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# **Journal of Operations Management and Information Technology**

## **Aims and Scope**

The aim of the journal of Operations Management and Information Technology is to provide academically robust papers, research, critical reviews and opinions on the organizational, social and management issues associated with significant information-based technologies. It is designed to be read by academics, scholars, advanced students, reflective practitioners, and those seeking an update on current experience and future prospects in relation to contemporary information and communications technology themes.

# Journal of Operations Management and Information Technology

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# A Trivial Survey on Preset Prediction of Coronary Heart Disease Using Data Mining and Soft Computing Technique

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## ABSTRACT

*Knowledge Discovery in Databases is a widely used in miscellaneous areas. The designation of data mining methodology has been conveyed through such relevance, integrating it with other technologies such as soft computing. The consequence on the prediction of coronary heart disease has been achieved through four –phases proposal. This proposal has been coiled with the tactics of classification and optimization. Coalesce of such methodologies makes the data mining system more rapid and more consistent. A cavernous survey of the literature is done to be evidence for the various purposes and achievements of soft computing methodologies along with data mining.*

**Keywords:** *Coronary Heart Disease, Data mining, Decision tree, Fuzzy system, optimization*

## 1. INTRODUCTION

Today's world of preset data anthology and futuristic database provides us with a copious amount of information in various e-formats. Detection and prediction with certain knowledge has become effective through data analytics. Extraction of acquaintance and preprocessing of missing attributes increase the process of such system. Splitting of huge database into branches with the classifiers such as Decision tree enhance the process of prediction. The fuzziness of the system should be impassive and optimized to gain better accuracy of the prophecy. The significance of the prediction in the health check domain is rapidly escalating now -a -days. One of such medical forecast that prevents heart attacks and sudden deaths is the prediction of Coronary Heart Disease (CHD). This manuscript deals with prophecy of the disease in the following sections: Section I - Preprocessing of the heart disease database to salvage the efficient attributes, Section II- Classification of the colossal database into prediction nodes, Section III –Eliminate the vagueness of the system and Section IV- Optimize to obtain the accuracy. The Survey on this relevance presents a better way of accepting a proposal by incorporating the above sections.

## 2. DATA MINING AND SOFT COMPUTING TECHNIQUES

### 2.1 Data Mining

The digital world of today produces a copious source of data known as big data. This big data consists of non-trivial, hidden, previously unknown and potentially valuable data. Such data can be used

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effectively for the prediction of future trends. This can be done through data mining processes. The veiled patterns and relationships can be retrieved knowledge based on mining. This effective tool is used to identify the acquaintance based on convinced criteria. Thus, it is some- times known as data or knowledge discovery [14].

The ultimate goal of data archeology is to extract useful data and analyze them with different perceptions and gather them into useful information. There are large database of information that has been stored in various electronic forms which may consist of curtailed, noisy and inconsistent data. The data mining methodologies are used to harvest the embedded in- formation which is used as a cause of knowledge for decision building.

The electronic data are preprocessed by the data or pattern analysis to construct the predictive modules. These modules are rooted with the algorithms such as K-means, SVM, KNN, CART, Naïve Bayes, etc to envisage the indispensable know- ledge or information for decision making.

### **2.1.1 Applications of Data Mining:**

Data Mining as considered as a powerful tool which is capa- ble of conducting decision making and for forecasting future trends of market. Data Mining tools and techniques can be successfully applied in various fields in various forms [13]. The medical and healthcare data mining are remarkable, since that there are huge and intricate volumes of data that have been generated by various un-automated analysis and health- care activities.

The following are considered as the major issues of medical data mining,

a) **Heterogeneity of Medical Data-** The medical data are in huge volumes and they pursue complexity by nature. The diverse interpretation of the physicians and the canonical form of the data also adds the heterogeneity of the data.

b) **Ethical, Legal and Social Issues-** The ownership of the data and the administrative issues are considered to enhance the privacy and the security of the human data.

### **2.1.2 Decision Tree**

A decision tree is a widely used data mining classifier, which incorporates both nominal and numerical data. Being uttered as a recursive partition of the instance space, the decision trees use certain discrete function of the input attributes. Ac- cording to a Survey on Decision Tree Algorithm for Classification



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by Brijain R Patel et al. (2014) [4], to extract models from a large data set there are two forms of data analysis namely classification and prediction. Such analysis can be effectively worn to foresee for prospecting data trends.

The decision trees are the well known paradigm to depiction any discrete value classifier that is proficient of handling datasets that may have error and missing values. Consequently, these trendy approaches are used to predict the accuracy of CHD in a choice of related studies. Widely used heart disease datasets in decision tree research consists of 303 numbers of instances and 75 numbers of attributes.

„The tree complexity has a decisive effect on its accuracy“ was the statement by Breiman et al. (1984) [3]. This tree complexity of the decision tree is clearly achieved by using stopping criteria and the pruning methodologies. Thus, the decision tree inducers provide exclusive potential to boost the conventional statistical forms of analysis.

The decision tree inducers are the algorithms that involuntarily construct a decision tree from a specified dataset. The primary objective is to obtain the optimal decision tree thereby minimizing the generalization error. The decision tree inducers can be reflected on either of top-down or bottom-up approaches. The greedy algorithm is considered to the indispensable learning approach that proceeds with the recursive top down approach of decision tree structure. The decision tree algorithm has experienced a lot in the world of data mining. These inducers algorithms such as CART, C4.5, and C5 are largely used in the predictions.

**CART:** Breiman et al., (1984) [3] has projected the classification algorithm called the Classification and regression tree (CART) for constructing binary trees in which each internal node precisely has two retiring edges. The CART algorithm has been also termed as Hierarchical Optimal Discriminate Analysis (HODA) that enables the users by providing the prior probability distribution. The cost-complexity Pruning and Gini index are used to prune the tree obtained from the CART algorithm and as the impurity measure for selecting attribute respectively. This algorithm makes use of both categorical and numeric variables either to construct classification or regression trees and thus it is a non-parametric decision tree learning technique. Persi Pamela et al. used Classification and Regression Tree (CART) algorithm along with the Particle Swarm Optimization (PSO) to predict 94% accuracy of CHD [16]. To envisage 87.74 % accuracy by means of 19 attributes Dursan et al. has used C5 and CART decision trees [7].

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**C4.5:** The algorithm proposed by Ross Quinlan is considered to be an extension of Quinlan's earlier ID3 algorithm has wisely used to generate a decision tree. C4.5 has been used for classification rather than regression, which are regularly referred to as a statistical classifier. Splitting criteria is used as the information gain in this algorithm. Both categorical and numerical values data are admitted even with missing values, thus by increasing its gain calculation. C4.5 algorithm provides an expedient way to lever the continuous values by generating threshold and dividing the attributes across the threshold value.

## 2.2 Fuzzy Systems

A fuzzy system is considered to be the conservatory of the traditional fuzzy mathematics. The fundamental of the fuzzy mathematics are laid by the fuzzy sets and the fuzzy logic. The multi-valued logic that allows transitional values to be defined between conventional evaluations like 0/1, true/false, yes/no, high/low, etc are known as Fuzzy Logic (FL) [20]. The fuzzy set is considered to be the basic notion of the fuzzy system. Membership functions of fuzzy sets can be distinct in any integer of ways as long as they follow the rules of the description of a fuzzy set.

The fuzzy logic is said to be the superset of Boolean logic that has been unmitigated to grip the concept of the partial certainty values between „completely true“ and „completely false“. The fuzzy system logic recognizes further than simple true and false values. The expertise considers fuzzy logic as “a constitution of knowledge depiction appropriate for notions that cannot be defined accurately, but which depend upon their context”.

