such papers. I believe in future this number will certainly increase. Presently we have really indulged in collecting information from the net, which has spread like a wildfire, but more such original contributions are made, students will also understand the essence of research and this definitely will inculcate the level of original thinking in the students.

I am indebted to Rev. Fr. Dr. J. Felix Raj S.J. principal, St. Xavier's College for his active support, encouragement and involvement in publishing this volume, without which, this volume would never be a reality. I am thankful to Mr. Biplab Bhowal and the members of Book Syndicate for their active help in publishing this volume in time.

I wish all the teaching and support staff a happy and prosperous New Year.

Dr. Arup Kumar Mitra,
Associate Professor and Head,
Post Graduate Department of Microbiology,
St. Xavier's College, Kolkata - 7000 16

List of Professors who obtained the Ph.D. degree during the year 2013

Ph.D. Awardee

Dr. Munmun Dey	Commerce(M)
Dr. Farhad Banu	Political Science
Dr. Arijit Ghosh	Commerce (M)

Project Grant Received by the College during the Year 2013

Name of the Professor	Department	Granting Body	Amount (Rs.)
1. Prof. Amitava Roy	BBA	UGC (Minor)	Rs. 75,000/-
2. Dr. Sudipa Sha	Biotechnology	UGC (Minor)	Rs. 1,28,000/-
3. Dr. Uma Siddhanta	Biotechnology	UGC (Minor)	Rs. 94,000/-
4. Dr. Saptarshi Roy	Commerce	UGC (Minor)	Rs. 54,895/-
5. Dr. Salabh Agarwal	Computer Science	UGC (Minor)	Rs. 1,63,000/-
6. Dr. Ronita Nag Chowdhury	Bitechnology	CSIR + DST	Rs. 12,38,550/-
7. Dr. Surupa Chakraborty	Statistics	CSIR	Rs. 2,52,000/-
8. Dr. Chandana Barat	Biotechnology	DST + CSIR	Rs. 23,37,200/-
9. Dr. Rajib Mukhopadhay	Education	UGC (Minor)	Rs. 19,200/-
10. Dr. Jhimli Dasgupta	Biotechnology	DBT+ICMR+BRNS	Rs. 27,31,542/-
11. Dr. Aryadeep Roy Chowdhury	Biotechnology	DST	Rs. 5,50,000/-
12. Dr. Dipankar Chakraborty	Biotechnology	DST + ICAR	Rs. 10,47,842/-
13. Dr. Kasturi Sarkar	Biotechnology	DST	Rs. 2,50,000/-
14. Dr. Tapati Dutta	Physics	IFCPAR	Rs. 2,12,900/-
		TOTAL	**Rs. 91,54,129/-**

Gall formation in mango leaf in presence of associated pathogen

Victor Banerjee*, Anamika Mandal, Nivya Thomas, Sunanda Mandal, Sharmistha Biswas, Sayantan Ghosh and Arup Kumar Mitra

Department of Microbiology,
St. Xavier's College (Autonomous), Kolkata-700016
Email*: recervictory@gmail.com

Keywords: Bacteritization, Chitinase activity, Mango leaf gall, Midge pathogen, Mango pest *management*

Abstract

Mango leaf gall midge (*Procontarinia sp.*) is an important pest of mango leaves. Mango leaf gall midge produces wart-like galls on the lamina in early stage of development, the initial green coloured gall, later change to black after one week of infection resulting in reduction of photosynthesis, later showing chlorosis and abscission. These infected leaves were collected from the outskirts of Kolkata and were found to be exhibiting mixed infection of both bacteria and fungi. The bacterium isolated from the spot was found to be *Xanthomonas campestris* on the basis of Gram characteristics and enzyme characteristics and the fungal isolate was found to be *Fusarium solani*, identified on the basis of the spore characteristics. The bacteria and fungus was studied for any relation with the gall. Apparently the infected leaf shows higher percentage of infection, which in presence of bacteria and fungus was found to be reduced. The chitinase activity in the bacteria is responsible for its inhibitory action to both the gall formation and insect infection. At the same time, the bacteria being a minor pathogen accounted for only minor foliar damage. Thus this bacteritization of the leaf can be a preventive measure to both the fungal and insect attack.

Introduction

Mango is one of the most cultivated fruits of the tropical world. Mango plantation often suffers from several diseases and all the parts of the plant are attacked by a number of pathogens. Mango leaf gall midge is a serious pest of mango leaves. Mango leaf gall midge produces wart-like galls on leaves. During the early stages the gall appeared green in colour that latter on changed to black, resulting in reduced photosynthesis, leading to leaf drop and lowered fruit production. Young trees may die while older trees fail to recover normal growth after repeated attacks. In this study infected mango leafs were collected and the anatomy and characterization of the gall were studied.

Morphology of Gall:

- ***Pattern of Infection:*** Leaves had tumorous growth on them in an asymmetric pattern. The galls were present all over the leaf.
- ***Anatomy:*** The anatomy shows a distinct epidermal crust, with undifferentiated parenchyma. The parenchyma is packed with round back mass of eggs. The central part (cells) shows, filamentous larvae hatching out of the eggs.
- ***Nature:*** Filamentous, Head & thorax undifferentiated, approx. 4-5 cell long. The undifferentiated once look like unsegmented rods.

The characterization of the causal organism of bacteria black spot in mango leaves has long been an issue. Bacterial black spot is a serious necrotic disease of mangoes which has been reported from most mango growing areas of the world, including India. The infected black rot spots in mango leaves which caused darkening of the vascular tissues near the gall were selected for pure culture isolation and further characterization.

A fungal pathogen which is air borne normally is disseminated in the form of air borne spores. It usually settles down on the leaf surface and the germ tube enters the leaf via stomata or lenticels or any other opening. Furthermore, brown infected spots from the leaves were isolated as pure culture and were further characterized.

Materials and Methods :

Pure culture Isolation

The bacterial and fungal culture obtained from the nutrient agar plates inoculated with the diseased leaf portion, i.e., leaf gall and the black spot of the leaf were pure cultured in some nutrient agar plates and potato dextrose agar slants.

Gram Characterization

Gram characterization of the isolated pure colonies was done. The bacterial pathogen was gram stained while *lactophenol cotton blue* staining was done in case of the fungal pathogen. Their dimension and sizes were also measured. The ocular reading of the dimension of the eggs and filaments within the gall were also measured. Results are given below in table 1 & 2.1 and 2.2. figures are given in (4-6)

Glucanase – Chitinase bioassy

The glucanase and chitinase bio-assay from the isolated bacteria were performed to determine the possible relationship between the insect and the bacterial pathogen present in the gall.

Slide Bioassay

Slide bio-assay was done to study the growth, development and interaction between the bacteria and fungi in presence and absence of different nutrient condition. Results are given below in table 3.

Reinoculation and Validation of Koch's Postulate

The healthy mango leaves were reinoculated with the spore suspension of the suspected pathogens derived from the infected plants. Finally the cause of the infection was confirmed by performing the Koch's postulate. Results are given below in table 4 and 5.

Results:

In case of bacteria, that was isolated from the ruptured gall was found to be Gram negative cocco-bacilli. While in case of fungus, which was isolated from the infected black spot on the leaf was found to have abundant microconidia which were oval in shape with the presence of small spores. The colony characteristics of the bacteria were found to be opaque, flattened, off white in colour, irregular in shape. While fungal colonies showed dense, white creamy mycelium which turned black during spore formation.

The average dimension of the eggs was found out to be 10.672 μm and the average length of the filaments was found out to be 16.72μm. Figures given in Fig 4, 5.

On the basis of all these results mentioned above the organisms were identified to be *Xanthomonas campestris* in case of bacteria and *Fusarium solani* in case of fungus. Figure given in fig:6.

In case of glucanase and chitinase bio-assay, the activity of glucanase was found to be 1.12 U/mg of total protein while the activity of chitinase was found to be 0.89 U/mg of total protein. The presence of chitinase and glucanase in the isolated bacteria shows that these enzymes were used to breakdown the insects' wall.Thus showing an antagonistic relationship between them.

In the slide bio-assay the fungus spores geminated less in presence of bacteria which indicated a possible antagonism between the two and as a nutrient sugar did not played any role in the germination of the spores.

Lastly, the percentage of infection was found out to be 60% in case of bacterial pathogen, & 90% in case of fugal pathogen, during the reinoculation of bacterial and fungal spore suspension in healthy mango leaves to confirm the koch's postulate.

Table 1: Gram characterization:

Nature of the organism	Colony Characteristics	Part from where	Microscopic Features isolated
Bacteria	Off white, Irregular & merged colonies, Opaque	Section of ruptured gall	Gram negative Cocco-bacilli
Fungi	Colonies growing rapidly, White cream mycelium, initially white that turns to black during spore Formation.	Infected black spot on leaf	Microconidia are usually abundant, cylindrical Kidney to oval shaped. Small spore.

Table 2.1 Dimension of eggs and filament:

OCULAR READING		FINAL READING (OCULAR READING x C.F.) (μm)	
EGGS	FILAMENTS	EGGS	FILAMENTS
2	5	2x 3.56=7.12	5 x3.56=17.8
2.5	6	2.5 x3.56=8.9	6 x3.56=21.36
4	4	4 x3.56=14.2	4 x3.56=14.2
3	5	3 x3.56=10.68	5 x3.56=17.8
3	6	3 x3.56= 10.68	6 x3.56=21.36
2	4	2 x3.56=7.12	4 x3.56=14.2
4	5	4 x3.56=14.2	5 x3.56=17.8
2	6	2 x3.56=7.12	6 x3.56=21.36
3	2	3 x3.56=10.68	2 x3.56=7.12
4.5	4	4.5 x3.56=16.02	4 x3.56=14.2

Average length of eggs =10.672 μm and average length of filaments =16.72 μm.

Standard Error of the Mean

The standard error of the mean is the standard deviation of the sample mean estimate of a population mean. It is usually calculated by the sample estimate of the population standard deviation (sample standard deviation) divided by the square root of the sample size (assuming statistical independence of the values in the sample):

The following is the sample standard deviation formula:

$$S = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2}$$

Where:

s = sample standard deviation

x1, ..., xN = the sample data set

$\bar{x}$ = mean value of the sample data set

N = size of the sample data set

Table 2.2: **Determination of Standard Error:**

	Total Number of Ocular readings	standard deviation	Standard error
Insect Eggs	10	0.91	0.28
Fungus Filaments	10	1.25	0.39

Table 3 : **Percentage of spore germinated and germ tube length**

Suspension of Microorganisms tube(µm)	Solution germ	Length of spores	Total no. of microorganisms	Total no. of germination	% of
Fungal spore suspension	Sterile water		33	25	***75.75%***
Fungal spore suspension	5% sugar solution		31	20	***64.50%***
Fungal spore suspension + Bacterial suspension	Sterile water		24	14	***58%***
Fungal spore suspension + Bacterial suspension	5% sugar solution		21	9	***42.8%***

Table 4 : **Calculation of the total no. of spores present in spore suspension (inoculum)**

SL.NO.	TYPE OF CULTURE ORGANISM	NAME OF THE PRESENT IN INOCULUM	NO. OF SPORES
(1)	BACTERIA	*Xanthomonas campestris*	$34x10^6/cm^3$
(2)	FUNGI	*Fusarium solani*	$76x10^4/cm^3$

Table 5: The percentage of infection of the Pathogens.

SL NO.	NATURE OF PATHOGEN	NAME OF PATHOGEN INOCULATED	NO. OF LEAVES INFECTED	NO. OF LEAVES SPOTS	APPEARANCE & NATURE OF	% OF INFECTION
(1)	BACTERIA	*Xanthomans campestris*	20	12	Browning observed.	(12/20) x 100 = 60%
(2)	FUNGI	*Fusarium solani*	20	18	White mycelia /cottony growth Surrounding the 1cm square leaf.	(18/20) x100 = 90%

The fungal culture isolate i.e. *Fusarium solani* is found to be more pathogenic to the mango leaves than the bacterial culture isolate *Xanthomonas campestris.*

Figures:

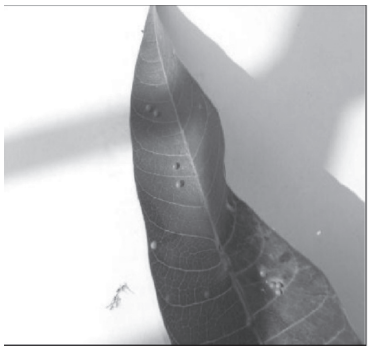


Fig 1:
Infected Mango Leaf

Fig 2:
Mango Leaf Galls

Fig 3.
Black spotted Galls

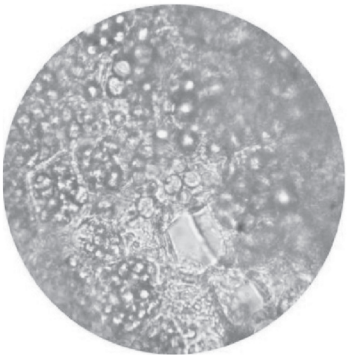


Fig 4:
Microscopic view of the cut section of the gall showing black eggs

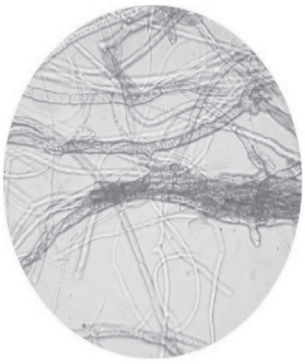


Fig 5 :
Microscopic view of the fungus isolated from the infected leaf

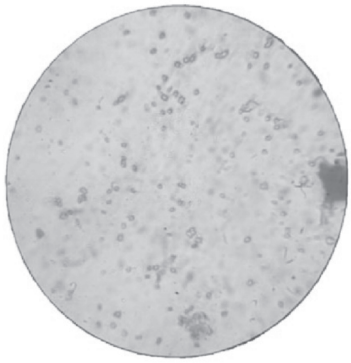


Fig 6 :
Microscopic view of the Bacteria isolated from the infected gall.

Discussion:

Discussion :

Usually in a urban environment, the trees are subjected to mechanical damage due to high amount of suspended particulate matter which not only causes damage to the epidermis but also may reduce photosynthetic efficiency. In this investigation, the mango leaf was mainly infected by the gall midge, unlike that of the report of other investigators where inflorescence (*Whitwell et al, 1993*), fruit (*Barnes et al, 1948*) and foliage (*Abbas et al, 1988* and *Shi et al, 1980*) can be affected at the same time. Here, the isolation of *Xanthomonas* was a major finding which had the ability to control both the insect and the fungi at the same time through Chitinase and Glucanase activity (Cohen et al, 1993). Being a minor pest it can easily be suggested, that early bacterial inoculation can prevent major setback induced by fungi and the insect. So, this can be a part of IPM (Integrated Pest Management) suggested by *Malik et al*, *2005 and Sankaran, T. and Mjeni, 1988*. Thus in conclusion it can be suggested that midge attack may be accidental because in this case there was no plantation, so bacteritisation at the early stage of development may be fruitful for the well being of the plant.

Acknowledgement:

We would like to thank our respected Principal, Rev. Dr. J.Felix Raj S.J. and all the faculty members of microbiology department for their support.

References:

- ***Abbas S.R., Verghese, A. and Fasih,*** M. 1988. Studies on the Mango Inflorescence Midge, Erosomya indica
- ***Barnes, H.F***. 1948. Gall Midges of Economic Importance: Gall Midges of Fruit, Vol. 3. Cosby Lockweek and Sons, London, UK.
- ***Malik et al.2005***. (Eds)International Conference on Mango and Date Palm: Culture and Export. 20th to 23rd June, University of Agriculture, Faisalabad. Grover, P. 1986b. Population fluctuation of Erosomya indica and Dasineura amaramanjarae and co-related extent of damage. Cecidol. Int. 7:43-57
- ***Sankaran, T. and Mjeni, A.M.*** 1988. Recent Studies on the mango leaf-gall midge Procontarinia Matteiana Kieffer and Cecconi (Dip. Cecidomyiidae) and its parasites in India and on prospects for biological control of the pest in Oman. Proc. 2nd International Symposium on Mango. Acta Horticulturae 231: 587-592.
- ***Shi, D.S.*** 1980. A new species of gall midges affecting young leaf of mango (Diptera: Cecidomyiidae). Entomotaxonomia 2: 131-134.
- ***Srivastava, R.P. 1997.*** Mango Insect Pest Management. International Book Distributing Co., New Delhi.

