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Virtual Environments of Educational Administration to Enhance the Teaching-Learning Process

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A B S T R A C T

Information and Communication Technologies offer through communication, they open a range of possibilities of use that can be located in different areas of education. The proper use of virtual environments of Company Resource Planning or virtual environments of school administration, assume the function of managing the different dimensions of schooling, such as: general organization, teaching-learning, counseling, student participation and community safety. school. The objective of this study was to analyze the importance of virtual environments to enhance the teaching-learning process, showing some of the main characteristics and functionalities of these tools most used in educational activities. The method used was the bibliographic review, the descriptive and inductive with a qualitative approach. The criteria of experts who evaluated the efficiency and effectiveness, as well as the adaptability of these environments to the organizational processes of educational institutions and the development of the teaching-learning process, were analyzed. The results demonstrate a high degree of functionality both in its structure and in the contextualization of three learning platforms, Moodle, Dockeos and Chamilo.

Keywords: virtual environments; Education Management; information management; teaching learning.

INTRODUCTION

Often in school administration there are two vitally important topics "educational quality standards and virtual administration environments" which energize and allow the teaching-learning process to advance and adapt to the immediate needs of the educational community. On the one hand, educational quality standards through systematized processes evaluate the quality of education and propose improvements. Virtual school administration environments or also called enterprise resource planning systems offer to streamline this entire process, simplify it and more, but how can we ensure that a virtual administration environment is efficient in this process? Is there a virtual administration environment effective for this process of vital importance in the education of an educational institution? The Ecuadorian state in its constitution, article 15 details that "environmentally clean technologies will be implemented", while, in the same supreme letter, article 16, numeral 4 indicates that "universal access to technology will be provided", mentioning twenty-three times the word "technology" and also limiting that it is the duty of the Ecuadorian state.

In addition to this, it is important to note that in the market there are various virtual administration environments or enterprise resource planning systems that promise to solve the implementation of educational standards and administration to enhance the teaching process, but what he mentions must be taken into account Muñoz, J. (2020) citing (Expósito et al., 2017), noting that the students who currently

make up the classrooms have very particular learning styles where they undoubtedly use technology, requiring a methodological change and the use of ofTechnologies for Learning and Knowledge, or also called (TAC) and it is important to understand that it is necessary to have a platform that provides organization, compilation and summary of the processes, that grants didactic sequencing giving freedom to the teaching-learning process, with globalized information and evaluation of education.

In Ecuador, several institutions are currently using these tools in the teaching-learning process, at different levels of teaching in process during COVID-19 (Bravo, Yánez& Rodríguez, 2020), in addition to gamification processes (Loor, San Andrés & Rodríguez, 2020).

MATERIALS AND METHODS

The methods used for the development of the study were: bibliographic review, trying to create a comparison between theories of reliable information through the exhaustive review of articles, books, theses and pertinent legal regulations and guidelines issued by the Ministry of Education Ecuador, which they mention the theme raised. In addition, the descriptive and inductive method with a qualitative approach was used, which allowed us to understand the use and benefits of virtual school administration environments and how they enhance the teaching-learning process. Analysis and discussion of the results To begin with, it must be understood that it is an educational institution of Basic General Education (EGB) and its operation, thus, from the bases determine the existing educational needs and, in the future, we can reach the solution of it. For Martínez, L. (2012), an educational institution is considered to be "organizations that are dedicated to meeting the needs of intellectuality in the human being, community or social group, promoting the teaching of learning in a physical, scientific or technological context". In relation to this, it can also be mentioned that the objective of the school administration is to manage oversight processes that allow the processes carried out to carry a correct development and therefore enhance the teaching-learning process. This same educational institution in its processes maintains a structure or flow diagram that allows us to see the hierarchy and determine the procedures in the specificity of educational work in its three general areas of management as observed in table 1.