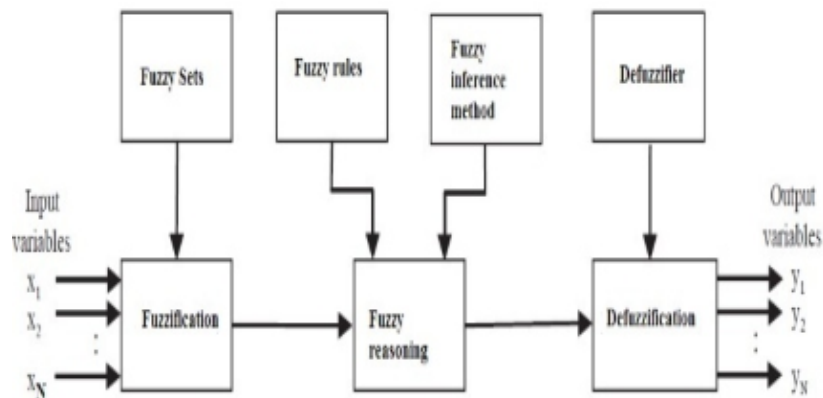
The Classical set or the Crisp set contains the objects that can convince accurate properties of membership. The Crisp membership functions have values of either one or zero. But the fuzzy set contains the vague properties of membership in correspondence to their objects. Fuzzy is said to determine “possibility” rather than “probability”. The impetus of the fuzzy logic is to alleviate difficulties in developing and analyzing complex systems encountered by the conventional mathematical utensils [2].

### Fuzzy Logic Process

The FL process is a progression of computing, reasoning and modeling with the fuzzy familiarity. Despite the fact that the massiveness of the information we incorporate each day with fuzzy, most of the actions or decisions implemented by humans or machines are crisp or binary. Fuzzy logic provides a substitute way to represent linguistic and subjective attributes of the real world in computing. It is able to be applied to control systems and other applications in order to improve the efficiency and simplicity of the design process.

The ultimate scenario of fuzzy system is the prospect for modeling of circumstances which are inherent and simultaneous numerical and linguistic data. Fuzzy systems are extensively used for modeling, simulating and replicating many genuine tribulations.

The figure 1 illustrates the structure of fuzzy system.



**Figure 1: Structure fuzzy system**

- **Fuzzification** - Converts the crisp input to a linguistic variable using the membership functions stored in the fuzzy data base.

The conversion of real inputs to fuzzy set values is the preliminary of the fuzzy system. In the real world, hardware and manuals generates crisp data, but these data are subject to investigational errors. By establishing the fact base of the fuzzy system we identify the input and output of the system. The IF THEN rules are coiled and uses unprocessed data to develop a membership function.

- **Fuzzy Inference System**

The Fuzzy rules are based on fuzzy premises and fuzzy consequences. Truth value for the premise of each rule is computed, and applied to the conclusion part of each rule. This results in one fuzzy subset to be assigned to each output variable for each rule. There are two inference methods/inference rules: MIN and PRODUCT.

- **Defuzzification- Convert the fuzzy value obtained from composition into a “crisp” value.**

This process is often intricate since the fuzzy set might not interpret directly into a crisp value. But it considered being obligatory, since controllers of substantial systems require discrete signals. The conversion of a fuzzy quantity to a precise quantity, just as fuzzification is the conversion of a precise quantity to a fuzzy quantity. The output of a fuzzy process can be the logical union of two or more fuzzy membership functions defined on the universe of discourse of the output variable.

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Defuzzification approach is intended at producing a non- fuzzy control action. The crisp value of the output variable is computed by finding the variable value of the center of gravity of the membership function for the fuzzy value. There different defuzzifying methods that used most commonly, one of them are Centroid of area (COA).

### **Centroid of Area (COA)**

COA finds the point where a vertical line would slice the aggregate set into two equal masses. Centroid defuzzification method finds a point representing the centre of gravity of the fuzzy set on its interval.

#### **2.2.1 Applications of Fuzzy System**

Fuzzy systems nowadays are extensively worn in various domains such as Aerospace, Business, Chemical industry, Defense, Signal processing and telecommunication, Transportations, etc.

One among them is the medical province. Medical diagnostic support system, control of arterial pressure during anesthesia, multivariable control of anesthesia, fuzzy inference diagnosis of diabetes are some of the paradigm of fuzzy system in the medical world.

### **3. OPTIMIZATION**

The analytical methods that are used to stumble on the optimum solution or unimpeded maxima or minima of constant and differentiable function are said to be the Classical optimization techniques [7]. The formula behind these techniques is executed iteratively by comparing diverse solutions in order to acquire the expected optimal result. There are two discrete

types of optimization algorithms generally used.

- Deterministic Algorithms - Specific rules for moving one solution to other.
- Stochastic Algorithms - Probabilistic translation rules for gaining popularity due to certain properties. One of such algorithm is the Swarm Intelligent (SI).

#### **Swarm Intelligent Optimization**

The synthetic intelligence which is based on the collective performance of decentralized and self-organized systems is known as Swarm Intelligent (SI). The SI is a loosely structured collection of interacting agents which can be distinguished, communicated and/or interrelated with each other. Since the agents can be easily added or removed without influencing the composition of the system, it is measured to be flexible and can be adapted in new situations [10].

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## Particle Swarm Optimization (PSO)

A Swarm Intelligent technique that searches for a best possible solution in the computable search space based on a population. This stochastic optimal search has been inspired by the Swarms of Bees, Flocks of Birds and Schools of Fish. The individuals of the search attempts to improve themselves by observing and imitating their neighbors. PSO are exceedingly used to find approximate solutions to extremely complex or unfeasible numeric maximization and minimization problems [6]. The algorithm of this optimization technique works as follows:

- Initialization by assembling of the random solutions.
- Searches for optimal by updating generations.
- Particles are swarmed in the solution space and the evaluating each solution are done with respect to some fitness measures behind each time step.
- In every iteration, each particle is rationalized as
- The first one is said to be the best fitness that has been acquired so far by the algorithm. This value is called pbest.
- Another "best" value that has been obtained by swarming among the population. This second best value is a global best and called gbest.
- When a particle takes part of the population as its topological neighbors, the second best value is a local best and is called lbest.

## Application of PSO

PSO relevance their therapeutic work in Human tremor analysis and other deadly diseases. Human performance assessment and Ingredient mix optimization are claimed through this modus operandi.

## 4. Application Collaborating the Above Techniques

According to aetiology, Atherosclerosis is alleged to be the most assassinating disease in the majority of developed and developing countries like India. Atherosclerosis is a medical terminology used to describe the ruptures of the arteries of the heart muscles by causing blood clots or plaque. The plaque is made up of fat, cholesterol, calcium and other substances which build upon the walls of the blood vessels. The arteries are responsible for supplying the oxygen rich blood to the heart muscles. When the blood clot grows huge enough, it blocks the flow of oxygen affluent blood to the heart muscles absolutely. This causes angina or heart attacks or even to sudden death. The angina is the chest pain or uneasiness due to the lack of oxygen in the blood.

The Coronary Heart Disease (CHD) is the damage in the interior of the coronary arteries leading to heart attacks and Arrhythmias. The Arrhythmias is the problem even in adolescent people with respective to

the rate or rhythm of their heartbeat. The early prediction of such tedious disease can reduce the mortality rate. These types of prophecy nowadays are quite impressive in the world of robotic technology. The following inspection provides us with better way to end with such prediction proposals [1].