  Uechi, N., Kawamura, F., Tokuda, M. and Yukawa, J. 2002.
- ***Whitwell, A.C***. 1993. The pest/predator/parasitoid complex on mango inflorescences in Dominica. Acta Hortic. 341: 421-432.
- ***Cohen E****., Chitin synthesis and degradation as targets for pesticide action, Archives of Insect Biochemistry and Physiology, Volume 22, Issue 1-2, pages 245–261, 1993*

The Causal Factors of Employee Turnover in Indian Information Technology Sector : An exploration

Sumana Guha
Assistant Professor
St. Xavier's College (Autonomous), Kolkata-700016

Key words: *Employee turnover, Human resource, Pull factor, Push factor*

Abstract

Present study is an endeavour to unveil the underlying factors behind the Information Technology (IT) employees' decision on staying or leaving a firm voluntarily.To conceptualize the employee turnover phenomenon in a wider perspective, the causal factors are classified here into push and pull factors.Six causal factors –'higher salary','higher portfolio', 'scope of foreign assignment', 'company's brand name', 'breach of commitment' and 'others' -are perceived to be influential to the IT professionals for leaving their jobs voluntarily. Analysis of the causal factorsof 214 IT professionals who have changed at least three companies revealed that'higher-salary', 'higher-portfolio' and 'company's brand name'are the three most important factors of employee turnover across age and gender. Employees' higher professional attitude combined with decent pay package and the scope of revealing skill are found reducing employee's propensity to leave the company. On the other, experienced employees have higher propensity to change company for locational advantage and greater freedom of work. However, propensity to change company is higher among younger employees reflecting their zeal to reach the top of the professional-ladder at the shortest possible time.

1. Introduction

The twenty first century provides us with ever increasing rates of technological changes along with hypercompetitive market rivalries. The exponents of resource-based theory [1, 2] argued that firm's resources and capabilities represent its potential competitive advantage under such hypercompetitive market environment. The scholars of human resource management are advocating that the success in dynamic, hypercompetitive markets depend more on innovation, speed and adaptability [3]which are mostly derive from firm's own human resources rather than external factors, like technology, patents etc. The human resources are considered as intangible capital with distinctive functional capabilities that control and augment both physical capital and other resources.But, the major problem facing by the firms is the departure of these human resources, i.e. the problem of employee

turnover. This employee turnover is considered as cost to the firm and this cost becomes higher when efficient and skilled employees left the firm.

One obvious question will arise – 'What are the factors behind employees' leaving or staying in the firm?'Hom and Griffeth [4] argued that it is employee's job satisfaction or dissatisfaction that motivates employee to stay or leave the firm. But these work attitudes play relatively small role [5, 6]in overall employee retention or leaving, rather factors like organizational commitment, opportunities of job alternatives etc are more important in explaining employee's turnover phenomenon. Mobley et al [7] observed that the two factors, one reflects employee's evaluation of the firm's future expected value with respect to employee's work aspirations and the other is the tension associated with the employee's present work conditions, are responsible for employee turnover. Becker [8], Kraut [9], Stevenset al[10] and many others argued that the employee has made an implicit comparison of expected job benefits with alternative job opportunities and if the benefits they are enjoying in their present job are greater than or equal to other alternatives then the employee will not leave their existing firm.

It is apparent that the underlying reasons behind employees' decision regarding leaving or staying in a firm are either the influences of some exogenous factors or some endogenous factors. Keeping this in mind, the underlying reasons of employee turnover are classified into push factors and pull factors. Push factors include employee's job dissatisfaction, breach of commitment, familial compulsion and the other similar factors which compel the employee to quit the job. On the other hand, pull factors include attractive offersfromother firms, like higher-salary, higher-portfolio, high brand company, etc. which are in fact the means of upgrading the one's social and economic status. This pull factors motivate employee to change organization.

Numerous studies have reported evidences of push factors, like work overload, role ambiguity, and role conflict in determining turnover decisions [11,12, 13,14,15,16]. It has been suggested that IT professionals in many firms are continually asked to take on impossible workloads with deadlines [17, 13].The primary component of job burnout, exhaustion, is defined as the depletion of mental resources[18]. Consequences of exhaustion are job dissatisfaction [19, 20, 21, 22];reduced organizational commitment Jackson et al.[23, 24, 25, 26]; enhance turnover intention[27, 23, 21].

Marta M. Elvira [28]observed that women are less likely to leave when more women are employed at their own job hierarchy.On the other hand, men's turnover decreased when more men were employed in executive levels. Women are found to be more satisfied with and attached to their jobs when they work with more women and they are less likely to leave when they work with more women at their job level [29]. Tsui,et al[30]observed that men's psychological attachment diminished with increasing proportions of women.

This study is an endeavor to ascertain the underlying reasons for the employees ofInformation Technology (IT) sector of West Bengal to leave firm voluntarily. In this regard we are mainly concern with six plausible factors, e.g. higher-salary, higher-portfolio, scope of foreign assignment, company's brand name, breach of commitment and others,- which are to be influential for the Indian IT professionals to leave their jobs voluntarily and examinerelative factor dominance across gender and age-groups which motivate them to leave the firm.

The following section deals with data and methodology of this study. The next section provides theempirical findings and that follows to the concluding section.

2. Data and Methodology:

For theprimary information regarding the causal factors behind employee turnover in the Information Technology sector a pre-ordained questionnaire is randomly circulated to 460 IT employees working presently in 17 different reputed IT firms in Kolkata, West Bengal. The questionnaire contains multidimensional questions pertaining to capture the behavioural patterns of the IT employees under the influences of different push and pull factors. Among the sample respondents, 420 respondents are found who have changed at least one company and the remaining 40 did not change their first company at the time of survey. 214 respondents (out of 420) are found who havechanged at least three firms.

For this present study we have chosen six plausible causese.g. 'higher salary','higher portfolio', 'scope of foreign assignment', 'company's brand name', 'breach of commitment' and 'others', - which are to be influential for the Indian IT professionals to leave their jobs voluntarily.The respondents are asked to rank these motivating factors according to the rationale of their leaving a firm. All the 214 respondents expressed their motivating factor by ranks in each occasion at the time of leaving their last three companies. Simple statistical techniques are applied for data analysis and presentation.

3. Empirical finding and illustration:

In order to judge the intrinsic factors behind employee's propensity to leave company we put forward some endogenous factors [e.g. Scope of revealing skill (SRS), professional attitude (PA), locational advantage (LA), year of experience in IT (ExIT), financial reason to change company (FRCC), 'higher independence leads to greater attachment' (HIHA)] before our 460 respondents to reveal their plausible response. One correlation matrix is prepared to see interrelationship among these factors and then a linear regression is fitted with 'number of changes' as dependent variable (Y).

Pearson Correlations Matrix (n=460)

Variabes	*No_Changes*	*SRS*	*PA*	*LA*	*ExIT*	*FRCC*	*HIHA*
No_changes	1						
SRS	-.098*	1					
PA	-.326*	.076	1				
LA	.131**	.061	-.005	1			
ExIT	.128**	.028	.012	-.055	1		
FRCC	-.108**	.063	-.003	.065	-.013	1	
HIHA	.127**	.014	-.067	.008	.040	-.020	
	1						

*****. Significant at the 0.01 level (2-tailed);***

****. Significant at the 0.05 level (2-tailed).***

Linear regression equation:

$$Y = 2.488 - 0.394(PA) - 0.651(FRCC) - 0.114(SRS) + 0.272(HIHA) + 0.427(LA) + 0.038(ExIT)$$
$$(5.715) \quad (-7.324) \quad (-2.553) \quad (-1.889) \quad (2.279) \quad (3.455) \quad (3.189)$$

(The figures in the parenthesis represent t values)

It is evident from the above matrix that the independent variables are significantly correlated with the dependent variables. In the regression also all the predictor variables are significantly related to the predicted variable. Employee's propensity to change company is negatively related with PA, FRCC and SRS which imply that employee's higher degree of professional attitude combined with a decent financial package and the scope of revealing skill to the company will reduce employee's propensity to leave the company. On the other hand, the attraction of locational advantage (LA) and greater freedom of work (HIHA)increase the propensity of the higher experienced (ExIT) IT employees to change a company.

Respondentsare asked to rank the given six plausible reasons, according to their own reasons for leaving a company, at each occasion of their last three changes. The average ofthe ranks of the causal factors is estimated and is summarized in table-1.It appears from table-1that 125 respondents (58.4 per cent) out of 214 respondents considered 'higher salary' as the most important (Rank-1) causal factor for leaving a company. In a similar way, the 2nd, 3rd, 4th, 5th and 6th ranks are given by the IT respondents to 'higher portfolio' (37.9 per cent); 'company's brand name' (39.7 per cent); 'breach of commitment' (41.6 per cent), 'others' (38.3 per cent) and 'scope for foreign assignment' (53.3 per cent) respectively.

Table 1: Distribution of ranks of the causal factors revealed by the employees for their last three changes of companies

Factors	Ranks of the causal factors over last three changes provided by the average respondents						Over al Rank
	Rank-1 (No.)	Rank-2 (No.)	Rank-3 (No.)	Rank-4 (No.)	Rank-5 (No.)	Rank-6 (No.)	
Higher Salary	125	41	32	14	2	0	I
	(58.4)	(19.2)	(15.0)	(6.5)	(0.9)	(0.0)	
Higher Portfolio	32	81	66	19	8	8	II
	(15.0)	(37.9)	(30.8)	(8.9)	(3.8)	(3.7)	
Scope of foreign assignment	11	16	12	16	45	114	VI
	(5.1)	(7.4)	(5.6)	(7.5)	(21.0	(53.3)	
Company Brand Name	36	57	85	20	3	13	III
	(16.8)	(26.6)	(39.7)	(9.3)	(1.4)	(6.1)	
Breach of Commitment	3	7	11	89	74	30	IV
	(1.4)	(3.3)	(5.1)	(41.6)	(37.6)	(14.0)	
Others	7	12	8	36	32	49	V
	(3.3)	(5.6)	(3.8)	(26.2)	(38.3)	(22.9)	
Total	214	214	214	214	214	214	
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	

Source : Primary Survey, 2012

Note : (i) 'Others' includes factors other than the above stated five factors, e.g. job dissatisfaction, ill health, familial compulsion etc.

(ii) Figures in the parenthesis are percentage of total respondents.

Among 214 respondents, there are 137 male and 77 female. To judge the above findings, the similar exercise is being carried out by gender division which is presented in table-2. It appears from table-2 that both male and female IT employees revealed exactly the same priority causal factors for leaving their respective companies, i.e. depicting similar ranking pattern as in table-1. For both male (62 per cent) and female (51.9 per cent) employees' most significant driving force of leaving a company is 'higher salary'. Unlike male employees, female employees' given ranks to 'higher portfolio' and 'company's brand name' (45.4 and 44.1per cents respectively) are not significantly different. One may notice that the first three ranks are given to pull factors by both the male and female employees. Therefore, one point of argument can bearising here that the rival companies' business game plan might be a factor behind employee turnover.

Young employees are expected to be comparatively less bounded by social compulsions and for that reason they are more vibrant and more prone to accept challenges in life as well as in their professional carrier than their older counter part. Keeping this in mind, the 214 IT employees are classified into three age groups- 'less than 30', '30-40' and 'above 40' and a frequency distribution of the time takento change firm (s) by respondents of different age-groups is prepared and is presented in table-3.It is quite evident that 72 per cent employee of 'less than 30' age group leave a company within less than one year and 70.3 per cent employee changes three companies within two years (see table-3). This percentage of employee turnover becomes significantly less to higher age groups. This distinctive feature of the young IT employees may describe as over enthusiasm to reach the top of the professional-ladder at the shortest possible time.

Table 2: Distribution of ranks of the causal factors revealed by male and female employees for their last three changes of companies

Factors	Ranks of the causal factors over last three changes provided by the average respondents						over all Rank
	Rank-1 (No.)	Rank-2 (No.)	Rank-3 (No.)	Rank-4 (No.)	Rank-5 (No.)	Rank-6 (No.)	I
Higher Salary	85 (62.0)	26 (19.0)	17 (12.5)	7 (5.1)	2 (1.5)	0 (0.0)	
Higher Portfolio	20 (14.6)	46 (33.6)	41 (29.9)	16 (11.7)	7 (5.1)	7 (5.1)	II
Scope of foreign assignment	2 (1.5)	15 (10.9)	11 (8.0)	16 (11.7)	35 (25.5)	58 (42.3)	VI

Company Brand Name	22	32	51	17	2	13	III
	(16.1)	(23.4)	(37.2)	(12.4)	(1.5)	(9.5)	
Breach of Commitment	1	7	11	50	43	25	IV
	(0.7)	(5.1)	(8.0)	(36.5)	(31.4)	(18.3)	
Others	7	11	6	31	48	34	V
	(5.1)	(8.0)	(4.4)	(22.6)	(35.0)	(24.8)	
Total	137	137	137	137	137	137	
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	
				Female			
Higher Salary	40	15	15	7	0	0	I
	(51.9)	(19.5)	(19.5)	(9.1)	(0.0)	(0.0)	
Higher Portfolio	12	35	25	3	1	1	II
	(15.6)	(45.4)	(32.5)	(3.9)	(1.3)	(1.3)	
Scope of foreign assignment	9	1	1	0	10	56	VI
	(11.7)	(1.3)	(1.3)	(0.0)	(13.0)	(72.7)	
Company Brand Name	14	25	34	3	1	0	III
	(18.2)	(32.5)	(44.1)	(3.9)	(1.3)	(0.0)	
Breach of Commitment	2	0	0	39	31	5	IV
	(2.6)	(0.0)	(0.0)	(50.6)	(40.3)	(6.5)	
Others	0	1	2	25	34	15	V
	(0.0)	(1.3)	(2.6)	(32.5)	(44.1)	(19.5)	
Total	77	77	77	77	77	77	
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	

Source: Primary survey, 2012.

Note:Figures in the parenthesis are percentage of total respondents.

Table3 : Frequency distribution of time taken to change firm (s) by respondents of differentage-groups

Time taken to change firm(s)	Age of respondent (in years)								
	Less than 30			30-40			Above 40		
	Number of change(s)			Number of change(s)			Number of change(s)		
	One	Two	Three	One	Two	Three	One	Two	Three
Less than 1 year	59	21	5	42	3	0	1	0	0
	(72.0)	(26.6)	(6.1)	(34.4)	(2.5)	(0.0)	(10.0)	(0.0)	(0.0)
1-2 years	29	61	58	48	60	25	1	2	0
	(35.4)	(74.4)	(70.7)	(39.3)	(49.2)	(20.5)	(10.0)	(0.0)	(0.0)
3-4 years	0	0	18	19	26	43	2	0	1
	(0.0)	(0.0)	(22.0)	(15.6)	(21.3)	(35.3)	(20.0)	(0.0)	(10.0)
5 years and over	0	0	1	13	33	54	6	8	9
	(0.0)	(0.0)	(1.2)	(10.7)	(27.1)	(44.3)	(60.0)	(0.0)	(90.0)

Source: Primary survey, 2012

Note: Figures in the parenthesis are percentage of total respondents of the respective age group.

Hence, it is clearly appeared from our empirical findings that the IT employee turnover is mostly guided by the pull factors irrespective of gender and the propensity to change companies is much higher among the young employees ('less than 30' age group) than the older employees.

4. Concluding remarks:

From the company's point of view,anyloss of potential human resource would undoubtedlybe a great cost.However, when inefficient employees leave the organizationand are replaced by the efficient ones then it will obviously be beneficial to the company.

It is revealed that among the six given plausible factors of employee turnover, attraction of 'higher salary' occupies the top priority followed by the attraction of 'higher portfolio'and'company's brand name'. All are in the array of pull factors. This behavioural pattern is unvaryingly valid across gender and ages and thus affirms the general notion that the IT professionals are too much career oriented. The propensity to change company for achieving a better or higher place in the professional-ladder is higher among younger employees. This might be due to persisting higher market demand for potential IT personals and the zeal of the young employees to reach the top of the professional-ladder at the shortest possible time

In order to give proper justice to any study on employee turnover,a comprehensive approach is required but the present study deals only with six plausible causes for employee turnover and that becomes one of its major limitations. However, this study tries to initiate a new way of thinking by grouping causal factors into push factors and pull factors and focus on various socio-economic dimensions of employee turnover which would help future researches.

References:

[1] *Wernerfelt B*, Strategic Management Journal, 5,171-80 (1984).

[2] *Grant R M,* Strategic Management Journal17, 109-122 (1996).

[3] *Pfeffer J*,Competitive advantage through people,Harvard Business School Press: Boston, (1994)

[4] *Hom P., & Griffeth R*, Journal of Applied Psychology, 76,350-366 (1991).

[5] *Hom P. & Griffeth* R,Employee turnover, Cincinnati, OH: Southwestern (1995).

[6] Griffeth, Hom, and Gaertner A Meta,463-488 (2000).

[7] *Mobley W. H., Griffeth R. W., Hand H. H., & Meglino B. M,* Psychological Bulletin, 86: 493-522 (1979).

[8] *Becker Gary,*Human Capital. 2d Ed. University of Chicago Press, Chicago(1975)

[9] *Kraut A. I*, Organizational Behavior and Human Performance,13, 233-243 (1975).

[10] *Stevens J. M., Beyer J. M., & Trice H. M,* Academy of Management Journal, 21, 380-396 (1978)

[11] *Bostrom R. P*, Association for Computing Machinery Press, New York, 88-112 (1981).

[12] *Goldstein, D. K., and Rockart, J. F,* MIS Quarterly, 8, 103-115 (1984).

Annual: Applications in Organizational Settings (5), Sage, Beverly Hills, CA: 133-153 (1984).

