A Study on the Adaptability of Smart Card in Indian Education System

Rahul Kumar Ghosh*

In the latest centuries convinced innovations in the field of conventionally recognized Integrated Circuit (IC) cards have directed to the delivery of an actually mobile computing podium identified as the SMARTCARD, which on one side permits to assimilate the broadly dispersed, disconnect systems creating scalability intrinsic hooked on the information system, and on the other side it provides an exposed frame to flawlessly plugin any vendor definite, technology definite or platforms definite supplements into the system devoid of the requirement toamend the present ones.

This paper identifies the factors impacting the adaptability of the SMART CARD in the Indian education system. It also provides a framework for analyzing student's perception on the practice of the same.

Keywords: Smart Card, Indian Education System, Information Technology (IT), Integrated Circuit (IC)

Introduction

Conferring to the cutting–edge technology developed in the arena of Information Technology (IT), most of us will come to an inference that Information Technology is progressing at an incredible speed, providing us further modernizations, improvements and inventions in the last one decade. Certainly no facet of human life is currently missing this revolution.

In the latest centuries convinced innovations in the field of conventionally recognized Integrated Circuit (IC) cards have directed to the delivery of an actually mobile computing podium identified as the Smart Card, which on one side permits to assimilate the broadly dispersed, disconnected systems creating a scalability fundamentals into the information system, and on the other side it provides an exposed framework to flawlessly plugin any vendor definite, technology definite or platforms definite supplements into the system devoid of the requirement to amend the present one. This increases the value of data distribution among the unlike applications and in utmost cases it eradicates the necessity for them to be tangibly present on the identical network, subsequently this in turn slices down the networking charges and maintenance expenses. Scientifically Smart Card carries on developing, fresh plus inventive concepts which are rapidly turning out to be an actual fact of life (Blackmore, 2010).

Ever since the first Smart Card system was presented by Moreno in 1974 (Smart Card, 2014), several Smart Card grounded systems have appeared. It can be used for countless applications. Smart Card is labeled as “SMART” because it encloses a computer chip. It is a plastic card, alike in form to a credit card comprising of one or added implanted semiconductor chips. Latest hi-tech development has appreciated the growth of a contactless Smart Card, which means the chip links with a card reader by means of Radio Frequency Identification (RFID) (Smart ID Cards for Education, 2015). Smart Card has developed a significant association with human life. It is a protected maneuver that permits optimistic user credentials and at the same time it is multifunctional, cost effective exercise that can be simply acclimate for both physical and logical entree. Smart Card provides plentiful advanced security features as compared to the simple plastic cards, and magnetic strip cards. The motive for advance security features in Smart Cardis for the fact that the end-users of the system are provided with the access to it. Consequently the security section is placed into the hands of the end–users, and hence it is open for the attacks from hackers, ingenious and malicious strangers. The improvement of Smart Card, along with fast progresses in cryptography, has led to a solution to the aforementioned problem (Taherdoost et al., 2011).

These days the notable movement is the use of multi-application cards. A multi-application card is a Smart Card which has a provision of using multiple sorts of applications on the card itself thus lessening the number of cards in the wallet. This proposal is concentrating on the multi-application Smart Card for the educational use only. However before applying any technology modernization, the societies' intention to adopt or acceptance would be the utmost essential thing in order to be fruitful.

***Research Scholar, Seacom Skills University, West Bengal**

Smart Card Outline

Round the globe now–a–days the technologies are merging as well as linking several methods like banking facilities is accessible over the mobile phone then internet facilities is offered by means of a host of diverse means such as digital television set, mobile phone, data card in addition to electronic wallet (E–Wallet) improvements are witnessing the incorporation of transportation, trade, vehicle parking and supplementary civic facilities. However, this uprising is yet to actually make an impersonation in India in a vast manner.

Smart cards at present have been acknowledged as the most convenient and protected method, by the grammar of biometrics plus added cryptographic proficiencies has guaranteed the uniform advanced levels of protection. In present three key groups of Smart Card technologies are in effect:

1. Contact Cards
2. Contact Less Cards
3. Hybrid Cards (Combination Cards)

Few advantages and the causes why Smart Cards are fated to be an integral part in our lifespan are as follows:

- Better security
- Possible user mobility
- Serial access to one machine by several users
- A single card can host multiple applications

Background

Beginning with universities to schools, an uprising in technology is captivating the shape. The times when ordinary jobs such as student attendance card, canteen card, fees card, library card, photo identity card, report card, etc. necessitates an ample amount of time and mass of managers to manage the heaps of bookkeeping is however can be resolved through a Smart Card in today's modern computing era. But at the same time the Indian education system is still to accept this technology which is a vital issue.