Table 1. Standards of Educational Quality

Standards of School Management	They refer to the management processes and institutional practices that contribute to the proper functioning of the institution. In addition, they favor the professional development of the people who make up the educational institution, allowing it to approach its ideal operation.
Professional Management Standards	Describe the actions necessary to optimize management work and refer to administrative management, pedagogical management, coexistence and school safety; to ensure their effective influence on quality learning of all the students of the educational institutions under their charge.
Professional Teacher Management Standards	They allow to establish the characteristics and practices of a quality teacher. These practices cover disciplinary, pedagogical and professional ethics aspects, which the teaching staff must show in order to develop a quality teaching-learning process.

Fountain:Ministry of Education. (2017). Implementation Manual of the Educational Quality Standards. Public Media EP. ISBN: 978-9942-22234-3

The educational quality standards are parameters of expected achievements, their objective is to guide, support and monitor the action of the groups of actors that make up the National Education System for their continuous improvement. They are distributed in learning standards, school management, professional performance.

The Ecuadorian Ministry of Education in the instructions for the implementation of the educational quality standards refers to the standards of school management and professional managerial and teaching performance. At the same time, it issues the dimensions and components that must be executed for the correct implementation and evaluation of institutional education. In this sense, the hierarchy should be considered as an important part since it determines how the institutional procedures manual should be developed, which subsequently affects the teaching-learning process of the students in many ways, as shown in figure 1 the institutional organization chart.

In this figure, the basic hierarchical aspects of an educational institution are detailed, which are then converted into procedures.

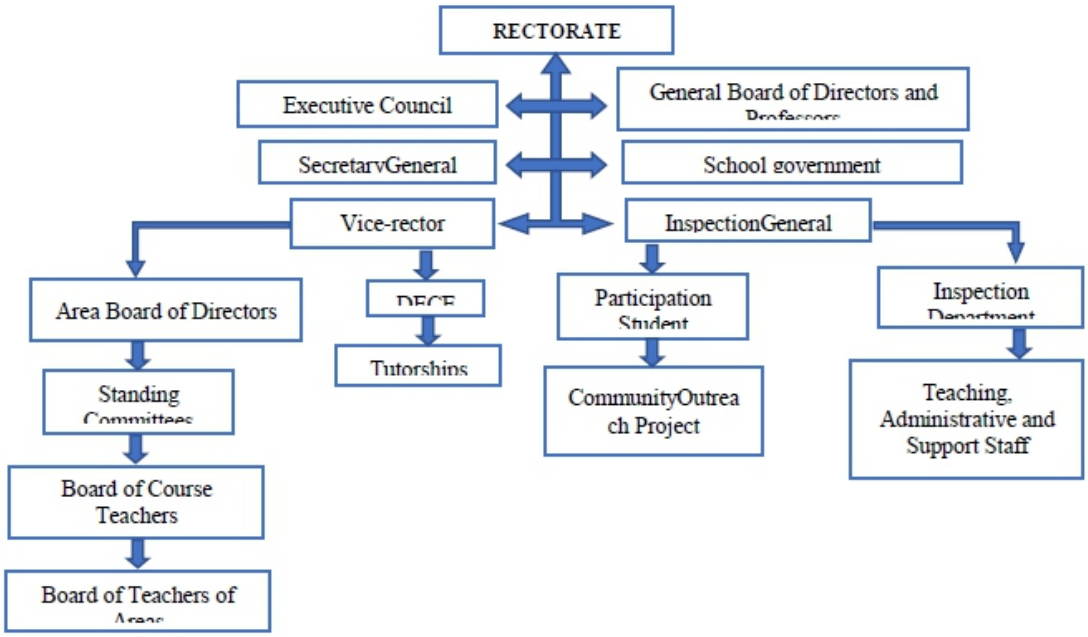

Figure 1. Institutional Organization Chart
Source: Ministry of Education Ecuador

As a result of this basic structure other broader schemes arise, according to the institutional approach according to the reality of the educational environment and its academic offer as specified in the (National Education Curriculum, 2016). (Pons-Escat, 2015) mentions that "Although each school has a different operation, they all share a series of characteristics that allow them to develop a vertical that they can use to carry out their internal management" therefore we must take into account that "the function of the administration in an educational institution would be to plan, design, and implement an efficient and effective system for the achievement of teaching-learning in a social environment in which the service is delivered, so that it responds to the needs of the students and of society, that is, take responsibility for the results of this system ", Martínez, L. (2012).