## 5. EXPLORATION OF TECHNIQUES USED

S.No	Author of the paper	Methodology used	No. of attribute	Attained accuracy % ~
1	Persi Pamela et al.	CART decision Tree; Fuzzy Sys- tem ;PSO	14	94%
2	Markos etal.	Decision Tree; Fuzzy modeling & Optimization	19	73.40%
3	Kantesh et al.	Fuzzy reasoning	6	80%
4	K Cinetha et al.	Fuzzy logic; De- cision Tree with Clustering	1230*	97.67%
5	Debabrata et al.	CAD Screening Expert System; Fuzzy System	7	84.20%
6	S Muthuka- rupp-an et al.	Decision Tree; PSO; Fuzzy ex- pert System	13	93.27%
7	Dursan et al.	Support Vector Machine ; Deci- sion Tree; Neural Networks	19	87.74%
8	Ilias et al.	Support Vector Machine	198#	77%
9	Chih-Lin Chi et al.	Decision Support System with Optimal Decision path finder	49	50%
10	Rajeshwar et al.	Artificial Neural Network ; Back Propagation	12	89.40%

\*Training data #Heart sound signal

Persi Pamela et al. used Classification and Regression Tree (CART) algorithm along with the Particle Swarm Optimization (PSO) to predict 94% accuracy of CHD [18]. Markos et al. has used C4.5 decision tree algorithm besides fuzzy optimization techniques to acquire the result of 73.4 % [15]. 1230 training data are facilitated by K Cinetha et al. to propose a Decision Support System (DSS) for precluding CHD using decision tree with Clustering techniques has attained a premier accuracy of 97.67% [5]. To envisage 87.74 % accuracy by means of 19 attributes Dursan et al. has used C5 and CART decision trees [8]. Fuzzy expert system along with decision tree algorithm has been intended to gain the accuracy of 93.27 % by S Muthu karuppan et al. [17].

## 6. CONCLUSIONS

From this brief study, the prediction system which incorporates the methodologies such as Data mining, Fuzzy logic and Decision tree with clustering provides us with the appropriate accuracy of 97.67%. The another system that have been implemented in the Mat lab 10 with the techniques of Decision tree , Fuzzy system and Particle Swarm Optimization pro- vides us the best accuracy of 94% even with less number of attributes which accounts to 14. Thereby, the study can be concluded as the system proposed by Persi Pamela et al. as worthy in regards of performance metrics as number of attributes, accuracy rate and time consumption.



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# Digital Marketing and Its Impulsiveness in Real Estate

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## **ABSTRACT**

*Digital marketing provides a unique platform of electronic communication that allows marketers to interact instantly with consumers for the purpose of goods and services endorsement. Undoubtedly, digital marketing and e-commerce is a bonus to real estate industry as it has significantly changed the traditional transaction methods. But at the same time, just like every coin has two sides, e-commerce along with digital marketing is negatively impacting the role of intermediators and agents in real estate and is intensely changing the existing practices. Therefore, upcoming trend of real estate industry is heading towards new opportunities and challenges at the same time. Moreover, due constantly increasing popularity of online marketing because of its easy accessibility, established firms also face competition resulting in highly impressive services to the customers by sellers. In addition, introduction of new communication means for publishing information such as world-wide web (www) has completely transformed the trade. Utilising smart devices and social media are further accelerating the success rate considering and meeting the consumer requirements on the priority basis. Various studies have also been done to find out the clear pictures from market to about convenience and usage of digital marketing. Although digital marketing is considerably enlarged from past few decades but its actual foundation to get fruitful outcome is also directly related to interactive nature of its service providers. In economy, the real estate is ranked as one of the most highly information technology (IT) intensive sector by the Department of Commerce<sup>[1]</sup>. Also, the modern advancements in technology have changed the administrative structure of companies and distribution networks of industries.*

**Keywords: Digital Marketing, Online Property, Real Estate, E- Commerce, Information Technology, Online transaction**

## **INTRODUCTION**

Digital marketing is also denoted as web marketing, internet marketing and online marketing & it is successfully setting new benchmarks across the globe. Displaying items/products online and other services by various digital mean/sources has become a common practice among sellers and customers, thus it is incorporated into market plans for future strategies. Since e-commerce offers a potential setup to study e-commerce due to its information-driven and information- intensive nature which is also experiencing ongoing IT related changes<sup>[2]</sup>. E-commerce applications have the ability to meticulously change the current practices in the real-estate industry. Technological inventions have altered all aspects of real estate series, beginning from design and construction via marketing till their sales. Improved information processing system and financial organisations lending loans to developers and home purchasers further lifts the real estate market<sup>[3]</sup>. Industry has shown a mixed reaction about the emergence of e-commerce in real estate. But no matter the response, e-commerce has already made its

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way into the real estate trade that reformed the terrain forever. As per the estimations, increased internet usage among consumers would ultimately increase the rate of sale-by-owner<sup>[4]</sup>. On the other hand, a decrease in employment and revenue level of professionals was expected. To get the desired outcome, real estate can also be coupled with some traditional aspects like networking and factual information. Innovative e-commerce era permits the entry of new comers in already competitive marketplace which results in more choices available to the customers<sup>[5]</sup>. Further, e-commerce requires real estate experts to think out of the box, so that more clients can be attracted. Modern industry is heading towards the addition of digital signature, where more online transactions can occur, which on acceptance, will create a room for long distance transactions to be completed within industry.

## **DIGITAL MARKETING AND REAL ESTATE**

Growth of e-commerce and digital marketing has fascinated the public interest. Online marketing being a universal network on public platform is skilfully managing the connectivity hitches between the potential trading associates. The internet has also created a platform for online auctions<sup>[4]</sup>. Several websites to support the sale-procedure in real estate and ultimately, various sites supporting the online transactions are also created. This allows sellers to directly reach the customers without any agent or other intermediary. Today, web sites are used to search suitable properties and houses. Thus, representing sellers are now efficiently using the internet for sales and are circumventing the Multiple Listing System (MLS) which is a platform for disseminating the information with other brokers to enable more reviews of assets. So, traders find it more expedient and less expensive to list their properties for sales through internet instead of selling with the help of brokers where they had to pay them also. But online websites permit them either free of cost usage or they pay for advertising only which costs very less. It clearly indicates that online websites are evading the traditional trading methods where agents and brokers had an important role to play. Now, properties and other goods are listed online to reach the potential buyers. It involves the following steps which support the transactions at different stages<sup>[6]</sup>:

### **Listing**

- Houses are listed on websites
- Allows direct reach to customer
- No need to pay the real estate agents
- Very less amount is required to display assets online

### **Searching**

- Sellers can directly search the houses in MLS listings: Its potential can be understood seeing the support to these websites by National Association of Realtors (NAR), which sponsors many of them

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and helps in easy access to 1.2 million houses (listed in different MLSs) with good searching and mapping tools.

### **Evaluation**

- Some of the websites offer virtual tours to properties and houses, giving the idea about how they look.

Above mentioned feature of virtual-walk eliminates the role of agents because neighbourhood and all other details are explained in an organised way using panoramic images.

### **Negotiation**

- For closing details of purchase, websites are synchronised with other service providers which add value to their clients and trades.
- Building inspectors, loan officers, advocates, and evaluators help to assist transactions. Offering such services to buyers provides the one-stop shopping with full service centre.

### **CLOSING TRANSACTION**

Currently the legal system is also facing difficulty in the electronic transaction closing. the second obstacle to the online transaction are the lack of guidelines and the norms which are not sufficient in the current market for the proper closing of the transaction as there are so many non- banking services available in the market and non-banking landers also decide to close transaction themselves, so this is also the challenge for the banking sector in filling the gap of such closed transaction.

### **DIGITAL MARKETING TRENDS AND CUSTOMER OPINION**

In this area of new technological environment, customers are at the top-most priority for every company and lots of customers are finding the way on Internet to save their time and retrieve updated information regarding the goods and services of their interest and trust. Customer is intelligent, smart enough and know how to visit company's website, examine the difference in cost of products and services and to purchase them online with lots of benefits taking into consideration various features such as money-back guarantee and easy replacement and return. Customer have variety of options today for comparing and choosing the competent products available with various vendors/sellers and reviews available by the public who had already used that particular product or service. Digital marketing allows 24 x 7 services to make transactions for the customers and there is a considerable amount of transparency onWeb. Internet marketing and e-commerce have the greatest future in the present market scenario and consumers are also satisfied purchasing products online due to its variety of advantages and most of

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them also find it is the safest mode of transactions. The ratio of male customers is very high in online shopping which is about 70% where the income of 49% of such consumer space lies from 10000- 20000 INR. Apart from that various organisations are also buying more than others through online shopping and is contributing about 50% of the online shopping<sup>[7]</sup>. Few of the customers find that online shopping incorporates a simple procedure for purchasing an item and is having a broader variety of products to choose with many other features like price, vender, popularity, brand and reviews. As every coin is having two sides, there are customers who do not prefer online transactions, products or services because of the security concerns those are incorporated with these systems.