A student admission procedure is still a manual, labor–intensive plus time consuming process. A limited number of institutions which provide higher education have accepted the wired admissions procedure, but then also a student needs to submit their previous education credentials and testimonials in a photocopy medium besides this they have to produce the original credentials and testimonials for verifying the genuineness to complete the admission procedure, which sets the students in danger that the original credentials and testimonials might get damaged or lost in the process, and apart from this the cost of the photocopying and the swelling necessity of the paper for photocopying are some other important issues.

By tradition the students are supposed to carry more than a few cards, which are vital for permissions and identification purposes in the different arena within the campus, which in consequence produces an additional liability for the students and the admins have to retain a track for all of them besides that it's a perplexing task of managing the validity of the aforementioned also.

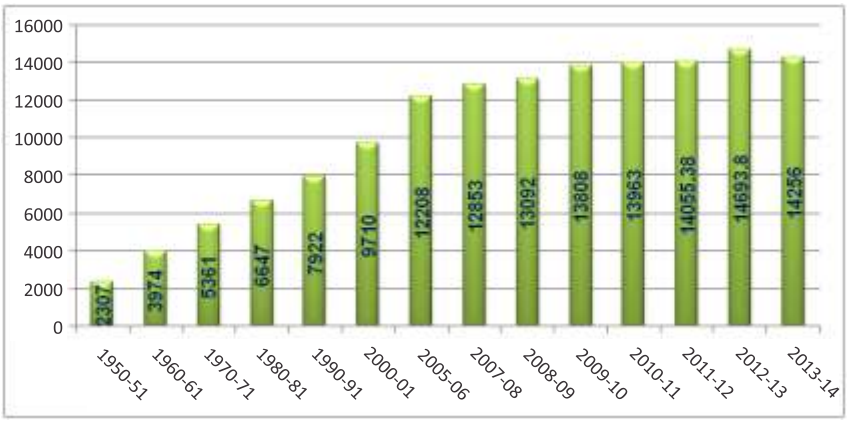
India is having a bulky student population plus maximum of the education system in India is not yet computerized, which places Indian education system in the absolute situation to inspire the Smart Card empowered campus. Handling the campus assets every time is quite a challenging task for the administrators. As the assets and departments has stretched and changed far away from simple computers workstations and printers to the recent community labs, campus intranet, electronic learning resources, meal program and transport facilities. Nowadays, campuses certainly not have any options of abandoning the hi–tech revolutions happening all around them (Rastogi and Das, 2002).

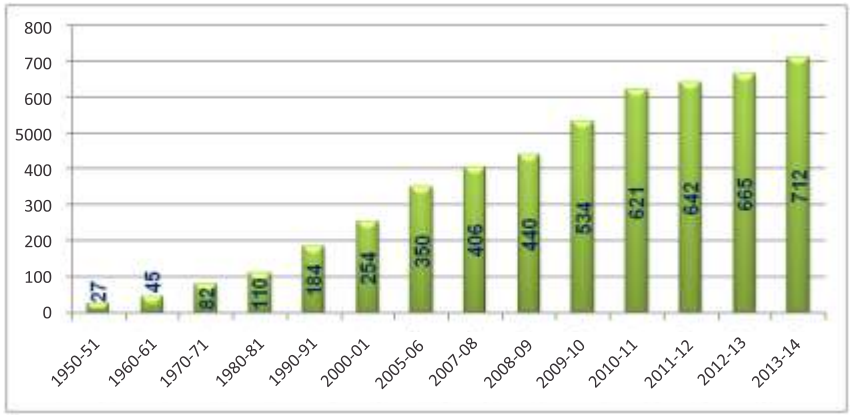
Along with the aforementioned problem a different set of problem also trails, which is the job application procedure for different government and private sectors. To the latest point of time the Smart Card has not been familiarized in the

job application procedure for any of the above mentioned sectors. At the present time many of the job applications procedure are online but many of the organization demands for the post–submission of the application form and the photocopies of the credentials and testimonials. Accordingly, the present job application procedure is also an added reason which causes the swelling necessity of the paper for photocopying.