Technology, computer systems and their communication services have become a basic need of the human being in their different fields, one of these is the educational field or educational field, which has

had to evolve in its educational strategies and means applied in the teaching-learning process to adapt to the synaptic evolutionary level of the student who fits perfectly with generational technological and industrial changes. Now, based on this educational structure, it is advisable to analyze the different virtual environments for free software school administration.

Information systems are "that set of interrelated components that capture, store, process and distribute information to support decision making, control, analysis and vision of the organization" (Laudon, 2008). information or business resource planning systems among its many definitions stands out the definition of (McGaughey, 2009) mentioning that they are "an information system that integrates business processes, with the aim of creating value and reducing costs, making the Correct information is available to the right people and at the right time to help them make decisions in the management of resources in a productive and proactive way. It is made up of several multi-module software packages that serve and support multiple functions in the company".

On the other hand, and much more successful we can mention (Laudon, 2008) defining the business resource system s as "information systems that integrate key business processes in such a way that information can flow freely between the different parts of the firm, thereby improving coordination, efficiency and the decision-making process."

In the market there is a great variety of free software that offers to cover this need of the educational system, (Stallman, 2002) defines free softwareas the software in which the user has the freedom to execute, copy, distribute, study, modify and improve the software, being a great advantage to have access to the source code and to be able to make improvements in its specificity. Other very important advantages as mentioned (Oltra et al. 2011) is that "of free software compared to the owner, its cost is the most relevant factor".

The purpose of software applied to education should be an education with expanded information, improving spaces and community interaction in the process, (Hanna, 2000) mentions that "The challenge is not to rebuild the master class system, nor achieve a totally independent learning via the web. What the universities have to do is build a new learning environment." In this sense, we can assume the institution in its management as a dynamic body for the culturization of its educational community.

Moodle

Let's start by detailing one of the most used platforms in educational management, being a participant not only in the basic educational context, but it is applied in university educational management due to its great performance and versatility, in this I mean "Moodle"(Ros, 2008) defines it with the following characteristics of figure 2.

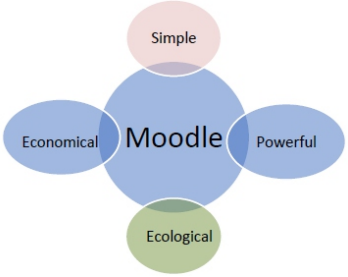

Figure 2. Performance and versatility characteristics
Source: Ros, I. (2008). Moodle, the platform for teaching and school organization.

The Moodle, "Allows the management of the subject, and there are many uses, from uploading the most diverse multimedia content (notes, videos, images ...,) to being able to evaluate the different tasks of our students or take online exams. It is essential for creating "learning objects" or "teaching units" and for promoting self-learning and cooperative learning. It is also the ideal tool to manage the organization of educational communities and allow communication and networking between its different members and with other centers. Being especially useful for the integration and implementation of curricula, communication with families and their use in the extracurricular environment"(Ros, 2008).

The great potential of this platform is defined in the environmentalism mentioned (Ros, 2008), e-learning, simple and powerful in addition to its efficiency and effectiveness in helping the management of educational centers, thus defining its main characteristics shown in the table 2.

Table 2. Characteristics Moodle

	MOODLE
Ecological It	allows the student to have complete information with digital files and easily stored, in addition to being inclusive, allowing easy access to people with educational needs such as: deaf mute, blind.
E-learning	Allows the teaching-learning process to be handled in synchronous or asynchronous mode
Simple and powerful	It offers us a lot of advantages in online classes, or completing face-to-face learning and virtual student tutorials, in addition to being simple to handle.
Useful in educational centers	Free and easy tool, enables comprehensive transversal and longitudinal curricular development, facilitates common planning and teamwork for the curricular development of each area and classroom curricular development, allows teachers to manage their course in modality synchronous or asynchronous, organizing its contents, tasks or evaluations, favors the participation and involvement of students and their families.