[21] *Pines A., Aronson E., and Kafry D, Burnout*: From Tedium to Personal Growth, The Free Press, New York (1981)

[22] *Wolpin J., Burke, R. J., and Greenglass, E. R, Human Relations,* 44: 193-209 (1991).

[23] *Jackson S. E., Turner J. A., and Brief A. P,* Journal of Occupational Behavior, 8, 339-349 (1987).

[24] *Leiter M. P,* Journal of Occupational Behavior, 1:2, 123-144 (1991).

[25] *Sethi V., Barrier T., and King, R. C,*Information Resources Management Journal,12-3, 5-13 (1999).

[26] *Thomas K. M. and Williams K. L,* paper presented at Work, Stress and Health '95: Creating Healthier Workplaces, Washington, D.C, (1995).

[27] *Jackson S. E., Schwab R. L. and Schuler R. S,*Journal of Applied Psychology, 71, 630-640 (1986).

[28] *Marta M. Elvira,*Academy of Management Journal, 44 -3, 591-605 (2001).

[29 *Tolbert P. S., Simons T., Andrews A., & Rhee J,*Industrial and Labor Relations Review, 48, 562-579, (1995).

[30] *Tsui A. S., Egan T. D., & O'Reilly C. A.*,Administrative Science Quarterly,37, 549-579(1992).

Developement of Value Through Science Education and Role of a Teacher

Dr. Rajib Mukhopadyay
Department of Ecucation
St. Xavier's College, 30 Park Street, Kolkata

Key words : *Value based science education, Teacher's understanding of the nature of science, Process and product aspect of scientific knowledge, Department of learners' value system*

Abstract

Importance of value based education is being felt more and more in the contemporary society. An inclusive value based education, as an integrated part of teaching science in schools has been considered as area of investigation of the present study. The study has identified the problem of value crisis of learners and explained its emergence in the modern context of revolution of science and technology. A solution of this problem has also been sought. The study has explained how does a comprehensive science teaching emphasizing both the process and product aspect of knowledge in science develop learners' value system. Though learners' recognition of true disciplinary values of science is the specific outcome of this value development program, present study has also identifiedthe possibility of developing their broad based social and humanitarian valuesas the long run goal of this program. The conceptual framework has been explained in details. Teachers' proper understanding of the nature of science (NOS) has been identified as a necessary condition leading to such a development. Various operational dimensions of NOS have been explained.The study has also discussed teachers' existing conceptions of NOS with adequate number of related references.

1. Introduction

Social relevance is one of the major quality parameters of education, in general. Various contemporary issues and emerging trends in the society are the major concerns of education. In fact, in order to cope with those changes, education needs continuous revision and reconstruction. This reconstruction, indeed is a critical process having a number of various considerations. One of such considerations has been selected asfocal area of the present study.

Liberalization, privatization, globalization, WTO- outsourcing, revolution of science and technology etc. are few among the contemporary trends influencing the quality of modern education. With all their desirable contributions, these are creating social instability in various forms also (NCTE Document, 2004). Liberalization, privatization, globalization, WTO-outsourcing etc transform the nature of knowledge. Knowledge is no longer generated for

its own sake, rather its generation is for utilization of economic gains. Education has to face the challenge of market forces, individual has the scope to show their worth. It undoubtedly increases accountability of any system or an individual, but at the same time results in exploitation and increases the possibility of unhealthy competition between the weak and strong (Mukhopadhyay, 2011). Revolution of science and technology transforms the traditional way of life. But, in addition, it also results in several problems. Over dependence on technology, particularly in the context of learning science, increases the possibility of degradation of human intellect (Neo et al.,2007). Explosion of information in spite of its several beneficial aspects,increases the load of school curriculum in general, and in the discipline science, in particular. As a consequence, 'product aspect of knowledge in science' is being emphasized by both the teacher and learner encouraging examination oriented learning only (Abell and Lederman, 2007). Different scientific concepts are directly told to the students, they are not allowed to think for themselves (Meador, 2003). These result in the problem of encouragement of mere rote memorization of good deal of information without due concern to information processing leading to exploration of new knowledge. Therefore, 'process aspect of learning science' is being neglected very much under this circumstance (Aktamis and Ergin, 2008). As a result, science teaching fails to nurture learners' creativity by encouraging their knowledge construction, in spite of having enough scope of such nurturance within its own domain (Lee, 2002). This may lead tolearners' failure of perceiving the true nature of learning science and also their failure in developing favorable attitude to contribute significantly for the benefit of society and human being utilizing their knowledge of science. This is also one type of value crisis of learners, particularly in the present context of revolution of science and technology.

The impact of these problems emerging in the present social context, especially on the educated youth, including school learners, is a matter of serious concern. The situation demands that teachers should concentrate their attention on inculcation and restoration of values. A common practice in this regard is to consider value education as a separate discipline. But this separate inclusion increases the possibility of many fold load on curriculum, as well. Therefore, it seems to be more justified to incorporate value-based education in an inclusive manner, as an integrated component of different other subject disciplines usually taught in school. Without increasing any further load on existing curriculum, it helps in inculcating value system in the mind of learners as a part of day-to-day teaching learning activities of different subjects. Present study is an active search for identifying a suitable way of ensuring such value-based education integrated as a part of teaching learning scienceparticularly.

Each discipline has its own value system. Proper understanding of these values may be a part of this value based education, inclusive to learning of those disciplines (Morten and Vanessa, 2007). Science has its own values also. Teachers' proper understanding of the nature of science (NOS) help them in realizing these intrinsic values (Lederman, 1992). This, again may also lead to an effective learning of those values by the learner ultimately (through the transfer of value system from teacher to learner; Carey and Smith : 1993) leading to a value based science education, inclusive to the learning science as the consequence. Some questions arise in this context- what is the nature of science ? how do the teachers' perceive this ? how does teachers' understanding and proper perception of that nature help in promoting learners' value system ? Present study is an attempt of finding answers of these. It aims at particularly-

- ❖ To explain the Nature of Science (NOS)- as recommended by different researchers
- ❖ To describe teachers' understanding of the nature- as identified by science educators

- To identify how does teachers' understanding of NOS help in promoting learners' value system?

The detailed conceptual framework is explained in the present study stepwise, which are as follows.

NATURE OF SCIENCE (NOS)

Science and technology play increasingly important roles in our lives. Most people probably realize that understanding science is important - at least for scientists - but scientists as well as the common people may not fully appreciate the importance of understanding the Nature of Science (NOS) - that is, the nature of scientific knowledge and the processes thatgenerate it. We are so accustomed to science being part of our lives that we take for granted that everyone knows what it is, but the reality is entirely different. Studies have shown that NOS misconceptions are prevalent among high school and college students and even among teachers (Chen, 2005).

Science, in most of the cases is considered in terms of several information (facts, theories, laws, phenomenon) etc which already exist. Undoubtedly this is one of the major aspects of science- but science in true sense is something more than this. It is a body of knowledge and at the same time the way of knowing (scientific process). Truth is the major concern of science and science considers truth as a product, as well as a process (Mukhopadhyay, 2011). To explore the objective reality of natural world is the ultimate aim of science, but for that exploration- people (including scientists) are guided very much by their subjective perception of reality. So what is science then? McComas (1998) has identified the following features of science:

- Science produces, demands and relies on empirical evidence
- Experiments are not the only route to knowledge
- Science uses both inductive reasoning and hypothetico-deductive testing
- Scientists make observations and produce inferences
- There is no single step-wise scientific method by which all science is done
- Science has a creative component
- Observations, ideas and conclusions in science are not entirely objective
- Historical, cultural and social influences impact the practice and direction of science
- Scientific knowledge is tentative, durable and self-correcting

The nature of science (NOS) typically refers to "the values and assumptions inherent to science, scientific knowledge and/or the development of scientific knowledge" (Lederman, 1992). In fact, NOS has a multidimensional construct and is defined operationally in a number of ways by different researchers. National and international science education standards have recognized the nature of science in terms of the seven components namely: tentativeness of scientific knowledge (subject to verification and reconceptualization), observation and inference, subjectivity and objectivity, creativity and rationality, social and cultural embeddedness, theories and laws, and scientific methods. Rubba and Andersen (1978) have identified 6 postulates of nature of scientific knowledge. According to this, scientific knowledge - 1) provides people with many capabilities, but does not provide instruction on how to use them; 2) is a product of human intellect; 3) is never proven in the absolute and final sense; 4) tends toward simplicity but not to the exclusion of complexity; 5) is capable of public empirical test; and 6) is born out of an effort to understand the unity of nature

According to Karl Popper's 'Philosophy of Science', there is no absolute scientific truth. A person only perceives a relative scientific truth, which is tentative. It is 'falsify able', as well.

Scientists always search for exploring the underlying truth of the natural world. For doing this, they are guided very much by their perception of relative truth, which they develop on the basis of their background scientific knowledge of scientific principles, concepts and theories. If their perception of truth fails to explain reality of natural world, discrepancy between theory and fact may appear resulting problems. In search of the solutions of those problems, scientists formulate multiple hypotheses and testify them stepwise. Scientific investigation thus begins. This ultimately leads to 'falsification' (Popper, 1956), establishing failure of inappropriate hypotheses. Hypotheses, which are not falsified, are retained and considered as the solutions of the problem. Popper called this approach as 'error elimination', which helps scientists to realize the truth of higher degree of probability. The solutions thus emerge, though are tentative also and subject to further falsification for realizing the truth of more and more higher degree of probability. This is why science is dynamic and an ongoing activity resulting in newer and newer theories to emerge.

TEACHERS' UNDERSTANDING OF NOS

Up gradation of knowledge of science teachers is important particularly in the context of modern scientific and technical society. Science has a rapidly changing knowledge base and expanding relevance to societal issues, and teachers need ongoing opportunities to build their understanding and ability (Abell and Lederman, 2007). Professional development for science teachers should be analogous to professional development for other professionals. Becoming an effective science teacher is a continuous process that stretches from pre- service experiences in undergraduate years to the end of a professional career. But the question arises in this context: What should be the nature of science teachers' professional knowledge? Whether it should include their understanding of various dimensions of NOS as an essential component? Explanation is as follows.

Shulman (1987) has proposed a model for understanding the specialized knowledge useful for a teacher necessary to make others learn, in general. This is a widely accepted model indicating the nature of professional knowledge essential for a teacher. The knowledge, as proposed by the model, is called as pedagogical content knowledge leading to teachers' professional development. Subject content knowledge, teachers' knowledge on the nature of the discipline to be taught, students' perception of its learning etc. have been considered major components of this pedagogical content knowledge of a teacher, in general. This view is also supported by Magnussion, Krajcik, and Borko (1999). They have identified essential components of science teachers' professional knowledge. Teachers' understanding of general features of science and knowledge of students' science understanding were few among these, as considered. Anderson (1992) has proposed five components of teachers' knowledge of context namely knowledge of socio-cultural perspectives, economic perspective, subject matter perspective, psychological perspective, and philosophical perspective. This proposal is also in the same line of the considerations of the early researchers in this regard, as referred.

Views of different science educators therefore reveal that, the knowledge of philosophical perspective of science indicating the nature of the discipline is undoubtedly an essential component of professional knowledge of a science teacher, in particular, helping him in realizing the right spirit of teaching science. Now the question arises how does this understanding promote learners' value system ? This is explained in the following section.

TEACHERS' UNDERSTANDING OF NOS AND PROMOTION OF LEARNERS' VALUE SYSTEM

In fact, research on understanding the nature of science (NOS) of the teachers is receiving more and more attention of science educators. This understanding, both at the national, as well as the international level, has been considered as one of the important objectives of science education [McComas, 2008]. In the most recent science education reform movements, this understanding has also been identified as one of the critical elements of developing students' scientific literacy (Abell and Lederman, 2007). Teachers' adequate knowledge on various dimensions of the nature of science might help them in making the teaching comprehensive emphasizing on both the process and the product aspect of knowledge. Learners thus may get acquainted with various scientific information and at the same time with various process skills (recognition of a problem identifying the variables, proper analysis of it, formulation of multiple hypotheses as the probable solutions, to conduct suitable experiments for verification or falsification leading to the solution, etc, Aktamis & Ergin: 2008) to acquire those information. For example- understanding the feature that 'scientific knowledge is tentative' (Rubba and Anderson, 1978)may enable a science teacher recognize that science is dynamic by nature. With this realization, the teacher may encourage students to verify scientific knowledge through proper observation, experimentation, and inference; which are three major skills of science learning. With understanding of the nature of scientific observation that 'observation may be affected by observer's anticipation', the knowledge that 'there is multiplicity in scientific methods', and also the understanding that 'subjectivity is an essential component of scientific knowledge' (Chen, 2005) - teacher will develop favorable attitude in accepting learners' point of view encouraging learners' construction of knowledge. Teachers' recognition of the 'importance of learners' imagination' (Rubba and Anderson, 1978) may ensure greater possibility of freedom in learning science. Science teaching in this way will not remain only rule bound and mechanical. Understanding of all these will arise learners' interest in learning science to a greater extent, motivate them more strongly encouraging their spirit of scientific enquiry, cultivating a proper scientific temper. As the consequence, students may be involved more deeply in learning science, in the same way as a scientist is deeply involved in exploring underlying truth of the nature. Learners may be more critically aware and attentive in their science classes. They may participate more actively with their new ideas and imagination resulting in a more lively science class.

Therefore, teachers' understanding of various aspects of NOS, in this way will ensure a scientific value based teaching, which may incline learners towards active search of scientific knowledge reducing the possibility of mere examination oriented learning. This might also increase the possibility of encouraging skills of higher order learning including learners' creative vision leading to a joyful learning, as the consequence.In long run, their pleasure in learning science may also provide them a feeling of joy in contributing something significant for the development of society. Their aroused critical awareness in science class may enable them in recognizing various problems emerging in the present context of complex society. With their creative vision (nurtured in a science class), they may also find effective solutions of those multidimensional and critical problems. In this way their thrust for scientific knowledge will attain a social dimension developing their commitment to the nation and broad based humanitarian valuesthrough the process of

transfer of learning. This is how teachers' knowledge of NOS can promote learners' value system.But what is the present reality? Whether science teachers are having sound understanding of the nature of the construct NOS? Following review might throw sufficient light in it.

TEACHERS' EXISTING CONCEPTION OF NOS- A BRIEF REVIEW

Development of teachers' conceptions of the NOS, particularly has been a concern of science educators for several years (Carey and Smith, 1993). However, these studies have consistently shown teachers' several common misconceptions of science. For example, researchers (Aikenhead and Ryan, 1992) used the Views on Science-Technology-Society (VOSTS) instrument to assess high school teachers' viewpoints on the epistemology of science. They found that majority of the teachers were "apparently influenced by a classic but erroneous notion that many discoveries occur by accident, a notion heralded in the media and by popular writers of the history of science" (p.566). In another study, with a Likert-scale instrument Nature of Scientific Knowledge Scale (NSKS), another group of researchers (Rubba et. al., 1981) identified that teachers even teaching high secondary students tended to be neutral toward the statement of "scientific theories and laws are true beyond a doubt". It was also reported (Haidar and Balfakih, 1999) that Emirate high school teachers held mixed understanding about the nature of science. The study suggested that cultural background influence teachers' views about the nature of science. In a separate study, it was also found that (Kang et al., 2005) most Korean teachers had an absolutist/empirical perspective of the nature of science. Trainee teachers' conceptions of the NOS remained unchanged over the year despite their participation in the project-based, hand-on science refresher course- which was also a major finding of researchers (Moss et al., 2001) in this regard.. However, another related study in this area (Khishfe and Khalick, 2002) identified that an explicit and reflective inquiry-oriented approach was more effective than an implicit inquiry-oriented approach in promoting NOS conceptions. Studies on teachers' views on the NOS revealed that teachers held many naive views (Clough, 1997). For example, these studies reported that majority of teachers believed that scientists follow a receipt so called scientific method in their investigation and scientific models are copies of reality rather than human invention. In addition, they overlook the role of creativity and imagination in science.

Review therefore reveals that in spite of the necessity of understanding the nature of science, a major number of existing studies on science education indicate science teachers' poor perception of NOS. This poor understanding of teachers may be one of the probable causes for which learners fail to perceive the true nature of learning science and also to recognize socio cultural aspects of science that science is for the benefit of society and human being. This failure may lead to one type of value crisis of learners, particularly in the present context of technicalities and complexities of the modern scientific society.

CONCLUSION

Discussion therefore explains the construct 'nature of science' in details. It reveals that, scientific knowledge is never absolute or certain. This knowledge, including facts, theories, laws etc. is rather tentative. It is subjective, as well. Nature of learners' scientific enquiry and that of scientific investigation of scientists are similar, creative components exist in both of them.. Teachers' understanding of this construct is essential leading to an effective knowledge construction by learners in science encouraging their creativity. Values of science, in this way may

be emphasized on by a science teacher through his day to day classroom teaching. This inclusive approach of value education is essential in the modern context of 'knowledge economy' where lies the relevance of this traditional aspect of knowledge, even in the modern context of technical society. Available studies indicate teachers' poor understanding of NOS. Role of effective design of teacher education program therefore is necessary in order to facilitate this functional knowledge of science teachers and its proper utilization through effective action in order to promote learners' value system in the domain of science as an immediate outcome leading to development of broad based social values as a long run goal.