### **CHALLENGES ENCOUNTERED**

The rise of e-commerce poses many challenges to physical retailers. Internet driven economy is causing new threats and opportunities to the various sectors at the same time. Presently, many obstacles are emerging on the way of e-commerce and digital marketing in real estate. Firstly, legal system and lack of regulations generate interruption in final closing of online transactions. Secondly, increased competency among companies and elimination of agents& brokers is also challenging the industry as the firms have to put extra efforts to make their products, retailer services more attractive to the consumers with limited manpower. Many e-commerce websites enter daily into the business markets but unfortunately, less than 10 percent of them survive after an year<sup>[8]</sup>. The other bigger challenge is ensuring the customer about transparency, privacy, reality of services and secure online transactions. Real estate companies find it difficult to incorporate technological changes in e-business because industry demands are swiftly changing every day. Additionally, minimal cost web-services can also be a problem for real estate consultants as it results in increased competency to survive in the era of online marketing coupled with e-commerce. Although real estate firms are trying their best to produce virtual tours but a gap between virtual and real parameters still exist<sup>[9]</sup>. Immature areas of certain e-commerce applications in real estate still require strengthening and shifting from infancy to mature and experienced marketplace which may require further expertise assistance.

### **FUTURE ASPECTS**

The future of e-commerce in the real estate is auspicious. Technology has expanded the horizons of industry taking it to the new levels. Nearest future implications still have a scope of improvement in terms of efficiency and competency-ability. Online transactions with digital signature will be increased considerably. Technological innovations will scratch down the geographical barriers allowing more long-distance transactions [4]. Thus, a management system for online transactions is expected to be highly sophisticated and intelligent. On considering the management aspect, better access to data will be possible due to multiple databases and analytical tools. Electronic commerce model of Property

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Management Areas embracing the idea to develop “digital cities” for planning the development of many cities. Therefore e-property management system can potentially replace the traditional ways of property management<sup>[9]</sup>. Customer Relationship Management System (CRM) will make it available to track ever customer’s deal and complete process of service. The tremendous combination of real estate with e-commerce and digital marketing will create miracle in modern urban development approaches.

## CONCLUSION

Digital revolution has significantly impacted the real estate by reducing the gap between retailers and sellers. It is necessary for corporates to ensure their valuable position in industry via responding to the new advancements promptly and accordingly making the future strategies. Government should also support the real estate market in organisation, co-ordination and all concerned aspects primarily consisting of property management. Meanwhile, real estate entrepreneurs should be encouraged to actively participate in grasping new opportunities so that all over growth becomes easily achievable. Although current trends are indicating declined involvement of brokers, but it can be successfully established by increasing transparency and reducing security related risks. Industry can be more benefitted. The real estate industry in India is matured enough and as per digital marketing performances incorporating user friendly software and the phenomenal increase in the number of hits (almost 300%) from digital marketing of the real estate platforms. Undoubtedly, digitalization basically makes the real estate and is impacting the buyers by exposing them to more choices than ever before. As web marketing plays a crucial role and is becoming an inseparable part of every industry and business, therefore, it is the time to evolve the real estate digital marketing strategy which should be handled explicitly. Digital marketing for real estate statistics clearly depicts how online marketing is influencing real estate industry as 80% of all home buyers are searching online, 83% of home buyers show their interest in watching property related videos and pictures, 52% of the prospects use smartphones and 49% of the leads come through referrals, social media is used by 91% of retailers and finally, 33% of the buyers buying for the first time are researching online<sup>[10]</sup>.

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# Role of Internet in Education of Commerce Students

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## **ABSTRACT**

### ***Background***

*Introduction of globally adopted modern technologies in the field of education provides an opportunity for modernization teaching methods, E-Learning and the facility to gain knowledge in each language, better understanding of the meaning of words through online dictionaries and easy download of the educational and literary things.*

### ***Materials and Methods***

*The proposed research work attempts to study the role of internet in education of college students. The study was undertaken in St. Peter's College Kolenchery. The respondents of the study were commerce students. The data were suitably classified and analyzed based on the objective of the study. Analysis was done via statistical software 16.0. Statistical tools like percentages, rank test and Friedman repeated measures analysis of variance on ranks have been applied for analyzing the data.*

### ***Results***

*Google was the most preferred browser of the students and Mozilla Firefox was the next preferred browser for them. The most used search engine by the students was All the Web and Alta Vista was ranked second and the least rank was given to Info Mine. Internet was mainly used for completing assignments and to check exam timetables.*

### ***Conclusion***

*Google was the most preferred browser of the students. The most used search engine by the students was All the Web. Most of them used internet for completing assignments and to check exam timetables and results.*

***Key words: E-Learning, All the Web, Dog Pile and Mozilla Firefox.***

## **MANUSCRIPT INTRODUCTION**

Internet is the fastest and cheapest source of sharing knowledge. There has been significant development in Internet and information and communication technologies in the last two decades which has made drastic changes in the field of education. Introduction of globally adopted modern technologies in the field of education provides an opportunity for modernization teaching methods, E-Learning and the facility to gain knowledge in each language, better understanding of the meaning of words through online dictionaries and easy download of the educational and literary things. Lazinger et al. (1997)<sup>2</sup> conducted a survey of the faculty members of the Hebrew University of Jerusalem



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provided data on internet access as of 1995. The results showed higher usage by the members of the faculties of science, medicine and agriculture than the members of the faculties of social science and humanities. Becker (1998)<sup>3</sup> conducted a study on the Internet use by 2250 teachers from public and private schools in the U.S. The study revealed that 90% of the teachers had Internet access. More than half of the teachers (59%) had Internet access at home. A majority of the teachers (68%) used Internet to find information resources for preparing their lessons. Singh (1998)<sup>3</sup> conducted a research study on the use of Internet by the librarians in Malaysia. The main findings of the study indicated that 90% of the students used the Internet for work related purposes. Most of the students were recent users.

## **SIGNIFICANCE OF THE STUDY**

The internet plays a significant role in education as it provides instant availability of vast stores of information on 24x7 basis. With the introduction of internet, learners have instant access to information on virtually any subject which they had to be physically near the information they wished to learn earlier. The internet has superseded libraries as a source for information gathering and research. On line learning facilitates the students to learn whatever they want, provides comfort, helps to acquire an online degree from a prestigious university at a low cost, self-paced learning etc. The variety of sources allows students to pursue subject in much greater details rather than being limited to class-room learning. In this context, the present study entitled “Role of Internet in Education of Commerce Students” has greater significance.

### **Scope of the Study**

The scope of the study is limited to the role of internet in education of commerce students of St. Peter's College, Kolenchery. The respondents of the study are students of Department of Commerce.

### **Objective of the study**

To analyse the role of internet in education of commerce students of St. Peter's College, Kolenchery.

### **Hypothesis of the study**

**HO1-** There is no difference in the usage of internet for education purpose among the commerce students of St. Peter's College Kolenchery.

### **Research Methodology Selection of sample**

The students of Dept. of Commerce of St. Peter's College Kolenchery form the population of study. There were in all 184 students (both U.G & P.G) in the Department of Commerce during the academic year 2015-2016. All the students were selected for the purpose of study.



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## Collection of data

The study was mainly based on primary data. Secondary data were also used wherever necessary.

## Primary Data

The primary data were collected through well-structured questionnaire. The questionnaire was used in such a way as it covers the entire objectives of the study.

## Secondary Data

Secondary data were collected from journals, books and from various web sites etc.

## Tools of Analysis

The data were suitably classified and analyzed based on the objective of the study. Analysis was done via statistical software 16.0. percentages, rank test and Friedman repeated measures analysis of variance on ranks were used.

## Period of study

The survey was conducted in the month of December 2016.