Source: Ros, I. (2008). Moodle, the platform for teaching and school organization

Dokeos

Another of the well-established platforms in its structure and search for users for its quality in efficiency and effectiveness is the platform "**Dokeos"** which (Lizárraga and Colado, 2015) mentions its origin noting that "The Dokeos system is developed by an international group of professors and computer scientists scattered throughout the world. The Université Catholique de Louvain encouraged the Institut de Pédagogie Universitaire et des Multimedia's to develop and distribute this platform. The system, therefore, has countless implementations around the world and thousands of students who use its functionalities (Universidad Santiago de Cali, 2005), in turn, it is vitally important to mention its main characteristics in terms of function detailed in Figure 3.

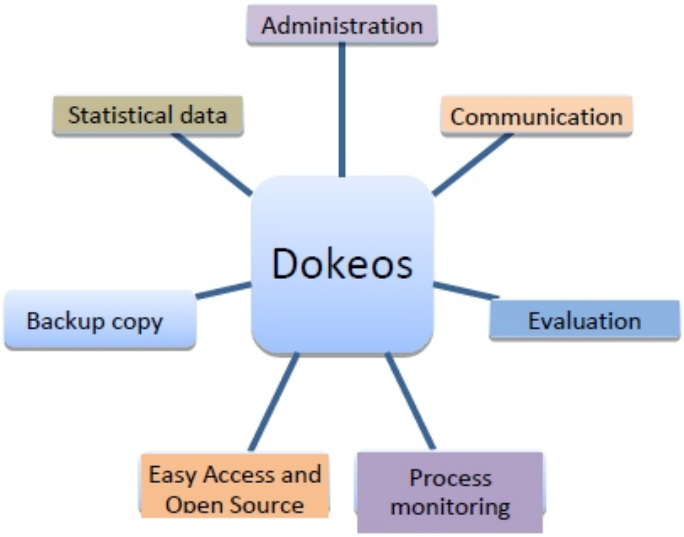

Figure 3. Main characteristics of the Dokeos Platform
Source: Lizárraga, RE, &Colado, AZ (2015). Comparative analysis of Moodle and Dokeos virtual educational platforms.

Table 3 shows the general functions of the Dokeos platform.

Table 3. General functions Dokeos platform

	DOKEOS
Admin	User administration, courses, multisite.
Social	Students can learn from others how to create videoconferences
Docum	Word, Pdf, Pptx, Flash, virtual library
Report	Track progress, times and grades in addition to generatingcertificates
Scorm	Content entry, Articulate, Captivate, Certify the results
Author	Quick online templates for rapid content development
Scenarios	Learning structure by chapters, weeks or activities as well as construction of case studies.
Exercises	29 online activity templates plus images for medical delineation.
Podcasts	Publish audio in addition to recording your voice online
Mind Maps Mind	maps can be created and imported.

Source: Lizárraga, RE, &Colado, AZ (2015). Comparative analysis of Moodle and Dokeos virtual educational platforms.

Chamilo

Chamilo LMS, is a free GNU license platform, open source, modifies and creates complementary elements that allow to adapt this platform to specific needs of e-learning projects. Among its main characteristics are detailed in figure 4.

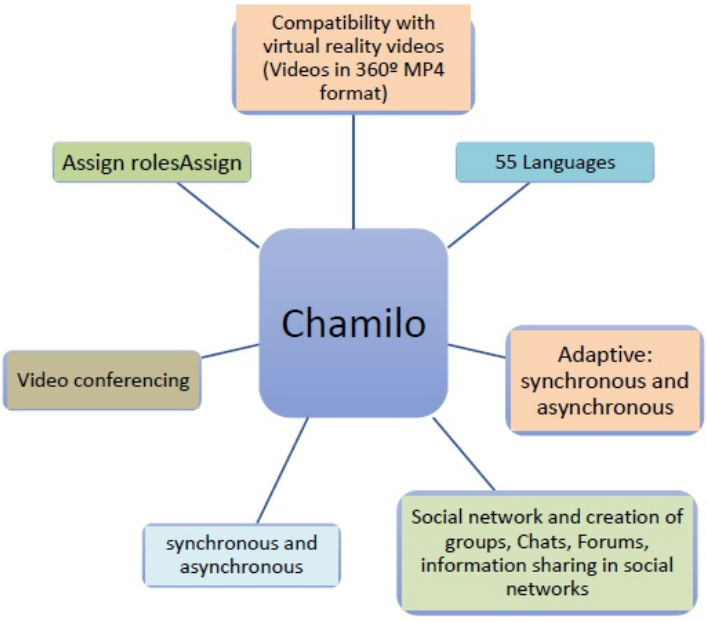

Figure 4. Main Characteristics Chamilo LMS
Source: E-learning & Collaboration Software, 2020, Chamilo LMS and the Association