Number of Acknowledged Schools and Enrolment in India :

The number of acknowledged schools and the overall enrolment in India has observed a stimulating growth over the years. The figures has increased from approximately 2,30,700 schools and 2,38,000 enrolments in 1950–51 to nearly 14,25,600 schools (as of 2013–14) and 25,48,000 enrolments (as of 2013–14), as per a recent MHRD report (source: Educational Statistics at a Glance – 2014). The succeeding two graphs (Fig. 1 & 2) will provide a comprehensive statistics about the acknowledged schools and enrolments over the last few years.





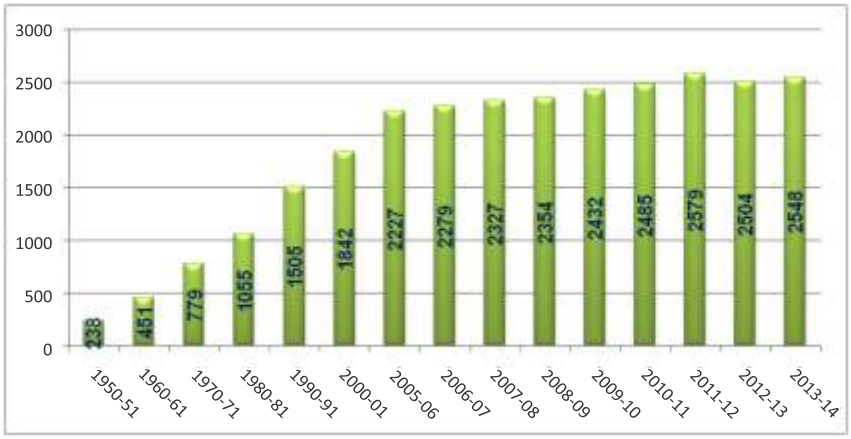


Figure 2: Year wise Enrolment
Source: ***Educational Statistics at a Glance – 2014***

As realized from above figures, around six–fold growth in the number of higher education institutes and eleven–fold growth in the number of enrolment has occurred in the country during the last decade.

2. Number of Higher Education Institutions and Enrolment in India :

Higher education in India has observed an inspiring progress over the years. The number of higher educational institutions has grown up from 27 universities and 578 colleges in 1950–51 to nearly 712 universities (as of 2013–14) and 36,671 colleges (as of 2013–14) as per a recent MHRD report (source: Educational Statistics at a Glance – 2014). The succeeding two graphs (Fig. 3 & 4) will provide a comprehensive statistics about the acknowledged numbers of universities and colleges in India over the last few years

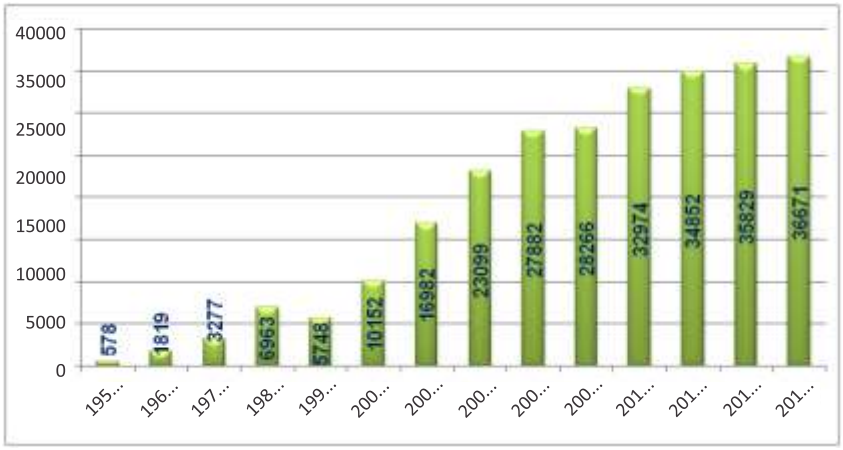
As realized from aforementioned Fig. 3 & 4, around twentysix–fold growth in the number of higher education universities and sixty three–fold growth in the number of higher education colleges has occurred in the country during the last decade.