## Major Findings of the study

15 % of the students always used, 36 % often used, 28 % rarely used, 12% sometimes used internet for education. However, 9 % had no opinion in this regard (Table 1). 65.2% of the students used mobile phone as gadgets for internet connection and 34.8% of them had internet connection in their computer (Table 2). Home was the main place of usage of internet for the students (Mean score=3.22) college was the next place (Mean score=3.12) and café was ranked as last (1.14) (Table 3). Google was the most preferred browser (Mean score=4.86) of the students and Mozilla Firefox (3.36) was the next preferred browser and Yahoo was the least preferred browser (Mean score=2.84) (Table 4). The most used search engine by the students was All the Web (Mean score=3.76), the second rank was given to Alta Vista (Mean score=3.29) and third rank was given to Dog Pile and the least rank was given to Info Mine (Mean score=2.33) (Table 5). 16.3% always used, 31% often used, 37% sometimes used and 15.8% rarely used internet for learning activities (Table 6). 30.4% of the students always used, 44% often used, 21.7% sometimes used and 3.8% rarely used internet for completing assignments (Table 7) 9.8% of students always used, 27.7 % often used, 32.6% sometimes used and 16.3% rarely used internet for informing useful websites to friends (Table 8). 11.4% of the students always used, 19% often used, 19% sometimes used, 27.7% rarely used internet to put bookmarks to websites (Table 9). 6.5% of students always used,

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9.2% often used, 14.7% sometimes used and 34.8% rarely used internet to communicate with teachers (Table 10). 2.2% of the students always used, 14.1% often used, 25% sometimes used and 37.5% rarely used internet to exchange of e-mails with friends (Table 11). 12% of the students always used, 8.2% often used, 24.5% sometimes used, 40.8% rarely use internet to access the library web sites (Table 12). 31.5% of the students always used, 30.4% often used, 20.1% sometimes used and 14.7% rarely used internet as the main source of information. (Table 13). 12.5% of the students always used, 15.8% often used, 33.7% sometimes used and 31.5% rarely used internet for finding latest information about the university. (Table 14). 12% of the students always used, 22.3% often used, 26.1% sometimes used and 24.5% rarely used internet for downloading software. (Table 15). 6% of the students always used, 33.2% often used, 29.3% sometimes used and 21.7% rarely used internet to download notes. (Table 16). 1.6% of the students always used, 7.6% often used, 39.1% sometimes used and 32.6% rarely used internet for finding articles from journals. (Table 17). 7.1% of the students always used, 10.3% often used, 21.7% sometimes used and 34.8% rarely used internet to upload files/documents (Table 18). 47.8% of the students always used, 21.7% often used, 15.2% sometimes used and 13.6% rarely used internet to check exam timetables and results. (Table 19). 7.6% of the students always used, 8.2% often used, 19.6% sometimes used and 31% rarely used internet to participate in online quizzes and exams. (Table 20). 4.9% of the students always cross checked, 46.2% often cross checked, 23.4% sometimes cross checked, 14.7% rarely cross checked the accuracy of information accessed through internet with other sources of information (Table 21). Most of them used internet for completing assignments and to check exam timetables and results.

The hypothesis of the study was that there is no difference in using internet for education purpose among the commerce students of St. Peter's College Kolenchery. Friedman test was used to test the hypothesis. The test result given in Table 22 revealed that there is a significant difference in the usage of internet for education purpose among the commerce students of St. Peter's College Kolenchery since the p value is less than 0.01. therefore, the null hypothesis H<sub>0</sub> is rejected.

## **CONCLUSION**

Google was the most preferred browser of the students and secondly, they preferred Mozilla Firefox, third and fourth ranks were given to Internet Explorer and Yahoo. The most used search engine by the students was All the Web, the second rank was given to Alta Vista and third rank was given to Dog Pile and the least rank was given to Info Mine. Most of them used internet for completing assignments and to check exam timetables and results.

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**Table 1 Frequency of Usage of Internet for Education**

Responses	Frequency	Percent
Always	28	15
Often	66	36
Rarely	51	28
Sometimes	22	12
No opinion	17	9
Total	184	100

Source: Primary data.

**Table 2 Gadgets Used**

Gadgets used	Frequency	Percent
Mobile phone	120	65.2
Computer	64	34.8
Total	184	100

Source: Primary data.

**Table 3 Place of Usage of Internet**

Place of Usage	Mean	Rank
Home	3.22	1
School/college	3.12	2
Cafe	1.14	4
Friend's/relatives' house	2.52	3

Source: Primary data.

**Table 4 The Browser Used**

Browser used	Mean	Rank
Google	4.86	1
Internet explorer	2.9	3
Mozilla Firefox	3.36	2
Yahoo	2.84	4

Source: Primary data.

**Table 5 Search Engines Used**

Search engine used	Mean	Rank
Dog pile	2.9	3
Alta vista	3.29	2
All the web	3.76	1
Info mine	2.33	5
Academic. us	2.72	4

Source: Primary data.

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**Table 6 Learning Activities**

Responses	Frequency	Percent
Always	30	16.3
Often	57	31
Sometimes	68	37
Rarely	29	15.8
Total	184	100

Source: Primary data.

$\chi^2=25.000$  with 3 degrees of freedom significant at 5%level.

**Table 7 Complete Assignments**

Responses	Frequency	Percent
Always	56	30.4
Often	81	44
Sometimes	40	21.7
Rarely	7	3.8
Total	184	100

Source: Primary data.

$\chi^2=62.652$  with 3 degrees of freedom significant at 5%level.

**Table 8 Inform Useful Websites to Friends**

Source: Primary data.

Responses	Frequency	Percent
Always	21	11.4
Often	35	19
Sometimes	35	19
Rarely	51	27.7
No opinion	42	22.8
Total	184	100

$\chi^2=34.750$  with 4 degrees of freedom significant at 5%level.

**Table 9 Put Bookmarks to Websites**

Source: Primary data.

$\chi^2=13.174$  with 4 degrees of freedom significant at 5%level.

Responses	Frequency	Percent
Always	18	9.8
Often	51	27.7
Sometimes	60	32.6
Rarely	30	16.3
No opinion	25	13.6
Total	184	100

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**Table 10 Communicate with Teachers**

Source: Primary data.

$\chi^2 = 70.185$  with 4 degrees of freedom significant at 5% level.

Responses	Frequency	Percent
Always	4	2.2
Often	26	14.1
Sometimes	46	25
Rarely	69	37.5
No opinion	39	21.2
Total	184	100

**Table 11 Exchange E-Mails with Friends**

Source: Primary data.

$\chi^2 = 63.011$  with 4 degrees of freedom significant at 5% level.

Responses	Frequency	Percent
Always	12	6.5
Often	17	9.2
Sometimes	27	14.7
Rarely	64	34.8
No opinion	64	34.8
Total	184	100

**Table 12 Access the library website**

Responses	Frequency	Percent
Always	22	12
Often	15	8.2
Sometimes	45	24.5
Rarely	75	40.8
No opinion	27	14.7
Total	184	100

Source: Primary data.

$\chi^2 = 62.957$  with 4 degrees of freedom significant at 5% level.

**Table 13 Use of Internet as Main Source of Information**

Responses	Frequency	Percent
Always	58	31.5
Often	56	30.4
Sometimes	37	20.1
Rarely	27	14.7
No opinion	6	3.3
Total	184	100

Source: Primary data.

$\chi^2 = 50.620$  with 4 degrees of freedom significant at 5% level.

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**Table 14 Find Latest Information about the University**

Responses	Frequency	Percent
Always	22	12
Often	41	22.3
Sometimes	48	26.1
Rarely	45	24.5
No opinion	28	15.2
Total	184	100

Source: Primary data.

$\chi^2 = 53.011$  with 4 degrees of freedom significant at 5% level.

**Table 15 Download Software**

Responses	Frequency	Percent
Always	23	12.5
Often	29	15.8
Sometimes	62	33.7
Rarely	58	31.5
No opinion	12	6.5
Total	184	100

Source: Primary data.

$\chi^2 = 13.772$  with 4 degrees of freedom significant at 5% level.