The dynamism that Chamilo presents, stands out for its particularities and ease of functionality, (Cruz, 2018) citing (Rodríguez, 2016) lists in a simplified way five didactic tools of the platform (Content creation tools, Communication, interaction and cooperative work tools, Administration tools, Evaluation and monitoring tools and Technical support tools in line) but each of the benefits provided by Chamilo in its use must be considered in detail, which are detailed in table 4.

Table 4. Tools and Benefits in the use of "Chamilo"

	CHAMILO
Characteristics	Import or create documents (audio, video, images) and publish them. Build exercises and exams with automatic grading and feedback if required Create or import content (SCORM and AICC) Configure the delivery of virtual works Describe the course components through the description section Communicate through the forum or chat Post announcements Add links. Create work groups or laboratory groups Establish a virtual classroom (through the videoconference extension) Manage qualifications, certifications and competencies in the evaluation tool Create surveys Add a wiki to collaboratively create documents Use a glossary Use an agenda Manage a project (through the blog tool) Track students in courses Record attendance Create a class diary (course progress)

Source: Chamilo, (E-learning & Collaboration Software, 2020)

Virtual learning environments energize and They operationalize the teaching process, becoming a simple but effective means of communication (Belloch, 2012) citing (Boneu, 2007) mentions four basic and indispensable characteristics of the VLE, which we can observe in table 5.

Table 5. Characteristics Virtual Learning Environments

VIRTUAL LEARNING ENVIRONMENTS	
Interactivity	Awareness to the person who is directly responsible for their educational training
Flexibility	E-learning adapts easily to the organization interested in its use, whether in organizational structure or curricula
Scalability It	works in the same way with few or many users.
Standardizatio n	Allows the import and export of courses in SCORM formats.

Source: Belloch, C. (2012). Virtual learning environments.

In relation to this we can note the versatility of virtual environments or educational administration, its easy handling and adaptability in educational business management, however, it is important to remember that the curricular guidelines must have their strategies and their plan manually for the full educational development. In other words, the EVA and ERP fulfill the function of keeping both the sender and the receiver communicated in a very dynamic and educational way, mentioning in another way is the "medium" within the PEA.

To what has been said, we must add what is established in article 347 of the Constitution of the Republic of Ecuador, in numeral 1 and 8, the Organic Law of Intercultural Education in its article 3 and 5, and Agreement No. MINEDUC-ME -2016-00015-A, which in summary establish guidelines and normative bases for the use of TACs in education, which does not happen and therefore Ecuadorian education continues to produce low levels of academic performance.

Proof of what has been said are the results of the program for the international evaluation of students for development (pisa-d), developed by the national institute for educational evaluation (ineval) in 2018, where it was identified that 50% of students did not,they do not even achieve level two in reading, 70% do not achieve basic mastery of mathematics and 52.7% do not achieve either in science (http://evaluación.evaluacion.gob.ec/bi/resultados-pisa/).

The digital revolution focuses on the development of robotics, artificial intelligence, blockchain, nanotechnology, quantum computing, biotechnology, internet of things, 3d and 4d printing. Starting from that context, as teachers and administrators of education, we must seek the necessary mechanisms to activate skills in students and enhance them to the point that they are useful to our society to a great extent.

Education in its generality needs to homologate the evolutionary development of the student in its different stages to achieve a significant advance not only in apprehension within the teaching-learning process but also to ensure that students are the ones who build the process and propose alternatives, in a parallelization education and the productive sectors of interest in the country, becoming organic in the process, to achieve firm foundations that keep the processes in constant innovation.