REFERENCE

[1] Abell, S.K. & Lederman, N.G. (2007). Handbook of Research on Science Education, Lawrence Erlbaum Associates : N. Jercy.

[2] Aikenhead, G. S., & Ryan, A. G. (1992). The development of a new instrument: "Views on science-technology-society" (VOSTS). Science Education, 76, 477-491.

[3] Aktamis, H., & Ergin, O. (2008). The effect of scientific process skill education on students' scientific creativity, scientific attitude and academic achievement. Asia Pacific Forum on Science Learning and Teaching, 9(1), article-4.

[4] Carey, S. & Smith, C. (1993). On understanding the nature of science knowledge, Educational Psychologist, 28(3), 235-251, Lawrence Erlbaum Associates, Inc.

[5] Chen, S.(2005). Development of an instrument to assess views on nature of science and attitude toward teaching science, Wiley inter science. Retrieved from http./www. interscience. wiley. com/ on 2.1.12.

[6] Clough, M. P. (1997). Strategies and activities for initiating and maintaining pressure on students' naive views concerning the nature of science, Interchange, 28, 191-204.

[7] Dass, P.M. (2004). New science coaches: preperation in the new rules of science education. In J, Weld. (Eds).Game of Science Education, Pearson Education, Inc. Allyn and Bacon : Boston.

[8] Driver, R., Osoko, H., Leach, J., Mortimer, E., and Scott, P. (1994). Constructing Scientific Knowledge in the class room. Educational Researcher, 23(7), 5-12.

[9] Haidar, A. H. & Balfakih, N. M. (1999) United Arab Emirates science students' views about the epistemology of science. Paper presented at the annual meeting of the national association for research in science teaching, Boston, MA.

[10] Kang, S., Scharmann, L.C. & Noh, T. (2005) Examining students' views on the nature of science: results from Korean 6th, 8th, and 10th graders. Science Education, 89, 314-334.

[11] Khishfe, R. & A.B.D.-El-Khalick, F. (2002) Influence of explicit and reflective versus implicit inquiry-oriented instruction on 6th-graders' views of nature of science. Journal of Research in Science Teaching, 39, 551-578.

[12] Lederman, N. G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. Journal of Research in Science Teaching, 29, 331-359.

[13] Lederman, N.G. (2007). Nature of science: Past, present, and future. In S. K. Abell & N. G. Lederman (Eds.), Handbook of research on science education (pp. 831-880). Mahwah, NJ: Lawrence Erlbaum.

[14] Lee, K. H. (2002). Creative thinking in real world situations in relation to gender and education of late adolescents. Korean Journal of Thinking and Problem Solving, 12, 59-70.

[15] McComas, W. F. (2008). Proposals for Core Nature of Science Content in Popular Books on the History and Philosophy of Science: Lessons for Science Education. In Lee, Y. J. & Tan, A. L. (Eds.) Science education at the nexus of theory and practice. Rotterdam: Sense Publishers.

[16] Meador, K.S. (2003). Thinking creativity about science – suggestions for primary teachers. Gifted Child Today, 26(1), 25 – 30.

[17] Morten, P.K. and Vanessa, K. (2007). Creativity in science education: Perspectives and challenges for developing school science. Retrieved from http://www.redorbit.com/news/science/915320/creativity in science education ..../ visited on February 5, 2009.

[18] Moss, D. M., Abrams, E. D., & Robb, J. (2001) Examining student misconceptions of the nature of science. International Journal of Science Education, 23, 771-790.

[19] Mukhopadhyay, R. (2011). Scientific creativity : its relationship with study approaches, aptitude in physics, and scientific attitude. Unpublished Ph.D Thesis, Department of Education, University of Calcutta.

[20] Neo, M., Neo, T-K. & Xiao-Lian, G.T. (2007). A constructivist approach to learning in interactive multimedia courses: Malayasian students' perspectives. Australasian Journal of Educational Technology, 23(4), PP: 470–489. Retrieve from http//www. ascilite.org.an/ajet/ajet23/r visited on October 9, 2012.

[21] Popper, K.R. (1959). The Logic of Scientific Discovery. N. York : Crown.

[22] Rubba, P.A., & Andersen, H. (1978). Development of an instrument to assess secondary school students' understanding of the nature of scientific knowledge. Science Education, 62(4), 449-458.

[23] Rubba, P.A., Horner, J. & Smith, J.M. (1981). A study of two misconceptions about the nature of science among junior high school students. School Science and Mathematics, 81, 221-226.

[24] Shulman, L. (1987). Knowledge and teaching: Foundations of new reformed, Harvard Educational Review.

[25] Some Specific Issues and Concerns of Teacher Education (2004). Discussion Document, NCTE, New Delhi.

An obstacle avoidance algorithm using fuzzy neural network

Soumalik Roy, Kaushik Mitra and
Prity Gupta,
Department of Computer Science,
St. Xavier's College, Kolkata, India.

Prof.Anal Acharya,
Assistant Professor
Department of Computer Science,
St. Xavier's College, Kolkata, India.

Key words : *Neural network, defuzzification, Mobile robot navigation, backpropagation, magnetometer.*

Abstract

An Autonomous Robot is an intelligent vehicle which is capable of travelling to unknown and unstructured environments independently. The common approaches for handing the navigation problem of a mobile robot is the simple fuzzy reactive approach. This approach, however, suffers from two primary problems, i.e., escaping from trap situations and the combinatorial explosion of the if-then rules in the inference engine.This paper presents a neuro-fuzzy approach for robot navigation. The proposed idea greatly reduces the number of if-then rules by introducing weighting factors for the sensor inputs, thus inferring the reflexive conclusions from each input to the system rather than putting all the possible states of all the inputs to infer a single conclusion.Three simple neural networks are used to determine the weighting factors. Each neural network is responsible for determining the weighting factor for one sensor input. Simulation results are presented to demonstrate the merits of the proposed system.

1. Introduction

There have been numerous researches during the last decade regarding navigation of mobile robot in unknown and unstructured places and places where we cannot rely on GPS for navigation. For example in indoor navigation we cannot use GPS since GPS has an accuracy tolerance of about 10 meters. In such situations the mobile robot has to solely rely on the sensor based data and the information that it acquired from its past experience to determine the appropriate control actions to the actuators.The robot is usually required to find out a safe path from the stating location to the end point (destination) in real time. Consequently the main issues that are to be addressed are reactive obstacle avoidance and target acquisition.

Classical mechanisms for robot control can only work for a specific domain and sometimes in known environments, for example industrial mobile robots where the environment is known beforehand. However uncertainty of the environment is a major problem in mobile robot navigation and the robot has to deal with such situations precisely and robustly.Currently soft computing paradigms have provided a powerful tool to deal with robot navigation. Among the soft computing techniques, fuzzy logic based decision making and neural networks have been found fit for this purpose.Fuzzy systems are tolerant to noise and error in the information coming from the sensory

system, and most importantly it is a factual reflection of the behavior of human expertise. However,fuzzy logic rules cannot be adjusted or tuned on real-time operation, and the off-line adjustment of their parameters is a time consuming process.

A new grid-based map model called "memory grid" and a new behavior-based Navigation method called "minimum risk method" was proposed by [1]. An integrated fuzzy logic and genetic algorithmic approach was presented by [2]. Several successful navigation approaches based on fuzzy logic has been suggested in the references.[3-10]. Recently the role of neural networks has been found to be very useful and effective when integrated with fuzzy control systems to produce what is called Neuro-fuzzy systems, and sometimes called fuzzy neural networks.Neuro fuzzy systems have the capability to mimic human experts as in fuzzy logic, and learn from previous experience capability as in neural networks.

In our proposed algorithm we use neuro-fuzzy logic to determine the angle to rotate when faced with an obstacle. This angle varies as the distance from obstacle varies. Thus, we set definite movements for different scenarios.Also, the target angle is used to make sure that the robot moves in such a way that it will reach the target direction (angle), after it has avoided an obstacle. Thus, we use a more controlled approach than conventional ways.

2. RESEARCH METHODOLOGY

Fig1 shows the flow of the main algorithm Neuroid. The algorithm Neuroid takes the current angle and sensor values as inputs. Using these two values, Neuroid generates the 'Collision Factors' via the Neural Network. After this step these Factors are passed to the Defuzzyfier to get back the 'Angle of rotation'.Neuroid then generates the appropriate commands which is sent to the vehicle/robot via Arduino(which controls the motors).

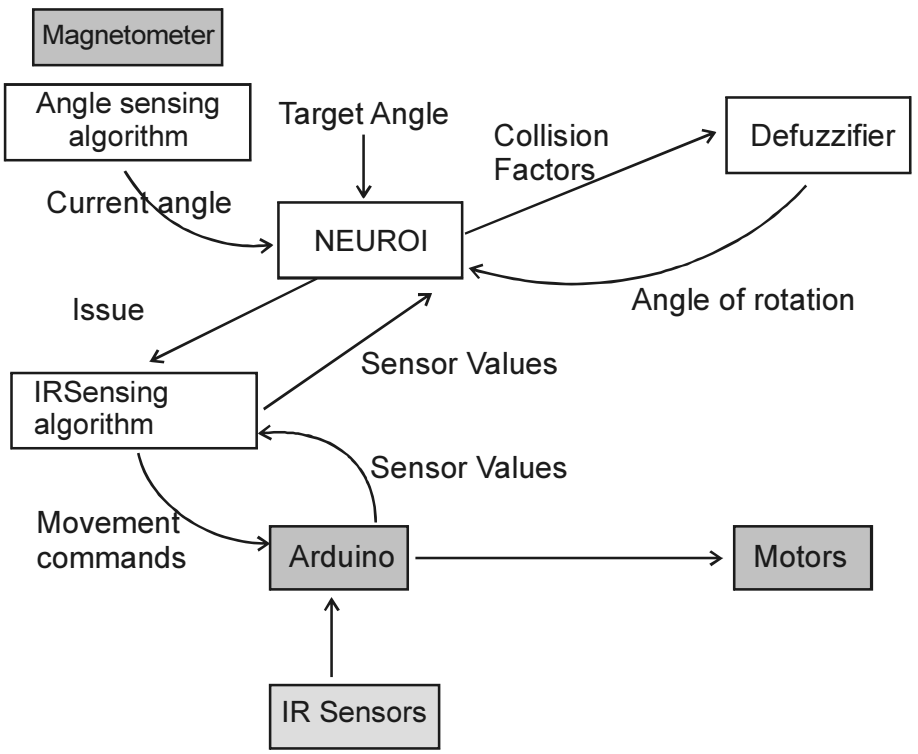


Fig. 1. Main algorithm

3. STRUCTURE OF THE NEURAL NETWORK

The main purpose of the Neural Network is to generate the collision avoidance factors. This is done by learning to associate the Sensor values(Inputs to the Neural Net) with the corresponding class of collision avoidance factors.The Structure of the Neural Network is shown below Fig 2.

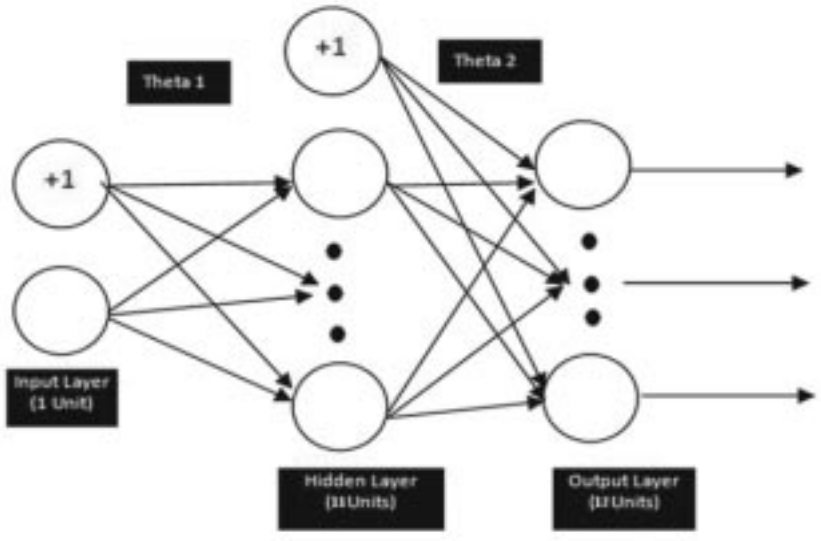


Fig. 2 : Structure of the Artificial Neural Network showing Input, Hidden and Output layers respectively

A Neural Network is trained for each of the three sensors(left, center and right). The trained weights (Thetas) are stored in separate files. These files are accessed by the algorithm to predict the class of collision factors for current input in real time/at runtime.A total of 12 classes have been used for collision factors ranging from 0 to 1, where 0 denotes low collision avoidance and 1 denotes high collision avoidance.Supervised learning method has been used and the Neural Network has been trained using back-propagation algorithm.

We divide the dataset in 2 parts. The algorithm for learning has the following terms and assumptions:

- The Inputs called Features (X), where X is given as :-

$$X = \begin{bmatrix} -(x^{(1)})^T - \\ -(x^{(2)})^T - \\ \vdots \\ -(x^{(m)})^T - \end{bmatrix}$$

Where $x^{(i)}$ is the i^{th} training example.

- The Labels (Y), where $y^{(i)}$ represents the Labels for i^{th}training example $x^{(i)}$.Also there are the Weight matrices called (θ_{ij}) such that (θ_{21}) represents the weights that control the activation values of layer 1 which are going in the neurons in layer 2.

We now train the Neural Network using the above dataset.Our aim is to come up with such a set of Theta matrices which will minimize the error,ie, deviation of actual output of the network and the given outputs should be minimum.

We use the following cost function :

$$J(\theta) = \sum_{k=1}^{m} \left[-y_k^{(i)} \log((h_\theta(x^{(i)}))_k) - (1 - y_k^{(i)}) \log(1 - (h_\theta(x^{(i)}))_k)\right]$$

Where λ is the regularization parameter, $J(\theta)$ is used in the back-propagation algorithm

The back-propagation algorithm is as follows:

Training set $\{(x^{(1)}, y^{(1)}), \ldots, (x^{(m)}, y^{(m)})\}$
Set $\triangle_{ij}^{(l)} = 0$ (for all l, i, j).
For $i = 1$ to m
Set $a^{(1)} = x^{(i)}$
Perform forward propagation to compute $a^{(l)}$ for $l = 2, 3, \ldots, L$
Using $y^{(i)}$, compute $\delta^{(L)} = a^{(L)} - y^{(i)}$
Compute $\delta^{(L-1)}, \delta^{(L-2)}, \ldots, \delta^{(2)}$
$\triangle_{ij}^{(l)} := \triangle_{ij}^{(l)} + a_j^{(l)} \delta_i^{(l+1)}$

$$D_{ij}^{(l)} := \frac{1}{m} \triangle_{ij}^{(l)} + \lambda \Theta_{ij}^{(l)} \text{ if } j \neq 0$$
$$D_{ij}^{(l)} := \frac{1}{m} \triangle_{ij}^{(l)} \text{ if } j = 0$$

$$\frac{\partial}{\partial \Theta_{ij}^{(l)}} J(\Theta) = D_{ij}^{(l)}$$

Where $\sum_{i=1}^{m}$ = "error" of node *j* in layer *l*.

Here 'm' is the size of training set.'D' is the partial derivative of J(θ), i.e. the gradient of J(θ).'a' is the activation values of units in each layer, where a^1 represents the activation values of units in layer 1.

The back-propagation algorithm is executed for all the layers.We then use gradient descent or other advanced optimization methods with back-propagation and try to reduce cost J(θ) as a function of parameters θ.

3.1 MEGNETOMETER SENSOR

A magnetometer is a measuring instrument used to measure the strength and, in some cases, the direction of magnetic fields. In our algorithm the magnetometer has been used to reposition the prototype to its target direction whenever it deviates from its target path.

Our algorithm has two objectives:

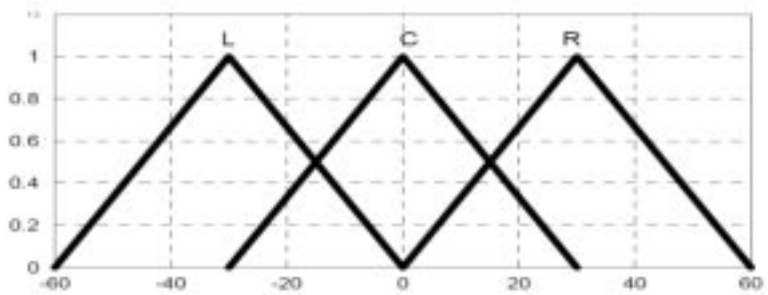
- Avoid static obstacles
- Move towards target direction(denoted by angle in degrees)

TThe 2nd objective i.e., "moving towards target direction", needed some mechanism to know the current direction of movement. This sense of direction is given by a simple Magnetometer. When obstacles are far away our proposed algorithm checks/measures the deviation between the current angle and the target angle. If this deviation goes above a certain threshold, then the algorithm makes sure that the prototype is rotated towards the target by some degree.This feature of the proposed algorithm also ensures that, even if the prototype is not moving in a straight line, the direction is adjusted automatically,provided obstacles are not in detection range.