The yearly admission of students is exceeding to 2.5 crores (counting the enrolment under Open and Distance Learning

System). The highest portion of student enrolment (82.9%) is at under–graduate level, followed by post–graduate (8.7%) and Diploma (7.0%), while all other levels are forming only 1.4%. India is currently graded as the third largest higher education system in the world after US and China (ASHE, 2013).

Significant Facts :

After having the aforementioned data, if we take an instance of admission procedure at undergraduate level in different higher education institutes then we can realize that a Higher Secondary (12th Standard) passed out student while applying for the undergraduate (UG) level admission in a single college has to submit 2 Admit Cards (10th&12th Standard) + 2 Pass Certificates (10th&12th Standard) + 2 Mark Sheets (10th&12th Standard) + 1 Migration Certificate, a total of



7(Seven) photocopies of the credentials and testimonials.

Therefore as per the data mentioned at the preceding sub–section (Number of Higher Education Institutions and Enrolment in India), if 82.9% of 2.5 crores enrolling students submit a total of 7(seven) photocopies each then the total number of papers used in photocopy is approximately 14.5crores.

Total Enrollment	X	UG Enrollment %	=	Total no. of UG Enrolling Students
25000000	X	82.9 %	=	**20725000 Students**
Total UG Enrolling Students	X	No. Photocopy Submitted by Each	=	Total no. of Paper Used
20725000	X	7	=	**145075000 Papers**

Figure 5: Paper Usage Estimation
Source: Calculated Figures

An individual tree can yield around 80,500 sheets of paper (How Much Information, 2003) and accordingly it requires approximately 1800 trees to fulfill the annual need of paper for Indian students (UG enrolling only) and that also applying to only one college. A regular A4 sheet is from 80 g/m2 paper (Grams/Square Meter to Pounds/Ream, 2005) and weighs nearly 5g (Paper Density, 2015), these types of paper is normally used by photocopy (Xerox) machines (Paper Size, 2015). Paper manufacturing is the third most energy demanding industry, spending nearly 12% of all energy in the manufacturing sector (The Facts – Paper Consumption and Its Impact).

In this digital era, the worldwide ecological footmark is massive. Nearly 4 billion (400 crores) trees worldwide are cut down each year for paper manufacturing representing about 35 percent of all harvested trees. World consumption of paper has grown up 400 percent in the past 40 years (Martin and Colby, 2011). Growing universal consumption and the fight to deliver low–priced paper has caused continuous market pressure which started to push manufacturer deeper into formerly unindustrialized forest lands, and has transformed high variety, carbon rich normal forest into wild rising, purely sterile tree plantations.

The paper manufacturing is the fourth major emitter of greenhouse gases in the industrial sector. Universal manufacture of pulp and paper sector is forecast to rise to 500 million tons by 2020 (Forests: What future do we want?, 2011). The most recent hazard to the globe is not the plastic bags, it's the yearly left-over, discarded tons of paper tossed out by workplace printers and photocopy machines, which is binned within hours.

Literature Review

Clemente (2014) have studied different Information Technology management models and has proposed a conceptual framework model for the MadinatZayed and Ruwais Colleges in Abu Dhabi, UAE. The proposed model has provided some helpful results to prove that this particular model was needed and will overcome most of the problems present in those colleges like management issues.Chopra (2010) have explored the RFID Smart Card security and practices in the perspective of privacy. The study was comprised of several kinds of outbreaks which include snooping, duplicating and skimming which in turn specified the lack of security which leads to defilement of confidentiality. Mirza and Alghathbar (2009) have conducted a study on 20 different universities across the four regions of the world namely Australian Continent, North America, Western Europe and South East Asia to discover the different applications that are presently begin used by these universities and have determined a total of 34 different applications out which 2 universities are using STORING ACADEMIC INFORMATION application through Smart Card. Mohammadi (2009) have studied the Smart Card application and acceptance model to estimate the users' approval of Smart Card technology amongst the students of universities in Iran. Different studies have been conducted on the implementation and application of Smart Cards, maximum of which have been concentrated on the areas like privacy, security and data storage on Smart Cards Gupta (2008), Crotch–Harvey (1997). A study by the printer industrialist Xerox had found that – "Office staffs throw away 45% of everything they print within a day, equivalent to more than a trillion pages every year. The most popular 'one–time use' examples are daily assignments, drafts and emails." Paul Smith, a laboratory manager at Xerox's research center in Toronto, Canada, said –"Some people use what they've printed only for a minute. A cover page on a network printer job only survives may be 30 seconds: you just recognize your job and then you recycle it Smith (2007)." Al–Alawi and Al–Amer (2006) have studied the acceptance and consciousness of the people to substitute their current cards with the new National Smart Card in Bahrain. The study has also found out the measures adopted by the government to form alertness between the public about the practice and features of the Smart Card under the national Smart Card program. Zahedi (2006) have studied in the direction of the Smart Card technology acceptance amongst the students of Tarbiat Modares University in Iran. Arami et al. (2004)have conducted a study on the students of Vienna University of Economics and Business Administration in Austria, to define the level of approval of Smart Card technology. Dhar (2004) have evidently stated that the prospect for Smart Card rest on the introduction of multi–application cards as well as changing the simple mentality that the Smart Cards are merely a device for making financial transaction only. Lee et al. (2003) have determined the level of acceptance of Smart Card technology by the students of Nanyang Technological University in Singapore plus a further study of students in Murdoch University in Australia was also conducted to realize the willingness of adoption of the Smart Card technology. An information paper by Panel on Security of the Legislative Council (Experience of Using Smart Identity Cards in Other Countries; 18 January 2001) had stated that – "Smart Card applications are getting well accepted worldwide. Smart Card consumptions are expected to grow significantly in the near future. The total consumption of Smart Cards in the whole industry in 1999 was 1,400 million (140 crores) cards, with an increase of 17% comparing to the figure in 1998. In the