**Table 16 Download Notes**

Responses	Frequency	Percent
Always	11	6
Often	61	33.2
Sometimes	54	29.3
Rarely	40	21.7
No opinion	18	9.8
Total	184	100

Source: Primary data.

$\chi^2 = 51.924$  with 4 degrees of freedom significant at 5% level.

**Table 17 Find Articles from Journals**

Responses	Frequency	Percent
Always	3	1.6
Often	14	7.6
Sometimes	72	39.1
Rarely	60	32.6
No opinion	35	19
Total	184	100

Source: Primary data.

$\chi^2 = 93.554$  with 4 degrees of freedom significant at 5% level.

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**Table 18 Upload Files/Documents**

Source: Primary data.

$\chi^2 = 47.793$  with 4 degrees of freedom significant at 5% level.

Responses	Frequency	Percent
Always	88	47.8
Often	40	21.7
Sometimes	28	15.2
Rarely	25	13.6
No opinion	3	1.6
Total	184	100

**Table 19 Check Exam Time Tables and Result**

Source: Primary data.

$\chi^2 = 108.446$  with 4 degrees of freedom significant at 5% level.

Responses	Frequency	Percent
Always	13	7.1
Often	19	10.3
Sometimes	40	21.7
Rarely	64	34.8
No opinion	48	26.1
Total	184	100

**Table 20 Participate in Online Quizzes and Exams**

Responses	Frequency	Percent
Always	14	7.6
Often	15	8.2
Sometimes	36	19.6
Rarely	57	31
No opinion	62	33.7
Total	184	100

Source: Primary data.

$\chi^2 = 55.402$  with 4 degrees of freedom significant at 5% level.

**Table 21 Cross Check the Accuracy of Information with Other Information Sources**

Responses	Frequency	Percent
Always	9	4.9
Often	85	46.2
Sometimes	43	23.4
Rarely	27	14.7
No opinion	20	10.9
Total	184	100

$\chi^2 = 95.457$  with 4 degrees of freedom significant at 5% level.

Source: Primary data.

**Table 22 Usage of internet for Education purpose (Friedman repeated measures analysis of variance on ranks)**

<b>Education purpose</b>	<b>Mean</b>	<b>Rank</b>
Use for learning activities	<b>10.04</b>	<b>4</b>
Collect materials to complete assignments	<b>11.8</b>	<b>1</b>
Inform friends about useful websites	<b>8.23</b>	<b>7</b>
Put bookmarks to website	<b>7.02</b>	<b>9</b>
Communicate with teachers	<b>5.08</b>	<b>14</b>
Exchange emails with friends on academic matters	<b>5.88</b>	<b>12</b>
Access library websites	<b>6.81</b>	<b>10</b>
Main source of information	<b>10.76</b>	<b>3</b>
Downloading software	<b>7.98</b>	<b>8</b>
Download notes	<b>8.52</b>	<b>6</b>
Find articles from journals	<b>5.95</b>	<b>11</b>
Upload files/documents	<b>5.86</b>	<b>13</b>
Check exam timetables and results	<b>11.59</b>	<b>2</b>
Participate in online quizzes and exams	<b>5.54</b>	<b>15</b>
Cross check the accuracy of information with other sources of information	<b>8.95</b>	<b>5</b>

Source: Primary data.

$\chi^2 = 731.720$  with 14 degrees of freedom significant at 5% level.



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# A Survey on Usage of Digital Services Among Organizations in East Bangalore

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## **ABSTRACT**

*Digital marketing is selling products or services on the internet with the help of various software and technologies. Since the Indian government is pushing for digitalization, a short survey was conducted to find out the awareness and usage level of various digital tools by organizations. The data for this study was gathered through survey method with 100 companies who own a website. It was found that many need training and awareness campaign to fully utilize the digital services and stay in the competition. This shows that it is the right time for the people to get aware of all the trends of digital marketing. This is important because without right tools and execution, any marketing campaign will go waste.*

**Key words:** *Digital marketing, website owners, digitalization, services, trends*

## **INTRODUCTION:**

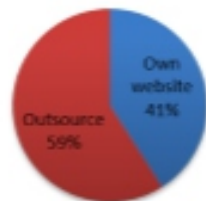
For years together the marketers are always targeting their customers through product, price promotion and place (4P's). These methods which are traditional in nature, focus on identifying the right audience segment, understand their behaviour, provide incentives and attract them to buy a product or service. Marketers also use different categories like print, broadcast, direct mail...etc. Today is the era of digital marketing. The companies market and promote their products or services on different forms of digital platform providing customer convenience. With digital marketing in force the companies have to be updated with the usage of technology and trends around them. There are many benefits a company can gain from digital usage like they can easily know how the campaign has performed on the Internet, how many times the company has been viewed or clicked, how many respondents have gone through their advertisement and how many responses are received. The field of digital possibilities are endless hence a marketer has enough tools and techniques not only to create but also to expand their ability in creativity. It might be easy to start a business off- line but it is quite hard to start business on-line as there are many parameters that a person should know before he starts his business on-line. Most of these parameters are not known and understanding them might not be easy for all.

## **MATERIALS AND METHOD:**

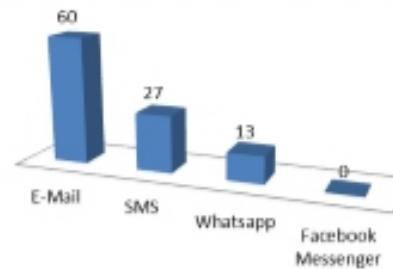
The main objective of study was to explore the awareness and usage of digital services. This research is descriptive in nature. The responses were confined to be 100 randomly chosen organizations in east Bangalore having their website. The data collected was entered in excel sheet, converted to percentage

analysis and the graphs were plotted. Below are the graphs showing: ownership and maintenance of website; organizations having profile on social media (Face Book, Twitter, LinkedIn & Pinterest); usage of social media campaigns to reach to customers; usage of online medium for customer interaction; usage of blogs; usage of market automation software and predictive marketing software; awareness level on mobile app marketing.

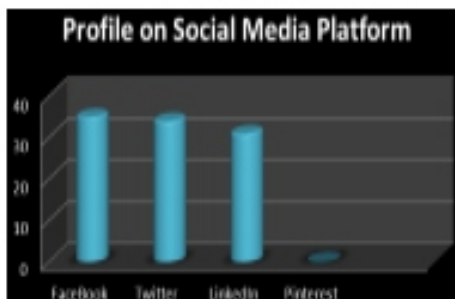
**OWNERSHIP & MAINTENANCE OF WEBSITE**



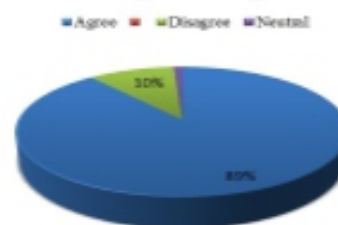
**Online Customer Interaction**



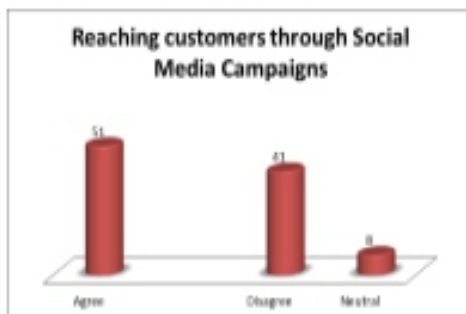
**Profile on Social Media Platform**



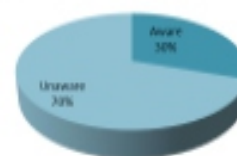
**Usage of Blogs**



**Reaching customers through Social Media Campaigns**

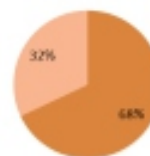


**Usage of Mobile App Marketing**



**Usage of Software**

Market Automation software Predictive Marketing Software



## RESULTS AND DISCUSSION:

From the study the following observations are made:

- 41% of the organizations have their website and maintain on their own whereas 59% respondents outsource their website related activities.
- When a question is being asked regarding usage of social media, 35% of respondents say they have their profile in Facebook, 34% in twitter and 31% in LinkedIn. None of the respondents have their profile in Pinterest.