3.2 DEFUZZIFICATION

Defuzzification is the process of finding one single crisp value that summarizes the fuzzyset that enters it from the inference block. In this algorithm the three fuzzy collision avoidance factors (L,C,R) are taken as input to find the crisp value for the steering angle. The defuzzifier system receives the Collision avoidance factors from the three neural networks (Left,Right and Centre Sensors) and the magnetometer value (i.e current deviation from the target) as input. It produces as output the steering angle θ which is calculated using the centre of area method of defuzzification.

The collision avoidance factors are values in the range 0 to 1 representing very low and very high chances of collision respectively.The defuzzifier receives the three weighting factors coming from the previous neural network subsystems, and checks whether the chances of collision are minimum (i.e collision avoidance factor >.75 for all 3 neural networks). If so then it uses the magnetometer to produce a value θ which adjusts the robot towards the target direction. Otherwise if there are any obstacles in the robot's path, then one or more of the three neural networks produce a low Collision avoidance factor<.75 and so the defuzzifier aims to produce a value to avoid such obstacles. It uses the Center of Area method to obtain the final crisp value for the steering angle of the robot. The membership functions for the fuzzy values of the output variable are shown in Figure 3.



Defuzzifier accepts the fuzzy membership values and outputs a crisp value for the steering angle.

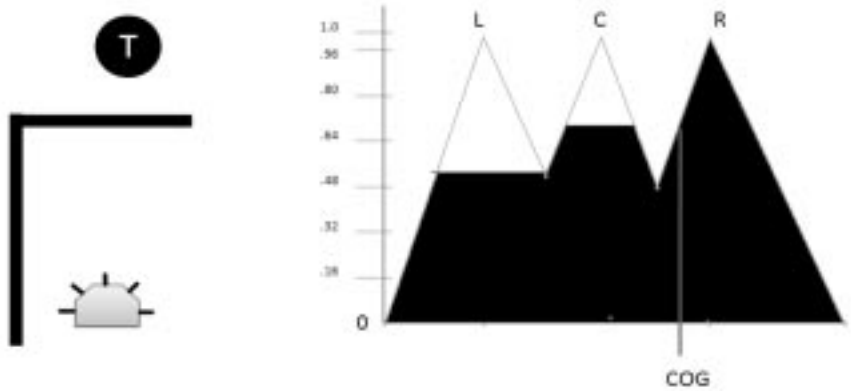


Fig. 4. . *A* ne Center of Gra e (i.e. directs the robot to move right)

3.2 STRUCTURE OF PROTOTYPE USED FOR EXPERIMENT

Fig 5 shows the structure of the prototype developed for testing the Neuroid Algorithm. The Front

view shows the IR sensors that were used for sensing obstacles and the Top view shows other components used namely – Motor driver IC, 9v battery, smart-phone (for Magnetometer) and Arduino Microcontroller.

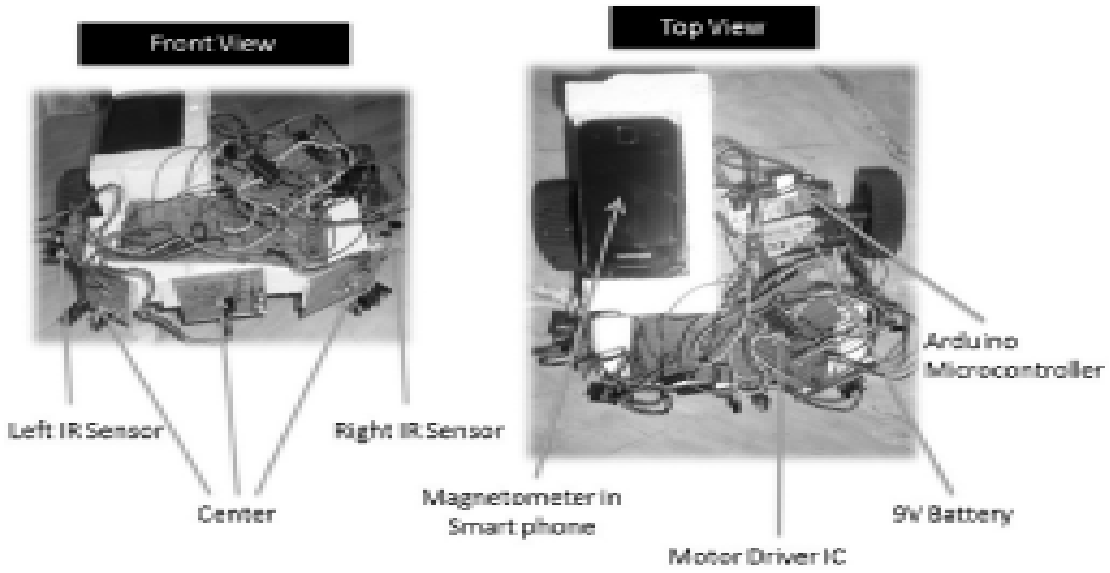


Fig.5. : Structure of the prototype

4. EXPERIMENTAL RESULTS ON PROTOTYPE

The prototype requires a 'Target' degree, which is externally fed into the program. The program that follows the Neuroid algorithm runs on a system(a laptop) which is connected to Arduino and the smart-phone. It is this main program that does calculations and generates movement commands.

The following tests were done with the prototype under different conditions (i.e., different obstacles), the results were fairly successful.

4.1 CASE 1: NO OBSTACLE

When there are no obstacles in the vicinity of the robot, the goal of our algorithm is to turn it towards the 'Target' direction. The algorithm calculates the deviation of the robot from the 'Target' and determines whether rotation should be clockwise or anti-clockwise. As shown below in Fig.6, in Case 1 the rotation is clockwise. Our algorithm rotates the robot by a small degree (10 degrees), this ensures that obstacles which are currently not visible by the sensors, but will hinder the path of the robot after rotation, can be detected and avoided.In Case 1 there are no further obstacles in the robot's path after rotation, so the robot moves towards the 'Target'.

For Position 1 there is no obstacles so it tries to move towards target resulting position 2 and hence the Center of Gravity/Center of Area is at centre and it tries to move toward target.

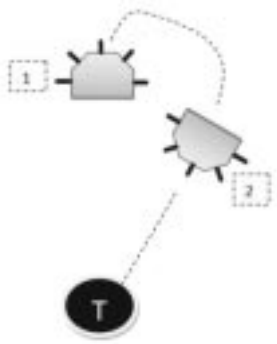


Fig. 6 : Path taken by the prototype when there is no obstacle

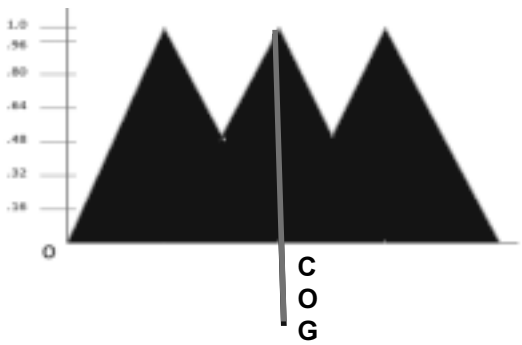


Fig. 7 : Steering angle output value = 0°for position 1

4.2 CASE 2: L SHAPED OBSTACLE

In this scenario shown inFigure [8],the robot first detects the left and top sides of the L-shaped obstacle, the algorithm generates an angle of rotation accordingly. The graph in Figure [9] shows the shift in the Center of Area towards the right and hence rotation is towards right.After rotation, the robot moves to position 2. Here it encounters obstacles at the left and top left sensors so it again rotates by some angle.

The robot now moves into position 3 where it senses no obstacles and hence the goal now is to rotate and move towards Target. The graph in Figure [10] shows the position of Center of Area at position 3.

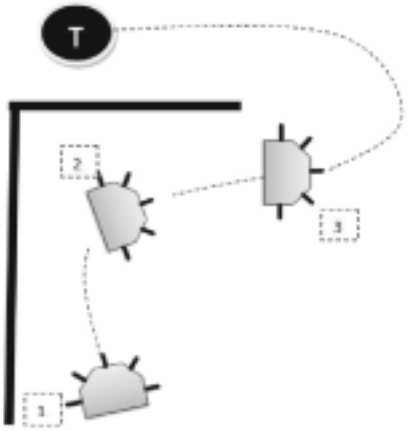


Fig. 8 : patu taken byprototype for an L haped obstacle.

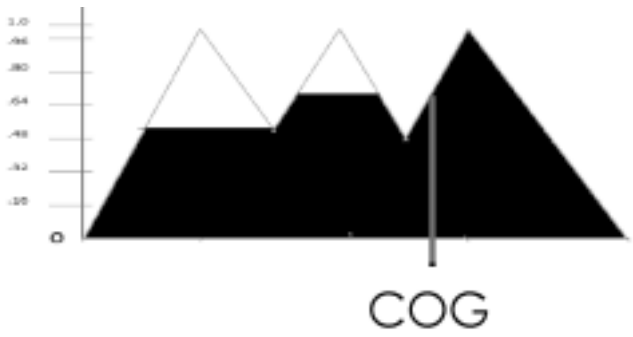


Fig. 9 : steening angle =+ve for in centre and night (portion)

Fig. 10 : steening angle =0 for no obstacles (portion 3)

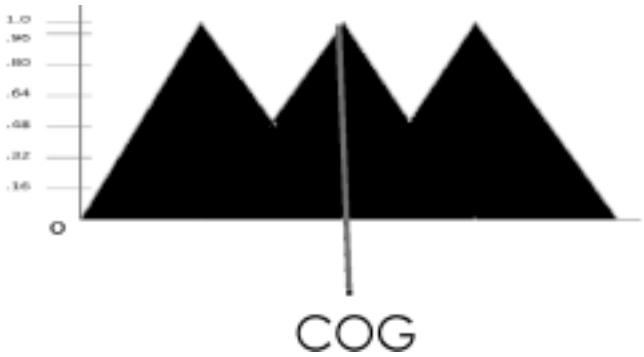


Figure 9 shows that in position 2 that there is obstacle in left and right and hence the Center of Gravity/Center of Area shifts towards the right. Defuzzifier outputs a positive angle (i.e. directs the robot to move right).Figure[10]is for Position 3 where there is no obstacles so the Center of Gravity/ Center of Area is at centre and it tries to move toward target.

4.3 CASE 3: INVERTED V- SHAPED OBSTACLE:

In this case (Fig[11])as the robot approaches the Inverted V-shaped obstacle, the left and top sensors sense the obstacle, the Center of Area shifts towards the right, hence the robot rotates towards right at position 2.

The robot now moves to position 3, where it senses no obstacles and hence the goal of the algorithm is to move towards the target. For Position 1 (Fig[12])there is no obstacles so the Center of Gravity/ Center of Area is at centre and it tries to move toward target.

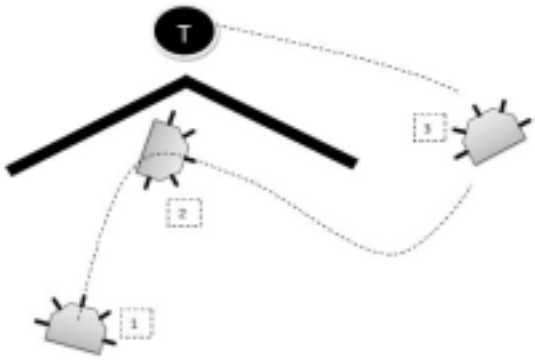


Fig. 11: Path taken by the prototype for inverted V

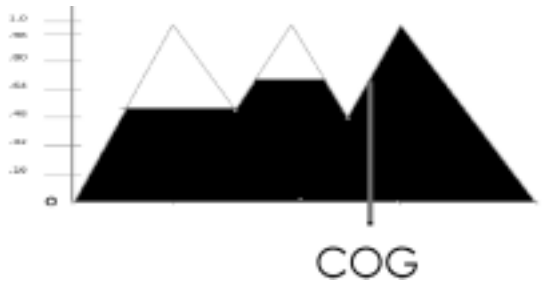


Fig. 13 : Steering angle = 0 for obstacles in centre and left

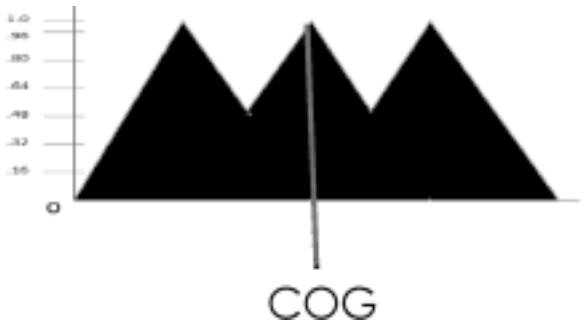


Fig. 12 : Steering angle = 0 for no obstacles (position 1)

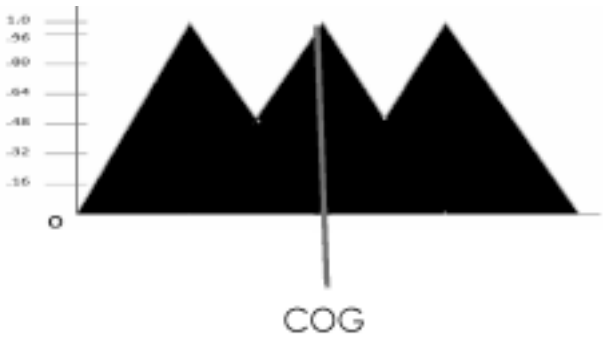


Fig. 14 : Steering angle = 0 for no obstacles position 3]

5. CONCLUSION AND FUTURE WORK

The above test results indicate that the algorithm Neuroid works satisfactorily and the results are acceptable.For sensing obstacles, the hardware used was a single IR transmitter-receiver pair for each direction left, right and center, so the accuracy can be increased using more such sensor pairs.We have assumed the obstacles to be static, which means that in case of moving objects the accuracy will be low.The Learning method used for the neural networks was supervised learning, which means that the networks were presented with training data sets and this was done manually.

Neuroid algorithm can be further improved in the following ways :

- We can use more number of sensor pairs for added accuracy. We can also use other sensors like SONARS which will enable the robot to sense obstacles that are farther away and will also be more accurate.
- We can improve our obstacle avoidance algorithm to work with dynamic or moving object.
- We can modify the learning mechanism to learn in unsupervised mode, by which the robot will learn on its own while it is on the move, though this process may require some supervision. For example, we can start with an unlearned network and while the robot is moving we would supervise its movements by telling or issuing a command whether it should follow the current course or not. In this way we can improve its flexibility though it will increase its complexity.
- Our algorithm enables a way for indoor navigation of the robot. Indoor navigation is currently a research topic for smart devices like smart phones, etc.

·"Neuroid" can be improved to solve mazes by arming it with some maze solving algorithms.

References

- M. Wang, J. Liu, "Fuzzy logic-based real-time robot navigation in unknown environment with dead ends". Robotics and Autonomous Systems, Vol. 56, 2008,pg 625–643.
- M. Begum, G. Mann, R. Gosine, "Integrated fuzzy logic and genetic algorithmic approach for simultaneous localization and mapping of mobile robots". Applied Soft Computing, Vol. 8, 2008,pg 150–165.
- J.-S. Chiou, K.-Y. Wang, "Application of a hybrid controller to a mobile robot". Simulation Modelling Practice and Theory, Vol. 16, 2008, pg 783–795.
- D. Bajaj, M.H. Ang, "An incremental approach in evolving robot behavior". Proc. of Sixth Int. Conf. on Control, Automation, Robotics and Vision, ICARCV, 2000.
- J.G. Ortega, E.F. Camacho, "Mobile robot navigation in a partially structured static environment, using neural predictive control". Control Eng. Practice, Vol. 4, No. 12, 1996, pg 1669-1679.
- R.K. Pal, A. Kar, "Mobile robotnavigation using neural net". Proc. IEEE Int. Conf. Robotics Automation, 1995, pg 1503-1508.
- P. Reignier, G. Hansen, J.L. Crowley, "Incremental supervised learning for mobile robot reactive control". Robotics and Autonomous Systems, Vol. 19, 1997, pg 242-257.
- J. Tani, N. Fukumura, "Self-organizing internal representation in learning of navigation: A physical experiment by mobile robot YAMABICO". Neural Networks, Vol. 10, No. 1, 1997, pg 153-159.
- J. Tani, "Model-based learning for mobile robot navigation from the dynamic systems Perspective". IEEE Trans. System, Man, and Cybernetics, Pt. B, Vol. 26, No. 3, 1996, pg 421-436.
- N. Tschichold-Gurman, "The neural network model rule net and its application to mobile robot navigation". Fuzzy Sets and Systems, Vol. 85, 1997, pg 287-303.