year of 2000, the consumption is forecasted to be 1,750 million (175 crores) cards, representing an overall year–on–year growth rate of 25%. Many countries/regions are issuing or planning to issue smart ID cards, and the direction is to aim for multi–applications.

Research Objectives

Despite the fact that the aforementioned research/study areas (subject wise and/or topographical wise) are certainly undeniable, esteemed and beneficial, but the proposed research work will be concentrating on a slightly diverse objective to study:

- To study the possible factors for implantation of Smart Card in the Indian education system.

The proposed research will be reasonably targeting in understanding the vision, observations and opinions of the Indian education system's officials and students with the diverse facts of the Smart Card in education sectors (offshore) in hand.

Sampling

The sample size is 50, the sampling technique that has been used in this case is the Multi Stage sampling. 2 universities are selected at random and a group of 25 students and staff are selected from each of the universities as the sample.

Data Analyses Methodology

The data collected from the survey will be subjected to data cleaning in order to identify missing value, sample characteristics and meet the assumptions of normality. After this, the descriptive analysis will be used to summarize the respondents' demography. Factor analysis will also be employed in this regard to help in reducing the number of variables that do not measure the constructs in this study as perceived by the respondents. In this case, the component factor analysis with varimax rotation will therefore be conducted on all the variables to extract factors from the scales of each construct. The researchers will ensure that all items meet the acceptable limit level. Therefore, in this study, all items below 0.50 will not be retained and those having a loading factor limit of above 0.50 will all be retained. The validity of the instrument will be determined by content and construct validity. The construct validity will be determined through the factor analysis in which the Kaiser- Meyer (KMO) index of sampling adequacy and Bartlett's test of sphericity will equally be determined. All variables with KMO above .6 will be regarded as valid for this proposed study.

Table 1: Parameter: Age

		Frequency	Percent	Valid Percen	Cumulative Percent
Valid	25 -34	25	50.0	50.0	50.0
	35 -44	13	26.0	26.0	76.0
	45 -54	5	10.0	10.0	86.0
	55 -64	7	14.0	14.0	100.0
	Total	50	100.0	100.0	

Empirics

The demographics of the respondent are presented under the 5 attributes i.e. age, gender, qualification. The following table(s) depicts the respondent's profile and the type of company they have selected for patronizing. As far as age is concerned, almost 50% of the respondents were between 25-34 years old (50%) followed by the age group of 35-44 years (13%) . On the other hand, 5 respondents (10%) were 45-54 years of age and 7 respondents (14%) were in the 55-64 years age group. Gender-wise, 56% of the respondents were male and only 44% were female. 50% of the respondents were Graduates followed by 32% higher secondary, Post graduates (12%) and PhD(s) only 6%.