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- 51% of respondents agree that they are reaching customers through social media campaigns while 41% disagree on the same. 8% of the respondents did not reply for the question being asked.
  - 60% of the respondents interact with their customers through E-mails, 27% through SMS 13% through WhatsApp whereas no one is using face-book messenger for interacting with their customer.
  - 89% of respondents agreed for the usage of blogs whereas 10% of respondents have stated that they do not blog and 1% of respondents did not reply for the question.
  - 68% of respondents say that they are aware of market automation software while 32% of respondents are aware of predictive marketing software.
  - 70% of respondents are aware of usage of marketing through mobile app whereas 30% of respondents are unaware about usage of mobile app marketing.

It's also been observed that when it comes to Digital marketing, respondents who own a website know basics of how it works and how to optimize it but they are not updated with the trends each company is coming up with to beat the competition. Therefore use of Google analytics is highly effective for such companies to update themselves and stay in the competition. Now days to build better branding most of the companies hire content writers to write blogs and maintain their website. The bigger the brand the better the market. Right SEO tools help in improving better strategies to get brand on top of the charts. Awareness on these SEO elements is also less. Most companies who are still using Emails as promotions may not stand in the competition as customers treat this as Spam. Companies are aware about promoting through social media but lack how to use it further. They can even use Facebook messenger, what's app to interact with clients rather than only e-mail. It's time that companies should invest money and time effectively to withstand all online competitions.

#### **CONCLUSION:**

Respondents have very vague idea in SEO. Training and awareness programs should be conducted for those interested in digital marketing. Social media can also be used in an optimized way. Companies have to adapt and invest in new software to reach out customers. Instead of outsourcing organizations can train their employees to implement digital marketing strategies in an effective way.

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# Role of Mobile Computing in Developing Technologies

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## **ABSTRACT**

*Mobile computing has changed the complete panorama of our everyday lifestyles. It is fitting most important due to the upward thrust within the number of transportable computer systems and the wish to have steady community connectivity to the internet without reference to the bodily location of the node. This technological know-how that allows transmission of data, voice and video via a laptop or any other Wi-Fi enabled gadget with no need to be linked to a fixed physical hyperlink. Cellular presents gigantic benefits for companies that decide on to integrate the science into their constant organizational expertise process. Starting from Wi-Fi laptops to cell phones and Wi-Fi/Bluetooth enabled individual Digital Assistants to wireless sensor networks; cell computing has become ubiquitous in its impact on our everyday lives. The purpose of this paper is to point out one of the characteristics, applications and obstacles of mobile computing.*

***Keywords: Mobile Computing, Wireless Technology, characteristics, Application and Limitation.***

## **I. INTRODUCTION**

In the last 10 years, the advent of cellular telephones as well as laptops has dramatically improved the provision of mobile contraptions to companies and residence users. Extra just lately, smaller moveable devices such as PDAs and chiefly embedded contraptions (e.g. Washing machines, sensors) have slowly changed the way humans live and consider of desktops. Computing is drifting faraway from simply being targeting computers and relates more and more in the direction of society, its persons and its infrastructures. This is specified real the place sensors are being developed to be so minute that they are literally embedded in garb and even humans.

Two technologies permit customers to move about with computing power and network assets at hand: transportable desktops and Wi-Fi communications. Computers are shrinking; enabling many to be held through hand regardless of spectacular computing capabilities, even as the bandwidth of wi-fi hyperlinks maintains growing. These alterations have more and more enabled folks to access their individual know-how, company knowledge, and public assets “each time, anyplace”.

Mobile computing is associated with mobility of hardware, data and software in computer applications. Mobile computing has become possible with convergence of mobile communications and computer technologies, which include mobile phones, personal digital assistants (PDA), handheld and portable

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computers, wireless local area networks (WLAN), wireless wide area networks and wireless ATMs. The increasing miniaturisation of virtually all system components is making mobile computing a reality [1][2]. Mobile computing - the use of a portable computer capable of wireless networking - is already revolutionising the way we use computers. Wireless networking has greatly enhanced the use of portable computers. It allows users versatile communication with other people and outright notification about important events and convenient access to up-to-date information, yet with much more flexibility than with cellular phones or pagers. It also enables continuous access to the services and resources of stationary computer networks. Wireless networking promises to do for portable computers what traditional networks have done for desktop personal computers. Networks enable stand-alone personal computers to participate in distributed systems that allow users anywhere on the network to access shared resources. With access to a wireless network, mobile users can download news or electronic documents, query a remote database, send or receive electronic mail, or even are involved in a real-time video-conference with other users. The technical challenges that mobile computing must resolve are hardly trivial. However, some of the challenges in developing software and hardware for mobile computing systems are quite different from those involved in the design of today's stationary networked systems [2]. Mobile user location becomes a dynamically changing piece of data. In this case, the user updates this information, while many others may access it to find out where the mobile user is. In the mobile environment, the location of a user can be regarded as a data item whose value changes with every move. Establishing a connection requires knowledge of the location of the party we want to establish a connection with. This implies that locating a person is the same as reading the location data of that person. Such read operations may involve an extensive search across the whole network as well as a database look up. Writing the location may involve updating the location of the user in the local database as well as in other replicas of this data item [3] one important characteristic about mobile computers is that they have severe power restrictions. A battery represents the most significant single source of weight in a lightweight computer. While reducing battery weight is important, a small battery can undermine the value of portability by causing users to recharge frequently, carry spare batteries, or use their mobile computers to a minimum. Minimising power consumption can improve portability by reducing battery weight and lengthening the life of a charge. Power can be conserved not only by the design of energy efficient software, but also by efficient operation [4][5].

## **II. CHARACTERISTICS**

Mobile computing is accomplished using a combination of computer hardware, system and applications software and some form of communications medium. Powerful mobile solutions have recently become possible because of the availability of an extremely powerful and small computing devices, specialized software and improved telecommunication. Some of the characteristics of mobile computing are based on following:

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**a) Hardware:-**The characteristics of mobile computing hardware are defined by the size and form factor, weight, microprocessor, primary storage, secondary storage, screen size and type, means of input, means of output, battery life, communications capabilities, expandability and durability of the device.

**b) Software: -** Mobile computers make use of a wide variety of system and application software. The most common system software and operating environments used on mobile computers includes MSDOS, Windows 3.1/3.11/95/98/NT, UNIX, android etc. These operating environments range in capabilities from a minimalist graphically enhanced- pen enabled DOS environment to the powerful capabilities of Windows NT. Every operating system/environment has some form of integrated development environment (IDE) for program development. Most of the operating environments provide more than one development environment strategy to custom application development.

**c) Communication: -** The ability of any mobile computer to connect in a few fashions with a set information system is a defining quality of mobile computing. The sort and option of communication medium significantly influences the sort of mobile computing program that may be created. Just how a mobile computing device communicates with a set information system can be grouped as: (a) linked (b) weakly linked (c) batch and (d) disconnected. The connected category implies a continuously available high-speed connection. The ability to communicate consistently but at poor speeds, allows mobile computers to be linked to the fixed information system weakly. A batch connection means that the mobile computer is not available for communication with the fixed information system continuously. Inside the batch mode, communication is set up randomly or periodically to switch and update information between your mobile computer and fixed information systems. Mobile computer systems may operate in batch method over communication mediums that can handle ongoing procedures, reducing the cellular airtime and associated fees. Disconnected mobile computer systems allow users to boost efficiency by causing calculations, saving contact information, keeping a routine, and other non-communications oriented jobs. This method of procedure is of little interest because the mobile device is not capable of electronically interacting and exchanging information with the set organizational information system. Exchange of information with a disconnected mobile computing device can only just be achieved by manually stepping into information in to the device or copying from the device's display screen and manually stepping into the information in to the set information system. This method of information exchange is more reliable than using papers which is effectively nonexistent, since almost all modern mobile computing hardware is with the capacity of some type of native electronic digital data communications. Data Communications is the exchange of data using existing communication networks. The word data covers a variety of applications including Document|Record|



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Data file transfer interconnection between Wide-Area-Networks (WAN), facsimile (fax), e-mail, usage of the internet and the internet (WWW).