A Simple Approach For Recognition of Geometrical Shapes Using Fuzzy Logic

Jayati Ghosh Dastidar, Sovan Ojha, Dipanjan Bhowal, Soumen Pal
Post Graduate Department of Computer Science, St. Xavier's College, Kolkata

Abstract:

This paper presents a simple method to recognize uni-stroke sketches of geometric shapes. It uses global geometric properties of figures to recognize a simple vocabulary of geometric shapes. The geometric features used (convex hull, smallest-area, regular polygons, perimeter and area scalar ratios) are invariant with rotation and scale of figures .This method can be used with acceptable recognition rate.

1. Introduction

Recognition of hand-drawn geometric shapes has garnered new attention with the widespread adoption of Personal Digital Assistants (PDAs). While conventional off-line approaches to recognition of geometric figures have long focused on raw classification performance, on-line systems raise a different set of issues. First, geometric figures in CAD drawings are input precisely either by human drafts-people or through computer peripherals. Recognizing these shapes deal mainly with noise introduced by sources outside the process, such as copy degradation or poor photographic reproduction. In online applications however, the noise is inherent to the process of information gathering and shapes are often sketched poorly due to media, operator and process limitations, yielding imperfect and ambiguous shapes that even humans find difficult to distinguish.

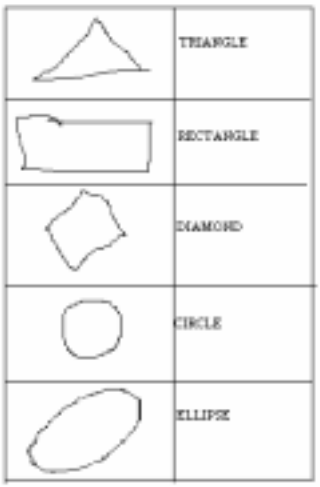


Fig 1.- Uni-stroke geometric shapes

2. The Recognition Technique

The recognition method is based on three main ideas.

First, it uses entirely global geometric properties extracted from input shapes. Since we are mainly interested in identifying geometric entities, the recognizer relies mainly on geometry information.

Second, to enhance recognition performance, we use a set of filters either to identify shapes or to filter out unwanted shapes using distinctive criteria.

Third, to overcome uncertainty and imprecision in shape sketches, we use fuzzy logic to associate

degrees of certainty to recognized shapes, thereby handling ambiguities naturally.

This algorithm recognizes elementary geometric shapes, such as Triangles, Rectangles, Diamonds, Circles, Ellipses, and Lines. Shapes are recognized independently of changes in rotation, size. Input shapes must be drawn using a single stroke. The recognizer works by looking up values of specific features in fuzzy sets associated to each shape.

3. Geometric Features Selection

We start the recognition process by collecting data points using a digitizing tablet, from the first pen-down event until a set timeout value after the last pen-up. Next, we compute the convex hull of the set of input points thus collected using Package's Wrap algorithm. We use the convex hull to compute two special polygons. Using a simple three-point algorithm we identify the largest-area triangle that fits inside the convex hull and the enclosing rectangle with minimum area. Finally, we compute the area and perimeter of each polygon to estimate features and degrees of likelihood for each shape class

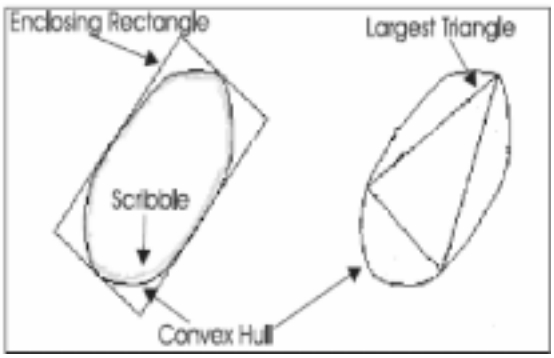


Fig 2.- Polygon used to estimate geometric features

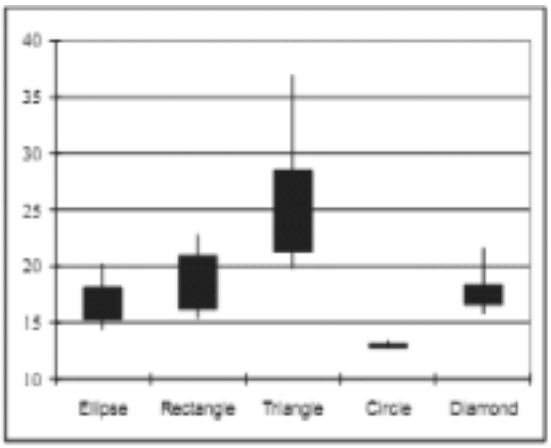


Fig. 3a : Thinness ratio for circle

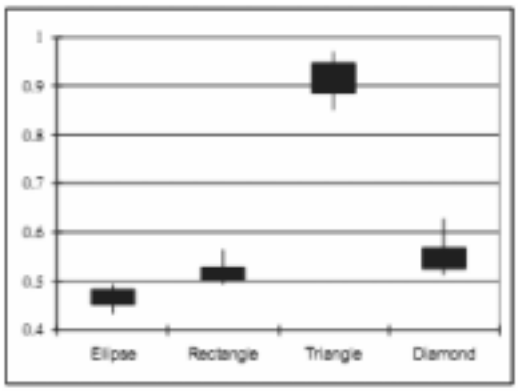


Fig-3b : Alt/Ach ratio

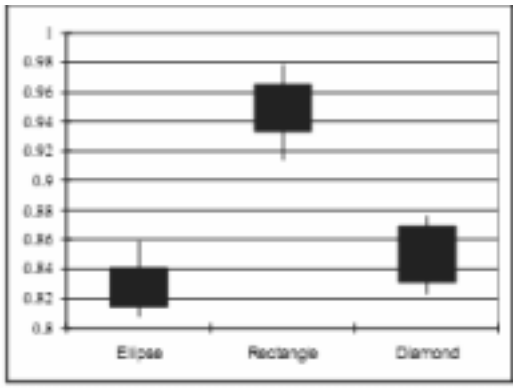


Fig 3c : Pch/Per ratio

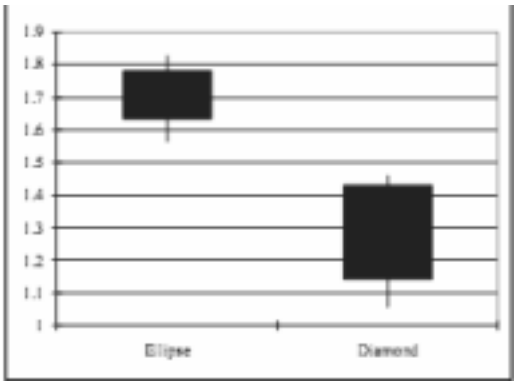


Fig 3d : Ach^2/(Aer*Alt) ratio

To distinguish circles and straight lines from other shapes we use the Thin-ness ratio (Pch^2 /Ach), where Ach is the area of the convex hull, and Pch^2 is its perimeter squared. The thinness of a Circle is minimal, since it is the planar figure with smallest perimeter enclosing a given area, yielding a value near 4π (see Fig.3.a).

We identify triangles by comparing the area of the largest triangle (Alt) that fits inside the convex hull to that of the convex hull. The Alt/Ach ratio will have values near unity for Triangles and smaller values for other shapes (see Fig.3.b).

Similarly, let Per be the perimeter of the enclosing rectangle. For rectangular shapes this perimeter will be very close to the convex hull's (see Fig. 3.c), thus we use Pch/Per to distinguish Rectangles from ellipses and diamonds.

We have found ellipses and diamonds the hardest to distinguish. We use a more complex ratio involving the convex hull and the largest enclosed tri-angle and rectangle areas. The ratio Ach^2 / (Aer*Alt) allows us to distinguish Ellipses which maximize it from diamonds which exhibit a smaller ratio (see Fig. 3.d). Because diamonds take up about two times the area of a triangle, an area ratio (Alt/Aer) under 50% means the object is a Diamond, otherwise the shape is not recognized. We should probably limit recognition of diamonds to constrained (non-rotated) shapes, for which the relationship above clearly holds.

4. USE OF FUZZY LOGIC.

The recognition method starts by collecting points from the input image and computing some important polygons. Using these polygons area and perimeter we compute values for features selected as described in the previous section. We use fuzzy sets associated with each feature to classify the shape class(es). These sets were derived from percentile graphics like the ones shown in Fig 3(a, b, c & d). We identify shapes drawn by computing their degree of membership (dom) using the fuzzy sets associated with each feature. If several shapes are identified, the recognizer returns all classifications ordered by degree of certainty. The following diagram (fig-5) depicts how fuzzy sets are used to recognize uni-stroke geometric shapes.

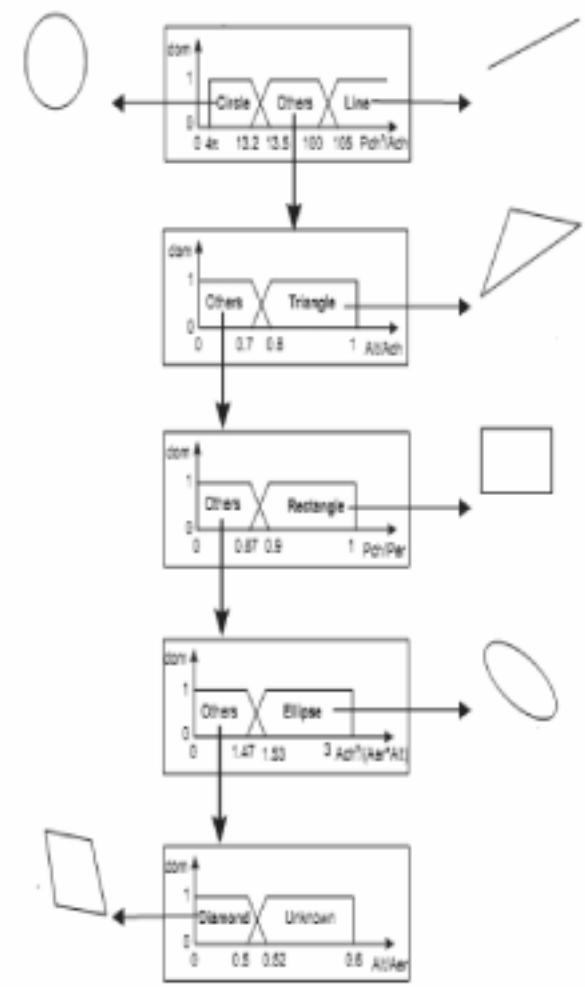


Fig. 4 : Decision Tree and Fuzzy Sets

5. RESOLVING AMBIGUITY

Taking into account the shapes identified by the recognizer, we present four special cases which can yield ambiguous results. These cases are presented in Fig.6.

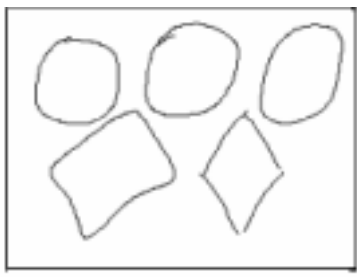


Fig 5 : Ambiguous Shapes

The ambiguities between shapes are modeled naturally using fuzzy logic to associate degrees of certainty to recognize shapes. For solving these ambiguous cases it is required to draw a largest area quadrilateral that fits inside the hull. Area of this quadrilateral is represented by Alq. Fig 6 illustrates corresponding fuzzy sets for the ambiguous cases shown in fig 5.

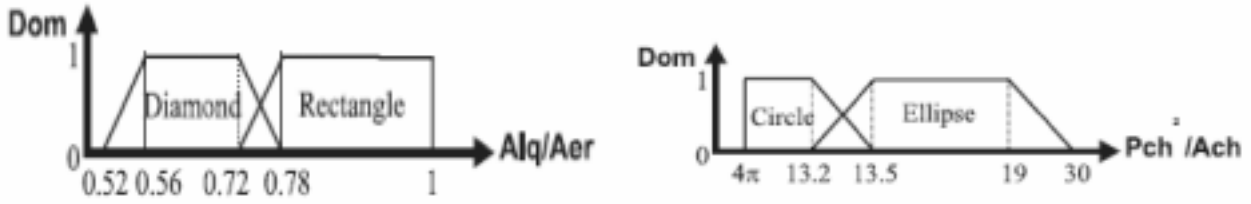


Fig-6 : Fuzzy sets representing ambiguity cases

In fuzzy logic, the inference rules are written in simple 'If else then' statements. Now the inference rules can be used to recognize the diamond from ambiguous shapes as follows

IF Alt/Alq IS LIKE Diamond AND

Alq/Ach IS NOT LIKE Ellipse AND

Alq/Aer IS NOT LIKE Rectangle

THEN

Shape IS Diamond

6. FUTURE SCOPE OF WORK

We have described a simple and fast recognizer for elementary geometric shapes. Our motivation is not to develop a foolproof method, but rather to provide a tool that will aid users in drawing geometric shapes interactively.

An application may be developed used for drawing dfd's or ERDs or flowcharts. This work can be extended to recognize other shapes, and even in recognizing characters and 3-D shapes.

References :

1. Computer Vision and Shape Recognition. By, Adam Kszyzak & T. Kasvand.
2. Fuzzy models for pattern recognition By James C. Bezdek and Sankar K. Pal.
3. Using fuzzy logic to recognize geometric shapes interactively, Fonseca, M.J. Dept. de Engenharia Inf., IST/UTL, Lisbon, Portugal Jorge, J.A., Fuzzy Systems, 2000. FUZZ IEEE 2000. The Ninth IEEE International Conference on (Volume:1
4. Shape Specification in Design Using Fuzzy Logic, Binh Pham, Research Centre for Intelligent Tele-imaging, School of Information Technology & Mathematical Sciences, University of Ballarat, PO Box 663 Ballarat VIC 3353 Australia
5. Fuzzy Sets For Geometric Shape Recognition in Triangular Meshes, Luca Di Angelo, Paolo Di Stefano Anna Eva Morabito, 01/2007; In proceeding of: IPMM 2007

———————————

Cell Phone/PC Controlled Home Automation System

Aparajita Datta#,Subhayan Bhattacharya#, Boris Biswas#, Debopam De#,
Sushmita Pramanik# and Rana Biswas*
Department of Computer Science, St.Xavier's College (Autonomous), Kolkata-700016,India

Abstract

It becomes very annoying at times to turn on or off switches. However switching on and off remains an integral part of controlling any electronic device. The switches have changed in shape, size and use, but one thing remains common to all switches till date, they have to be operated manually.

Introduction :

The aim of this project is to be able to turn on or off any electronic device from any distance where cell phone connection is available. Thus it is an effort to bring automation into switches.We can also assign different functions to each switch. For example it can be used in a security system if we use a web cam with the help of this automation system.We can also handle any electrical gadget at any remote place for any useful purpose such as any small industry. As many switches can be handled with this system, if we assign a particular function for each switch an industry can be handled with less human resource, moreover it can save much more energy.

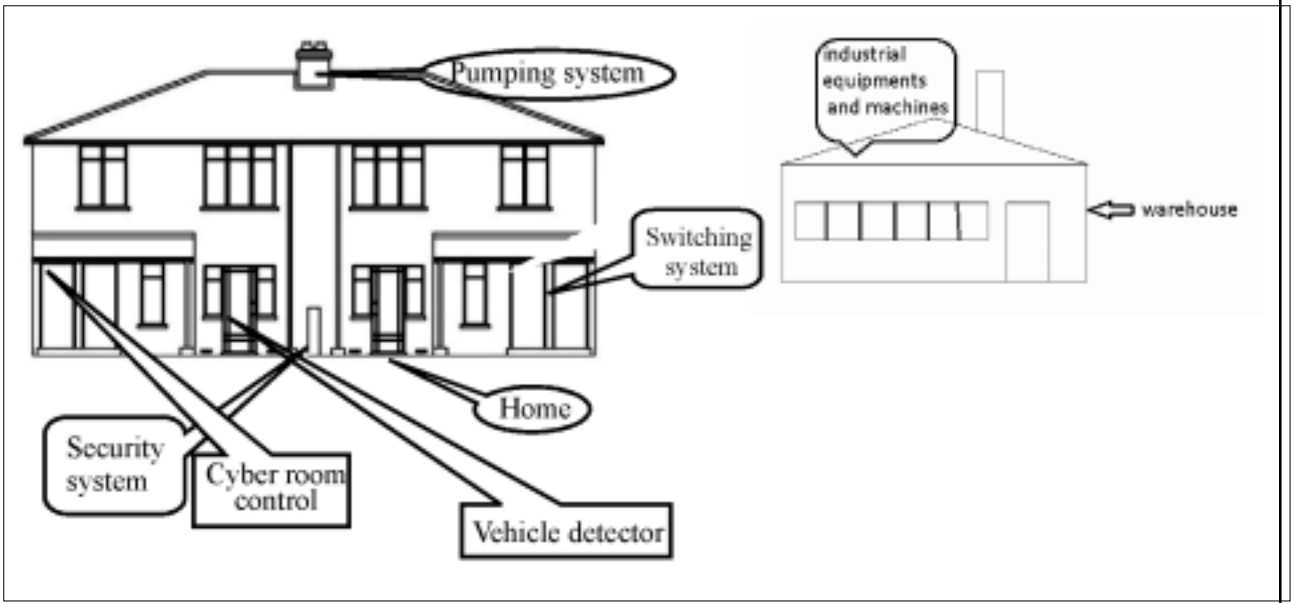


Figure 1 : overall function of the system. Different functions of the home are being handled by a single wireless device(cell phone) and the functions of warehouse and agricultural field are also handled by that device .