Table 2: Parameter: Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	28	56.0	56.0	56.0
Female	22	44.0	44.0	100.0
Total	50	100.0	100.0	

Table 3: Parameter: Education Qualification

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Higher Secondary	16	32.0	32.0	32.0
Graduate	25	50.0	50.0	82.0
Post Graduate	6	12.0	12.0	94.0
PhD	3	6.0	6.0	100.0
Total	50	100.0	100.0	

Factor Analysis Results

A total of 50 respondents were surveyed using the questionnaire. The raw data was analyzed using SPSS 17.0 and factor analysis in order to summarize the 10 variables into smaller sets. Then data was subjected to principal component analysis. Hence, these 10 variables were reduced to 3 principal components through varimax rotation (Table 6). Items with factor loadings of 0.40 or higher were clustered together to form separate constructs, as recommended by Hair et al. (2006). Here, the researcher had considered only those factors whose eigen-values is more than one, as significant. Table 5 indicates that, in the present test the Kaiser-Meyer-Olkin(KMO) measure was 0.671. Bartlett's sphericity test also found highly significant; Chi-Square = 428.383, df = 105 with a significance of 0.000 it provide support for validity of the factor analysis of the data set and indicates that, factor analysis is appropriate.

Table 5: KMO and Bartlett's Test

Kaiser -Meyer -Olkin Measure of Sampling Adequacy.		.671
Bartlett's Test of Sphericity	Approx. Chi- Square	428.383
	Df	105
	Sig.	.000

Table 6: Rotated Component Matrix

	Component		
	1	2	3
1. Use of SMART CARD can be very useful in education sector	**.906**	.108	.154
2. The technology will be highly easy to use.	**.736**	.095	.121
3. Image	.086	.015	**.856**
4. Authentication	.085	**.831**	.171
5. Social Influence	.062	.014	**.691**
6. SMART Card will be highly supportive for operations in education sector	**.812**	.098	.155

7. Visibility	.263	.133	**.798**
8. SMART cards will be highly compatible	**.648**	.043	.118
9. Data can be highly confidential	.195	**.731**	.139
10. Data Integrity	.147	**.881**	.209

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

2	**Security**	3.285		
	Authentication		.831	
	Data can be highly confidential		.731	
	Data Integrity		.881	
3	**Other factors**	2.025	13.959	63.201
	Image		.856	
	Social Influence		.691	
	Visibility		.798	

In the Rotated Component Matrix table, each number represents the partial correlation coefficient between variable and rotated component. All the variables having factor loadings of greater than .50 for a given component define the component. The following (Table 7) displays the variables constituting the 4 components.

Table 7: Components

Serial No.	Factors	Eigen Value	Variance	Cumulative Variance
1	**Satisfaction**	4.217		
	Use of SMART CARD can be very useful in education sector		.906	
	The technology will be highly easy to use.		.736	
	SMART Card will be highly supportive for operations in education sector		.812	
	SMART cards will be highly compatible		.648	
			.837	

Conclusion

The research study leads us to three (3) major dimensions of the students of different educational institute of West Bengal. The dimensions are classified as satisfaction, which is composed of different variables like the usefulness of the card (instrument) in the education sector, the ease of the use of the card its effective support of operations in the education sector and its compatibility. The 2nd dimension is the security feature, which includes the authentication and the confidentiality of the Smart Card. The 3rd dimension includes the factors such as the visibility and the accountability of the card, the social benefits and its image which has big impact in the education sector.