### III. TECHNOLOGIES AVAILABLE

There are lots of communications technologies on hand in these days that permit mobile computers to communicate. The most common of those applied sciences are: (a) wireless nearby subject Networks (WLANs) (b) satellite (c) Cell Digital Packet data (CDPD) (d) personal Communications systems (PCS) (e) global system for mobile communications (GSM) (f) RAM and ARDIS knowledge networks (g) specialized mobile Radio (SMR) carrier (h) one and two- manner paging (i) simple ancient cell process (POTS) (j) internet (k) infra-red (l) docking (serial, parallel, LAN) and (m) disk swapping. These numerous communications applied sciences make to be had a continuum of connectivity that presents communications capabilities ranging from guide-assisted batch transfers to excessive-pace steady communication.

### IV. PORTABLE COMPUTING DEVICES

A number of categories of portable computing devices can run on batteries but usually are not quite often categorised as laptops: portable computers, PDAs, ultra cellular PCs (UMPCs), capsules and Smartphone's:

- i. A moveable computer (discontinued) is a general-motive computer that can be comfortably moved from position to location, but cannot be used whilst in transit, by and large considering it requires some "environment-up" and an AC power supply. The most noted example is the Osborne 1. Portable desktops are also known as a "transportable" or a "luggable" pc.
- ii. A private digital assistant (PDA) (discontinued) is a small, frequently pocket-sized, pc with limited functionality. It is intended to supplement and to synchronize with a desktop pc, giving access to contacts, deal with book, notes, e mail and different aspects.
- iii. An ultra mobile laptop (discontinued) is a full-featured, PDA-sized laptop jogging a basic-motive operating system.
- iv. A pill laptop that lacks a keyboard (also known as a non-convertible pill) is shaped like a slate or a paper pocket book. As an alternative a physical keyboard it has a touch reveal with some mixture of digital keyboard, stylus and/or handwriting realization program. Tablets is probably not fine suited for purposes requiring a bodily keyboard for typing, however are in any other case equipped of accomplishing most of the duties of an average computer.
- v. A Smartphone has a wide variety of features and set up-competent applications.
- vi. A carputer is mounted in a car. It operates as a Wi-Fi pc, sound procedure, GPS, and DVD player. It also contains word processing software and is Bluetooth suitable.



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- vii. A gadget the scale and form of a pen. It functions as a writing utensil, MP3 participant, language translator, digital storage gadget, and calculator.
  - viii. A software-exact laptop is one that's tailored to a particular utility. For example, Ferranti offered a handheld software-particular cellular pc (the MRT-a hundred) within the type of a clipboard for conducting opinion polls.

Boundaries that separate these categories are blurry at times. For illustration, the OQO UMPC can also be a PDA-sized pill laptop; the Apple e-Mate had the clamshell type aspect of a laptop, however ran PDA application. The HP Omni book line of laptops incorporated some contraptions small more adequate to be called extremely cellular PCs. The hardware of the Nokia 770 internet tablet is just about the identical as that of a PDA such as the Zaurus 6000; the only reason it's now not called a PDA is that it does now not have PIM program. On the other hand, both the 770 and the Zaurus can run some laptop Linux application, most commonly with changes.

## **V. WORKING**

Cell computing starts with the actual hardware inside a Smartphone. A microprocessor powers mobile computing and reminiscence chips furnish for knowledge storage. A radio frequency aspect handles power sourcing and different proprietary telecom science sends outgoing signals and receives incoming signals from a 3G or 4G wireless network. The wireless networks elevate the data where it needs to go. Mainly, data was routed via mobile phone towers in a detailed provider's physical network to one more person's cell phone. With brand new cell computing, information can also be almost always delivered onto the web through the provider's telecom network. This hybrid procedure is a part of what comprises mobile computing, where customers can entry man or woman internet web sites over their Smartphone's. With up to date advances in cellular computing, customers can now perform mobile computing on their Smartphone's at the same time finishing mobile phone calls. This technology includes parallel processing of exclusive threads for digital voice and knowledge operations. Present day Smartphone's are lots like computer systems, with their possess working systems and complex logical infrastructure, which allows extra developed mobile computing and the proliferation of cellular applications for a mess of functions and makes use of.

## **VI. APPLICATIONS**

The true power of mobile computing turns into apparent when mobile hardware, application, and communications are optimally configured and used to accomplish a particular cell project. Although many assorted functions exist, cellular computing purposes can frequently be divided into two categories--horizontal and vertical.

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**1. Horizontal:** Horizontal functions have vast-based enchantment and include program that performs functions reminiscent of: (a) e mail; (b) web searching; (c) phrase processing; (d) scheduling; (e) contact administration; (f) to-do lists; (g) messaging; (h) presentation. These types of functions usually come ordinary on Palmtops, Clamshells, and laptops with systems program equivalent to windows 95.

**2. Vertical:** Vertical applications are industry-specified and only have appeal within the particular enterprise for which the appliance was once written. Vertical purposes are on the whole utilized in industries comparable to: (a) retailing; (b) utilities; (c) warehousing; (d) shipping; (e) scientific and (f) regulation enforcement and public security. These vertical applications are mostly transaction oriented and more often than not interface with a corporate database. Different software areas include: (a) mining; (b) forestry; (c) agriculture; and (d) surveying etc.

## VII. LIMITATION

**A. Range & Bandwidth:** cellular web entry is most likely slower than direct cable connections, making use of applied sciences comparable to GPRS and EDGE, and more not too long ago HSDPA, HSUPA, 3G and 4G networks and in addition the upcoming 5G community.

These networks are almost always available inside range of business cell towers. Excessive pace community Wi-Fi LANs are low priced however have very constrained range.

**B. Protection requisites:** When working cell, one is dependent on public networks, requiring careful use of VPN. Security is a foremost problem while regarding the cell computing standards on the fleet. You may with ease assault the VPN through a large quantity of networks interconnected by means of the line.

**C. Power consumption:** When a power outlet or portable generator is not available, cell computers must depend totally on battery energy. Mixed with the compact size of many cell instruments, this mostly means strangely high-priced batteries need to be used to receive the quintessential battery lifestyles.

**D. Transmission interferences:** climate, terrain, and the variety from the closest sign factor can all interfere with signal reception. Reception in tunnels, some constructions, and rural areas is most of the time bad.

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**E. Capabilities health hazards:** men and women who use cell instruments at the same time using are traditionally distracted from riding and are as a consequence assumed extra more likely to be concerned in traffic accidents. At the same time this will likely appear apparent, there's tremendous dialogue about whether banning cell device use even as riding reduces accidents or no longer. Cell phones may just intervene with sensitive medical instruments. Questions involving mobile phone radiation and wellbeing had been raised.

**F. Human interface with device:** displays and keyboards are typically small, which can make them rough to make use of. Alternate enter methods similar to speech or handwriting consciousness require coaching.

## VII. CONCLUSION

Mobile computing is an important, developing technology. It permits mobile staff to effectively converse and connect to the set organizational information system while staying unconstrained by physical location. Mobile computing offers significant benefits for organizations that choose to assimilate the technology to their set organizational information system. Mobile computing is manufactured possible by lightweight computer hardware, software, and communications systems that connect to a non-mobile organizational information system while from the normal, predetermined workplace. Mobile computing is a versatile and strategic technology that boosts information quality and accessibility potentially, increases functional efficiency, and enhances management performance. Mobile computing might be carried out using many combos of hardware, software, and communications technologies. The systems must be carefully determined and the applications made to achieve the business enterprise needs required from the entire organizational information system. Within this paper we've in term determined a few of the applications of mobile computing along with several characteristics of Mobile computing and limitations.

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