Components Used :

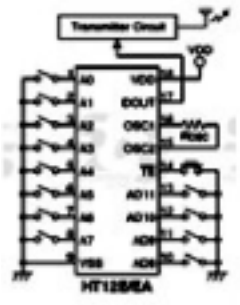


Figure : 2

1. Encoder HT12E(Figure 2): HT12E is an encoder integrated circuit of 2^{12} series of encoders. They are paired with 2^{12} series of decoders used in remote control system applications. It is mainly used for interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data

2. Decoder HT12D(Figure 3): HT12D is a decoder integrated circuit that belongs to 2^{12} series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 2^{12} series of encoders. The chosen pair of encoder/decoder should have samenumber of addresses and data.

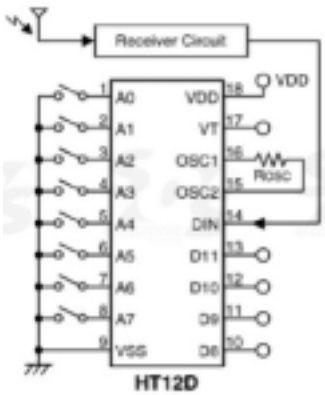


Figure : 3

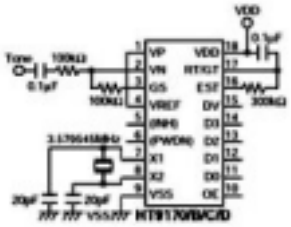


Figure : 4

3) HT9170 DTMF receiver(Figure 4): The HT9170D is a Dual Tone Multi Frequency (DTMF) receiver integrated with digital decoder and band split filter functions. It supplies power down mode and inhibit mode supply. It uses digital counting techniques to detect and decode all the 16 DTMF tones into 4 bit output codes.

Figure : 5

4) CD4028 Decimal Counter(Figure 5): The CD4028 decimal counter converts binary signals(0000 through 1001) into decimal digits(0 through 9) depending on the input provided.

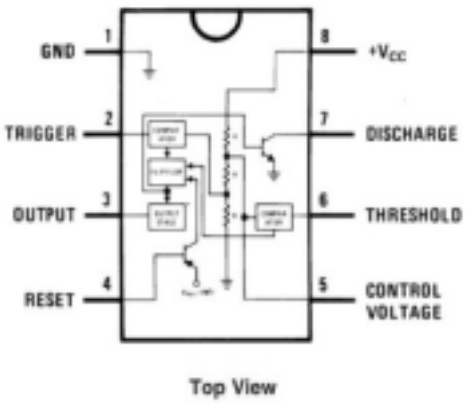


Figure : 6

4) Bi-stable timer 555(Figure 6): The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide up to four timing circuits in one package.

5) Electromagnetic Relay : A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

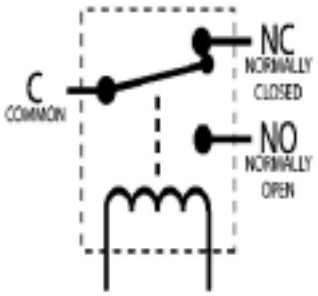


Figure : 7

Development:

The beginning and problems faced

The first process in developing the project was to design a block diagram and based on that a working circuit. The first basic block diagram was like this. There was a fundamental problem in this block diagram. The first was that by using the demultiplexer, we could control the different electronic appliances, but without the use of any flip flops, there was no way to retain the on/off state of the appliance as the output of all the pins of the demultiplexer would change once again

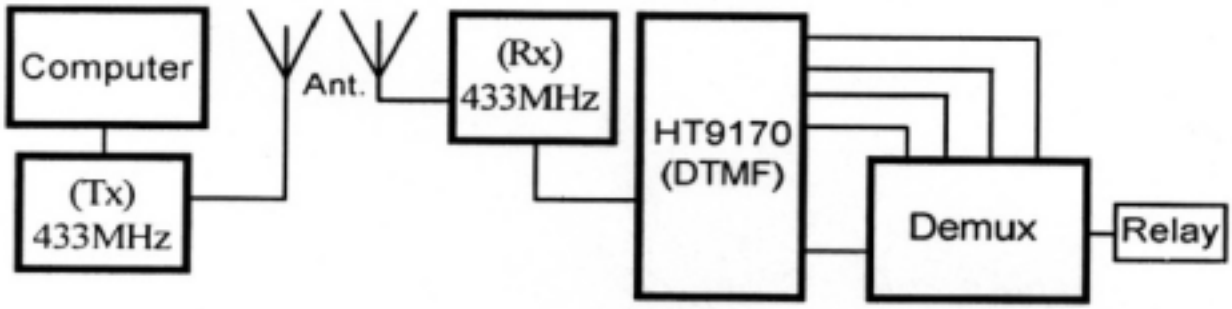


Figure 8 : 1st Block diagram

output to one of of the pins of the demultiplexer changed.The solution to this problem was to first replace the demultiplexer with a decimal counter (in this case the CD4028 integrated circuit chip). The next step was to use a bistable flip flop (in this case the 555 integrated circuit chip) so that the on/off state of the appliance can be present as long as required.

The Second attempt

After solving the previously stated problem, the new block diagram appeared to be like this. The circuit was developed following this block diagram and it was functioning properly. A problem still

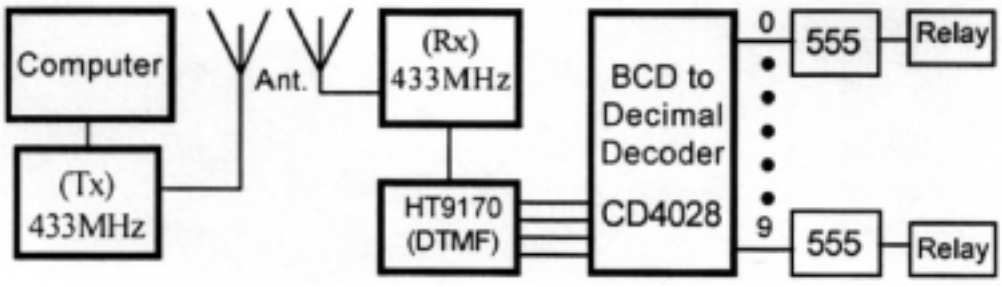


Figure 9 : 2nd Block diagram

remained when considering the commercialisation of this project. If the project was being sold for commercial purposes then the major problem would be that if two adjacent house (or houses with a

separation of less than 100 metres) used this project in their household, then due to the same frequency of the transmitter and receiver (in this case it is 433Hz) the functioning of one of the project will affect the functioning of the other.

To solve this problem, a pair of encoder and decoder (in this case the HT12E and HT12D integrated circuit chip) was included in the transmitter and receiver circuit respectively. By doing this there can now be 256 combinations of the encoder as well as decoder. So if the combinations of the encoder and decoder of a project matched then only the circuit would function. By following this block diagram, for a single frequency of transmitter and receiver, there can be 256 systems, and it was more commercially beneficial.

Block Diagram and Description:

- The computer generates a DTMF signal with the help of a DTMF tone generator.
- The DTMF tone is converted to electric pulse using the HT9170.
- The pulse is then encoded using the HT12E chip, so that it does not interfere with other similar signals in close affinity.
- The output of the HT9170 is then transmitted using the transmitter.
- The transmitted signal is then received and decoded using the HT12D chip.
- The decoded signal is then turned to a decimal signal using the CD4028 binary to decimal counter.
- Each of the output of the CD4028 is then passed through a 555 timer and a relay on to the switch

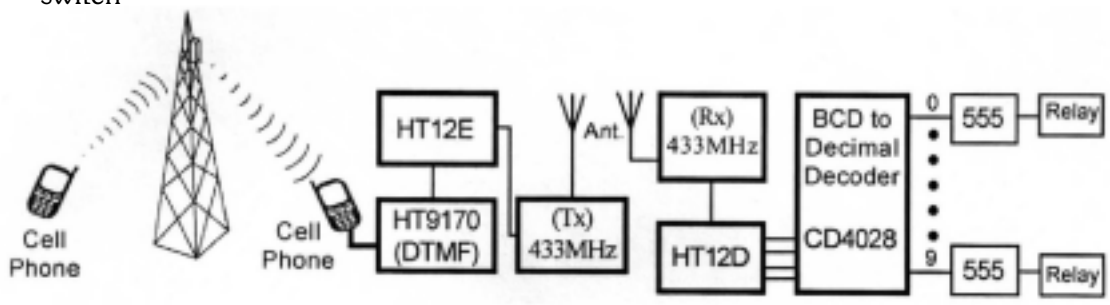


Figure 10: final block diagram with cell phone control

- cell phone 1 calls cell phone 2(connected to receiver circuit)
- any number is pressed on cell phone 1 which is automatically transmitted as a DTMF tone (inherent property of every cell phone)
- the DTMF tone is transmitted via satellite(of the service provider such as Vodafone, Airtel etc) to cell phone 2 which receives the signal
- The DTMF tone is converted to electric pulse using the HT9170.
- The pulse is then encoded using the HT12E chip, so that it does not interfere with other similar signals in close affinity.
- The output of the HT9170 is then transmitted using the transmitter.
- The transmitted signal is then received and decoded using the HT12D chip.
- The decoded signal is then turned to a decimal signal using the CD4028 binary to decimal counter.

Transmitter Circuit description:

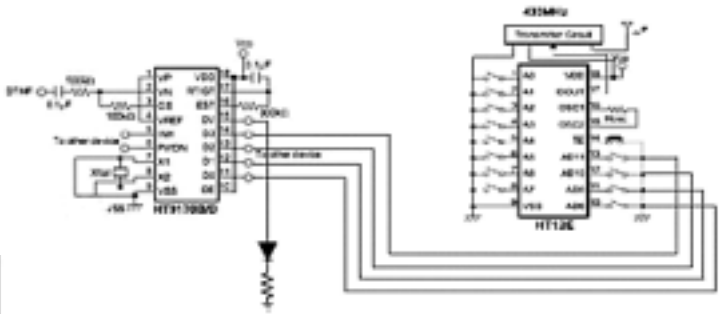
- The circuit receives power from the USB port of the PC and the tone is received from the audio port of the PC through a 3.5mm jack.

- The IC HT9170 converts the audio signal into electric pulse
- The IC HT12E codes the pulse signal with the preset combination
- The transmitter sends the signal over to the receiver circuit at 433 MHz

Receiver Circuit Description

- The receiver receives the signal at 433MHz and sends it to the next part
- The HT12D decoder chip decodes the electric pulse signal. This becomes possible as the encoder and decoder has the same combination set
- The signal then passes on to the IC CD4028 which acts as a decimal counter and one of the 10 outputs, representing the 10 decimal digits, is set to high.
- After this the signal passes through a 555 bi-stable flip flop that holds on to the signal state as long as a new reset signal is received. The odd digit high signal from decimal counter is used as set of the flip flop and the even digit high signal as reset.
- The signal is then passed through a relay so that high voltage electronic appliances can be used using this circuit.
- An additional part of this circuit is the IC 7808 which is used as different parts of the circuit works on different voltages. It is not a part of the circuit.

Cirucit Diagram



Figurfe 11 : transmitter

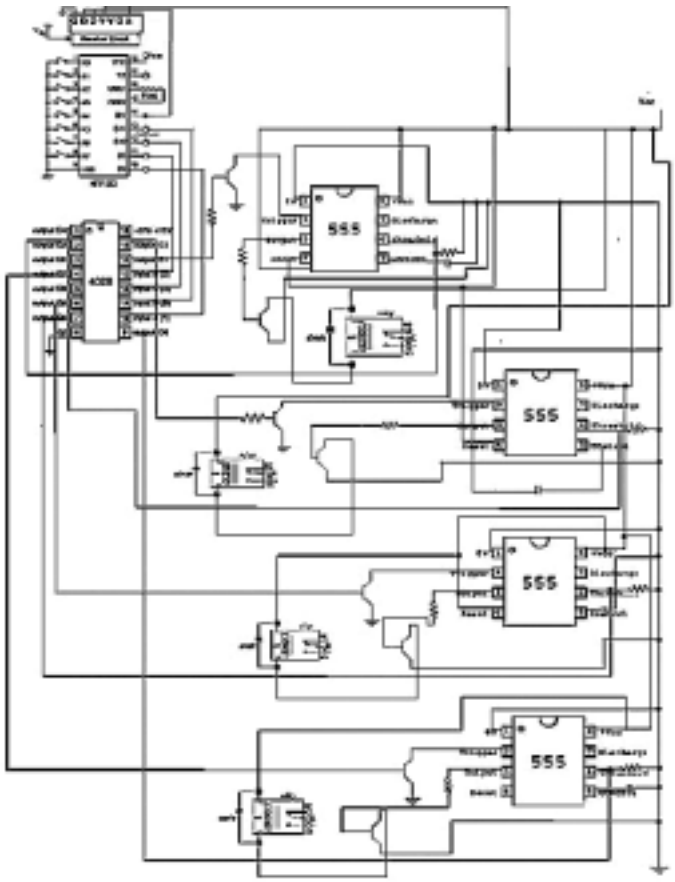


Figure 12 : Receiver

Reciever Circuit Transmitter Circuit (Prototype)

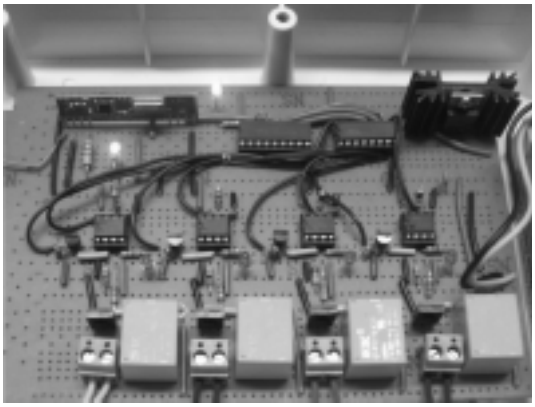


Figure : 13

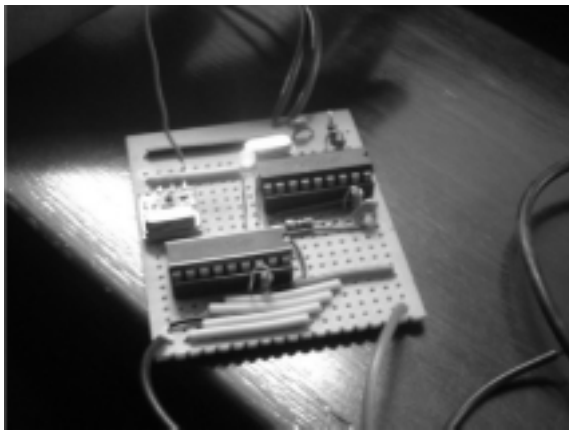


Figure : 14

Uses:

1. It can be used, if modified accordingly, in any domestic or industrial, and even agricultural environments to turn on or off any electrical device of any voltage and current range.
2. In the college itself, control of all electrical devices can be centralised. For example, it can be installed in the cyber room to facilitate switching on an off all the computers from the front desk only.

Future Prospects:

1. The project can be attached with any device to make it automated. Hence it can be used in collaboration with any other project to enhance their performance.
2. The project can be expanded to facilitate more functionality such as controlling more aspects of electrical devices other than switching on and off.

Conclusion:

The commercial production of this project will make its price well within the affordable range. With the advancement of science and technology similar projects are to replace conventional switches in the future. It is an ongoing process and changes have already been set into motion with a hope that this project can make a contribution to it.

Acknowledgement:

Our deepest gratitude is to our Rev. Father Dr Felix Raj,Principal of St.Xavier's College, Kolkata for his constant encouragement in going forward with this project.

Our profound gratitude also goes to all the faculties of Department of Computer Science,St. Xavier's College,Kolkata, for their appreciation,guidance,and motivation.

Acknowledgements to Science St.Xavier's College Science Association(SXCSA),for their appreciation and motivation.It would not have been possible for us to complete this paper without their support and encouragement.

Reference :

1. Digital Design and Computer Design, by M.Morris Mano,Prentice Hall of India,(p 1-614)
2. http://www.holtek.com
3. http://alldatasheets.com

European Travel Writing, British Romantic Poetry and the 'Vale of Cashmere'

Prof Argha Banerjee (PhD,Sussex, UK) is currently the Dean of Arts and a Faculty member of the Department of English, St Xavier's College, Kolkata.