References

- Al–Alawi, A. I. and Al–Amer, M. A. (2006). Young Generation Attitudes and Awareness Towards the Implementation of Smart Card in Bahrain: An Exploratory Study. Journal of Computer Science, 2(5), 441 – 446.
- Annual Status of Higher Education of States and UTs in India (ASHE) (2013). Retrieved January 23, 2015, from https://www.mycii.in/KmResourceApplication/41213.ASHEReport2013.pdf
- Arami, M., Koller, M., and Krimmer, R. (2004). User Acceptance of Multifunctional Smart Cards. In Proceedings of the 13th European Conference on Information Systems, Turku, Finland, June 14 – 16, 2004.
- Blackmore, B. (2010, April 27). The Future of Smart Card Technology Is Here Today Or Is It? Retrieved January 21, 2015, from http://www.hidglobal.com/blog/future-smart-card-technology-here-today-or-it
- Chopra, K. (2010). Physics behind RFID Smart Card Security in Context of Privacy. Arlington, U.S.A: University Of Texas.
- Clemente, C. (2014). Development of an Information Technology Management Model for Madinat Zayed and Ruwais Colleges in Abu Dhabi, United Arab Emirates. Review of Integrative Business & Economics Research, 4(1), 184 – 202
- Crotch–Harvey, T. (1997). Electronic Money and the Law – The Implications. In The International Smart Card Industry Guide (pp. 7 – 20). Smart Card News. ISBN: 0 9524394 1 7
- Dhar, S. (2004, November 16). Introduction to Smart Cards. Retrieved January 23, 2015, from http://sumitdhar.blogspot.in/2004/11/introduction-to-smart-cards.html
- Educational Statistics At A Glance, 2014 (2014, December 22). Retrieved July02, 2015, from http://mhrd.gov.in/sites/upload_files/mhrd/files/statistics/EAG2014.pdf
- Experience of Using Smart Identity Cards in Other Countries (2001). Information Paper,LC Paper No. CB (2)695/00-01(01), 1 – 10.
- Forests: What future do we want? (2011). Retrieved January 23, 2015, from http://wwf.panda.org/what_we_do/how_we_work/conservation/forests/publications/living_forests_report/
- Grams/Square Meter to Pounds/Ream (2005, October 7). Retrieved January 23, 2015, fromhttp://www.onlineconversion.com/forum/forum_1118773419.htm
- Gupta, A. (2008, May). Design and Implementation of Public Key Infrastructure on Smart Card Operating System. Kanpur: Indian Institute of Technology Kanpur.
- Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). Multivariate data analysis (6th ed.). Uppersaddle River, N.J.: Pearson Prentice Hall.
- How Much Information? 2003. (2003, October 27). Retrieved January 23, 2015, from http://www2.sims.berkeley.edu/research/projects/how-much-info-2003/printable_report.pdf
- Lee, C., Cheng, Y., and Depickere, A. (2003). Comparing smart card adoption in Singapore and Australian universities. Int. J. Human–Computer Studies,58(3), 307 – 325.
- Martin, S., & Colby, S. (2011, September 10). Paper Chase. Retrieved January 23, 2015, from http://www.ecology.com/2011/09/10/paper-chase/

- Mirza, A. A. and Alghathbar, K. (2009). Acceptance and Applications of Smart Cards Technology in University Settings. 8th IEEE International Conference on Dependable, Autonomic And Secure Computing, 746 – 748
- Mohammadi, H.T. (2009). Development of an Adoption Model to Assess Smart Card Technology Acceptance. University Teknologi Malaysia.
- Paper density. (2015, January 19). In Wikipedia, The Free Encyclopedia. Retrieved January 23, 2015, from http://en.wikipedia.org/w/index.php?title=Paper_density&oldid=643195757
- Paper size. (2015, January 6). In Wikipedia, The Free Encyclopedia. Retrieved January 23, 2015, from http://en.wikipedia.org/w/index.php?title=Paper_size&oldid=641280319
- Rastogi, L. and Das, P. (2002). Re–engineering Educational Institutions Through Smart Cards. Retrieved January 21, 2015, fromhttp://www.au-kbc.org/bpmain1/Security/smartcardwp.pdf
- Smart Card Applications around the World. (1997). In the International Smart Card Industry Guide (pp. 46 – 55). Smart Card News. ISBN: 0 9524394 1 7
- Smart card. (2014, December 12). In Wikipedia, The Free Encyclopedia. Retrieved January 23, 2015, from http://en.wikipedia.org/w/index.php?title=Smart_card&oldid=637796648
- Smart Id Cards For Education: Secure the Campus While Providing Essential Services. (n.d.). Retrieved January 21, 2015, from http://www.zebra.com/content/dam/zebra/white-papers/en-us/smart-id-education-en-us.pdf
- Smith, D. (2007, October 14). Britain's trillion–page mountain stacks up. Retrieved January 23, 2015, from http://www.theguardian.com/money/2007/oct/14/workandcareers.news
- Taherdoost, H., Sahibuddin, S. and Jalaliyoon, N. (2011). Smart Card Security; Technology and Adoption. International Journal of Security, 5(2), 74 – 84
- The Facts – Paper Consumption And Its Impacts. (N.D.). Retrieved January 23, 2015, from http://www.forestethics.org/paper-the-facts
- Zahedi, A. (2006). Intention to Adopt Smart Cards. Case of Application in Universities,ISSN: 1653-0187.