In his poem 'The Light of the Harem' (1817), Thomas Moore (1779-1852) extols the pristine verdant beauty of the 'vale of Cashmere'. Moore chooses the Indian valley as the setting of his poem: 'Who has not heard of the Vale of Cashmere, / With its roses the brightest the earth ever gave, / Its temples, and grottos, and fountains as clear. / As the love-lighted eyes that hang over their wave?'[1] While describing the beauty of the 'Cashmere' valley, Moore more or less echoes European travel writer George Forster's observation in *A Journey from Bengal to England Through the Northern Part of India, Kashmire, Afghanistan, and Persia, and into Russia, by the Caspian Sea*: 'The rose of Kashmir, for its brilliancy and delicacy of odor, has long been proverbial in the East.'[2] Moore chronicles the lure of the valley not only during the various times of the day but also tries to capture its captivating nocturnal beauty in his poem: 'Or to see it by moonlight,—when mellowly shines / The light o' er its palaces, gardens, and shrines; / When the water-falls gleam, like a quick fall of stars'.[3]

The 'vale of Cashmere' interestingly occupies a crucial position in the spectre of the Romantic Imagination. This essay, at a rudimentary level though, intends to explore the nature and the extent of influence the majestic valley had, not only on Moore's verse, but also on the works of some other Romantic poets like P.B. Shelley, Samuel Taylor Coleridge and Robert Southey among others. Most British Romantic poets were perhaps influenced by their readings of 'Cashmere', as described by the various contemporary European travel writers like Bernier Francois (1625-1688), Thomas Maurice(1754-1824), George Forster (? -1792), Mountstuart Elphinstone (1779-1859) and James Rennell (1742-1830) among several others. This essay tries to analyze the portrayal of 'Cashmere' as explored by various European travel writers from the late seventeenth to the early nineteenth centuries and then subsequently makes an effort to trace as to how the verdant valley may have inspired some of the leading British Romantic poets.

Francois Bernier (1625-1688) the first European to visit Kashmir borrowed from the Mughal emperors his conception of the valley as 'the terrestrial Paradise of the Indies'.[4] Initially attached

[1] Thomas Moore, *Lalla Rookh* (New York: Hurd & Houghton, 1867), pp.235-236, hereafter cited as *Lalla Rookh*.

[2] George Forster, *A Journey from Bengal to England Vol 2.* (London: R.Faulder/New Bond Street, 1798), p.11. Hereafter cited as Forster.

[3] *Lalla Rookh*, p. 235-236.

[4] Bernier Francois, *Comprehending a Description of the Moghul Empire Including the Kingdom of Kashmir. Translated from French by John Stuart* (Calcutta: Baptist Mission Press, 1826), pp.113-114. Hereafter cited as Bernier

for a brief span of time with Dara Shikoh, he functioned as a medical advisor in the court of Aurangzeb. With Aurangzeb he managed to undertake a tour of Kashmir and for a long time he remained the only European to do so. In his work *Comprehending a Description of the Moghul Empire Including the Kingdom of Kashmir* (Translated from the French by John Steuart) Bernier provides us with an elaborate description of the valley of Kashmir. Referring to it as the 'Terrestrial Paradise of India', Bernier waxes eloquent about the beauty of the land in his travelogue:

> You may easily infer, from all what I have said that I am not a little delighted with Kashmir; a kingdom, though small in extent, beautiful in extreme; and there is not another, in my humble opinion, to surpass it. At one period, the whole of the neighbouring mountains, as far as the confines of Tartary, and all Hindostan, even to Ceylon, were under its dominion: and it is not without just reason that the Moguls have distinguished it by name of the Terrestrial Paradise of India; that Acbar took such infinite trouble to subdue it; and that his son Jehangir became so captivated with it, that he never could quit it, and was frequently heard to say, he would rather surrender his whole Empire than lose Kashmir.[5]

In his *Letter IX* titled *An Accurate Description of the Kingdom of Kashmir, and of the Present State of the Neighbouring Mountains* Bernier recounts the geographical details and the inherent beauty of the land:

> The histories of the ancient kings of Kashmir relate, that the whole of the country was once a large lake; and that by the instrumentality of Cashep, a Pyr, or Saint, an outlet was afforded to the waters by miraculously cutting the mountain of Baramula. This may be seen in the abridgement of those histories, which Jehangir caused to be compiled, and which I have myself translated from the Persian language…
>
> However that may be, Kashmir is no longer a lake; it is now a beautiful plain, diversified with many hillocks, about thirty leagues in length, and ten to twelve in breadth; it is situated at the extremity of Hindostan, north of Lahore, and is embosomed at the base of the mountains of Caucasus, between the territories of the Kings of Great and Little Thibet, and of Rajah Gamon, who are its adjacent neighbours.[6]

Like Bernier, George Forster, almost a century later, also described the beautiful valley in an eloquent manner in his travelogue. A British traveler and an employee of the East India Company in Madras, Forster travelled through Kashmir in all probability during 1782:

> The lake of Kashmir, or in the provincial language, the Dall, long celebrated for its beauties, and the pleasure it affords to the inhabitants of this country, extends from the north-east quarter of the city, in an oval circumference of five or six miles, and joins the Jalum by a narrow channel, near the suburbs. On the entrance to the eastward is seen a detached hill, on which some devout Mahometan has dedicated a temple to the great king Solomon, whose memory is held in profound veneration… the legends of the country assert, that Solomon visited this valley, and finding it covered, except the eminence now mentioned with a noxious water, which had no outlet, he opened a passage in the mountains, and gave to Kashmire its beautiful plains… [7]

Describing the valley as the 'retreat of pleasure' Forster celebrates the enchanting beauty of the 'chinaur' trees and the grand foliage of the land:

> The plane-tree, that species termed the Platanus Orientalis, is commonly cultivated in Kashmire, where it is said to arrive at a greater perfection than in other countries. This tree, which in most parts of Asia is called the Chinaur, grows to the size of an oak, and has a taper straight trunk, with a silver coloured bark; and its leaf, not unlike an expanded hand, is of a pale green. When in full foliage, it has a grand and beautiful appearance, and in the hot

. [5] Bernier, pp.113-114.

[6] Bernier, pp.107-114.

[7] Forster, p.11.

weather, it affords a refreshing shade.[8]

Forster's observation again tends to echo Thomas Moore's celebration in 'The Light of the Harem': 'And the nightingale's hymn from the Isle of Chenars / Is broken by laughs and echoes of feet / From the cool, shining walks where the young people meet'.[9] Describing the thriving flora and fauna of Kashmir, Bernier, reporting much earlier, had gone a step ahead and labeled it as the 'Land of Promise' and even alluded to the Mount 'Olympus' while describing its beauty:

> The first range of mountains surrounding it, I mean those which are nearest the plain, are of moderate height, all verdant with trees and pasture, abounding with every kind of cattle, as cows, sheep, goats, horses; game in great variety, such as partridges, hares, antelopes and some animals which produce musk. There are also swarms of bees; and, what is a rare circumstance in India, serpents, tigers, bears, or lions, are very seldom, if ever, to be seen: so that it may be truly said of these mountains, that they are not only harmless, but flowing with milk and honey, similar to those of the Land of Promise...
>
> Beyond these mountains, which are of moderate height, others, more lofty, are perceptible, the summits of which are covered with snow at all seasons, and appear above the fogs and clouds, Olympus-like, ever luminous and serene. [10]

From all these travel accounts spanning from the late seventeenth to the end of the eighteenth century, we can infer that the valley was recurrently celebrated by European travelers largely for its unsurpassable beauty and enduring appeal. At the turn of the eighteenth century, the valley of Kashmir became emblematic of a host of suggestions to the English mind, largely refracted through the travelogues written by various European travellers to Asia ranging from Bernier to Forster. Some of the images in Coleridge's celebrated poem 'Kubla Khan' seem to run parallel to the descriptions provided by Bernier in his travelogues. In the first part of the poem, Coleridge, while describing the 'stately pleasure dome' observes: 'So twice five miles of fertile ground / With walls and towers were girdled round; / And there were gardens bright with sinuous rills'. Bernier's account strikingly overlaps with the images we encounter in Coleridge's poem:

> From all these mountains issue an infinite number of fountains and rivulets, which the inhabitants conduct through their fields of rice for the purpose of irrigation, and convey, by means of high banks, even up to the little hills; and which, producing thousands of petty rivulets and cascades all around, ultimately unite, and form into a beautiful river, navigable for boats of as considerable burthen as those on the Seine; and, after gently winding its course all round the kingdom, and flowing through the Capital, discharges itself at Baramula, between two steep-rocks; then dashing over precipices, and receiving several small streams from the mountains, it runs toward attack into the Indus.
>
> So many rivulets, flowing from the mountains, render the plain and these hillocks so fertile and beautiful, that the entire kingdom represents, as it were, a luxuriant garden, all verdant, interspersed with villages and hamlets discovering themselves between the trees, and diversified with little meadows, fields of rice, of corn, of many other kinds of pulse, of hemp, and saffron… in every direction also are to be found most of the European flowers and plants, as well as all sorts our forest and fruit trees, particularly the apple, the pear, the plumb, the apricot and nut, and abundance of grapes.[11]

[8] Forster, p.15.
[9] *Lalla Rookh,* p.235-36.
[10] Bernier, p.108
[11] Bernier, p.109.

Bernier's description of fruit bearing trees and forests in the valley seem to serve as an invisible backdrop for Coleridge's 'Kubla Khan': 'Where blossomed many an incense-bearing tree; / And here were forests ancient as the hills, / Enfolding sunny spots of greenery'. Bernier refers to the mountains of Kashmir as 'Hari-parbet'[12] or the verdant mountain full of melons, water-melons, carrots, beet-root, radishes and even 'most of our pot-herbs'. Bernier's ecstasy about Kashmir valley is evident in his outburst: 'you may easily infer, from all what I have said, that I am not a little delighted with Kashmir; a kingdom, though small in extent, beautiful in the extreme; and there is not another, in my humble opinion, to surpass it.'[13] Pointing out as to how it is a coveted theme for most poets, Bernier asserts: 'from the time our arrival here, all the poets, both Kashmerians and Moguls, have strived to out vie each other in composing verses in its praise for presentation to Aurangzebe, who graciously accepts and rewards such performances.'[14] Besides comparing the rivers which emerge from here with the 'Pison, the Gihon' he was confident that this was the true terrestrial paradise 'rather than Armenia'. Kashmir to him is the 'Chef-d'oeuvre of nature', akin to paradise and very difficult to access:

> I remember, that, among others, was one, who after exaggerating the extraordinary height of the mountains encompassing Kashmir, and its inaccessibility at every point, declared, that their extreme altitude made the Heavens to recede, and assume, to all appearance, the Figure of a Vault; and that Kashmir being the *chef-d'oeuvre* of nature, and the King of the Kingdoms of the World, it was ordained that it should be difficult to access, and thus enjoy uninterrupted peace and tranquility, commanding all, and not being subject to, or controlled by any. He added, that the reason why nature had surrounded it with mountains, of which the highest and most remote were always white and clad with snow, the lowest and next to the plain, all verdant and covered with wood, was, because the King of the Kingdoms of the World was to wear the most precious crown, the top of which was to be studded with diamonds, and the base with emeralds.[15]

The quest for a terrestrial paradise and sublimity in nature is also indirectly aligned with the prevalent trends of British gardening. In a somewhat allied context it is also imperative to remember what the critic Kathleen Wheeler observes in the essay 'Kubla Khan and Eighteenth Century Aesthetic Theories', where she points out that the poem 'also explicitly reflects the widespread interest in gardens, and particularly the oriental or "Chinese Garden" whose design was actually imported into the grounds of stately homes throughout England.' Wheeler, in her reading of the poem, underlines the issue of gradual transition from the 'formal geometric garden of the seventeenth century' to the prescription of 'a more natural garden' in the poem. Wheeler's reading of the poem as a negation of artifice against the onslaught of natural inspiration is in tune with the Romantic tradition and against the preceding eighteenth century sensibility that eulogized a measured response to nature. [16]

Recent critics and scholars like J Livingstone Lowes, John Beer, H.W Piper have undertaken multiple readings of Coleridge's 'Kubla Khan' exploring new avenues in Purchas's *Pilgrimage*, Bruce's *Travels to Discover the Source of Nile*, Maurice's *History of Hindostan* and Bartram's *Travels Through North and South Carolina* among others. In his work *India and the Romantic Imagination* John Drew asserts that 'a good many of the principal images of "Kubla Khan" are to be found also in Bernier,

[12] Bernier, p.111.

[13] Bernier, p.113-114.

[14] Bernier, p.114.

[15] Bernier, pp.114-115.

[16] Kathleen Wheeler, 'Kubla Khan and Eighteenth Century Aesthetic Theories', *The Wordsworth Circle* 22, No 1(Winter1991), pp.15-16.

not simply scattered about but held together by a similar underlying sense of Paradise so crucial to the poem'.[17] As John Livingstone Lowes has observed in *The Road to Xanadu* that there is no conclusive evidence as to whether Coleridge had read Bernier or not. Yet the close affinity of imagery has inevitably drawn comparisons from readers. John Drew refers to Kashmir as the 'unnamed objective correlative' for the 'highly charged interior landscape of Kubla Khan'.[18] However, as Drew points out 'Bernier's account lacks an overriding sense of the daemonic and potentially destructive, nor does it evoke, in spite of his predilection for Kashmiri women, the Abyssinian maid and her celestial music.' [19] In his reading of the poem 'Kubla Khan' John Drew provides the readers with a detailed analysis. As he argues, the poet in 'Kubla Khan' aspires to revive in his verse the arduous feat of ingenuity:

> The man who could revive within himself her music would be capable not only of containing the caves within the dome but of thereby building the dome in air, an aetherealization which is clearly to be valued since others who heard the same music would recognize him as a sacred or mystical figure. The recurring image of the dome may lead us to conjecture that this male figure represents a potential not realized by his counterpart (or other self) in the first section.[20]

Drew directly associates the dome in the poem with that of Kashmir:

> The dome, as we have seen, Coleridge may have associated directly with Kashmir. The historical Kublai is not said to have built a dome and the association is much more (and indeed highly) likely with the Mughal rulers of India. As it happens, Purchas, like the Mughals themselves, regarded them as direct descendants of the Mongols, from whom they did, in fact, borrow the architecture of the dome. It was a late-eighteenth – century view, evident in the Indian writings of not only Maurice but also Hodges and Robertson, that domed architecture was a supraterrestrial expression of the cave as plainisphere. Maurice, especially, regarded the cave in Platonist terms as the world out of which the soul has to make its ascent. This view happens to be congenial with the account given by a Kashmiri contemporary of Kublai's of how Buddha attained *parinirvana* by ascending through the top of a dome-shaped edifice of pure crystal, a symbol of the soul's final ascent through the sutures of the skull. The domes built by the mystical Mughals decorated gardens deliberately conceived of as paradises, earthly expressions as those are of the state of spiritual enlightenment.[21]

The 'caves of ice' in the poem has also been interpreted in a different light by Drew:

> The conception of the caves of ice (which in 'Kubla Khan' threaten the existence of the sunny pleasure –dome) has been traced to a reference Maurice makes to the cave at which Bernier hoped to conclude his tour of Kashmir. Even Maurice was not fully aware of the significance of this cave. Situated high up in the mountains, it is the object of an important pilgrimage for Hindus on the full moon day of Sravana in late summer. Its name, Amarnath, literally means Lord of Immortality, and this refers to the block of ice within it which during that month first waxes and then decreases in size. It is an embodiment of the god Shiva, the great yogi who practices asceticism in these mountains. The legend is that when the gods, threatened by Death, sought Siva's protection, he gave them here the amrita, or milk of immortality, before relapsing into his customary absorbed state of devotional abstraction. Those who similarly still seek him out may find him in the cave at Amarnath in the form of a linga of ice, for the Hindus a supernatural because self-created (svayambhu) wonder within (and not exclusive of) Nature. Porphyry could speak of a cave being symbolic not only of the material void but also of the intelligible essence, but Amarnath is a unique

[17] John Drew, *India and the Romantic Imagination* (Delhi: Oxford University Press, 1987, rpt. 1998) p.203.

[18] John Drew, *India and the Romantic Imagination*, p.205. (Hereafter cited as Drew).

[19] Drew, p.203.

[20] Drew, pp.213-14

[21] Drew, p.214.

public expression of how a cave of ice can be transformed into the milk of paradise.[22]

In tune with Drew's reading, Kubla of Coleridge's poem, quite akin to the historical Kublai and much like the Mughal emperors, desires to convey his mystical aspiration by creating a pleasure-dome at the center of a heavenly garden. Not only in case of Coleridge, but the gradual rise of Kashmir in the English consciousness as an 'Oriental paradise' inspired curiosity among a number of other Romantic poets. Robert Southey envisaged the vale of 'Cashmeer' as the veritable backdrop of *Thalaba* and his later work *The Curse of Kehama.* Like Southey, P.B. Shelley's exposure to India and Kashmir came through his reading of Elphinstone's travelogue and *The Missionary* which later inspired his play *Prometheus Unbound.* Though it is difficult to trace the evidences of engagement of British Romantic poets with various European travelogues, it is undeniable that Kashmir perhaps remains and recurs as a veiled backdrop for a number of Romantic poems (ranging from Coleridge's *Kubla Khan* to Shelley's *Prometheus Unbound*) — largely inspired by European travel writing, which perhaps served as the only reliable source of information on the Indian subcontinent for these poets.

———————————


ST. XAVIER'S COLLEGE
CALCUTTA
NIHIL ULTRA