The educational administration environments provide a benefit to the system, providing globalized information, continuous education and dynamism in the process, through research through an education with a technological, practical and environmentally friendly approach, with the necessary equipment in all aspects that allow work experience, productivity and innovation from instruction, mentioning the right words of (Lev Vygotsky, 1982) that understands human development as a "gradual learning process where the human being plays an active role" we must double efforts, strategies and means to achieve that the country's education is at a level of global competitiveness, where a generational link is achieved between education, industry and technology.

CONCLUSION

The results obtained showed the benefit that school administration environments provide, with an emphasis on optimizing time, promoting intellectuality and professionalism in human talent and providing real-time information on student participation and management of general information to the entire educational community.

It was possible to conclude through the bibliographic review, the importance, creation and use of virtual environments of school administration, since they give sustainability to the academic management process to relapse into the teaching-learning process and ensure educational quality in the school system.

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An Appraisal of Adoption of Information Technology and Innovative Measures in an Emerging Market

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ABSTRACT

In this era of new technology, research facilities, globalization and the flood of new products, tough competition is being faced by Indian automobile industry. Today's automotive consumers are well informed and have a wider choice in the market place. All the companies are facing massive challenges and strive to acquire the maximum possible market share in an overcrowded market. Therefore, the area of Relationship Marketing and CRM continues to receive attention both in literature and practice to enhance customer loyalty and customer retention. CRM has been accompanied by technology developments that emphasizes on individual or one to one relationships with customers by integrating database knowledge with the long term prospects of growth and customer loyalty. Hence, the present study empirically examines the extent of adoption of new technology and innovative measures to implement CRM by automobile companies in India. Data was collected from the 150 sales executives of top 10 car manufacturing companies in Punjab. The results found that the sales executives of all the companies believe that their respective automobile company adopts the new technology to implement CRM but their adoption level differs from company to company. However, initiatives are still required to use innovative strategies for the successful implementation of CRM technology.

Key Words: Customer Relationship Management (CRM), Information Technology (IT), Innovation

INTRODUCTION

The automobile industry in India has prospered after economic liberalization in 1990's like never before. After the liberalization of the economy in 1991, Indian automotive industry is moving upwards on the growth track with large number of international auto manufacturers setting up their manufacturing facilities in India. As a result, Indian automobile industry suddenly exposed to a vast international market as an opportunity and to global competition in large scale. The rapid improvement in infrastructure, huge domestic market, increasing purchasing power, established financial market and stable corporate governance framework have made the country a favourable destination for investment by global leaders in the auto industry, as per AMP 2006-16. The Indian automobile industry has opportunity in terms of business opportunity worldwide and threats from mega suppliers who are more equipped to compete. Owing to innovations, advancement in new technology and changes in customers' needs, preferences and expectations, the industry faced a major shift from a seller's market to a buyer's market. To cope up with enhanced competition, changing customers' needs and preference and ongoing product improvement, the marketing trends are changing from mass marketing to interactive & customized marketing and finally to relationship marketing. Consequently, all objectives are focused on one ultimate goal, that is, to make customers satisfied and happy because they are the one who keep businesses running.

CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Presently, the technology provides businesses with systems that can help companies track customers' interactions with firms and allow the firm's employees to quickly retrieve all information about customers. This concept is known as Customer Relationship Management (CRM) system and if used properly, could enhance a company's ability to achieve the ultimate goal of retaining customers and gain a strategic advantage over its competitors (Nguyen et.al, 2007). The term "Customer Relationship Management" emerged in Information Technology (IT) vendor community and practitioner community in the mid-1990s. It is often used to describe technology based customer solutions, such as sales force automation (Payne and Frow, 2005). But, CRM is a strategy by which companies optimize profitability through enhanced customer satisfaction. It is a business strategy, not a technology. It involves process, technology and the people issues (Chaturvedi & Chaturvedi, 2005). Therefore, thinking about CRM in primarily technological terms is a mistake. The more useful to think about CRM is as a process that helps bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness and market trends (Saxena, 2010). It is a business strategy designed to help an enterprise understand and anticipate the needs of its potential and current customers. Customer data, acquired in several different areas of enterprise, is kept in central database and analyzed and distributed to the key points (called touch points). Touch points can constitute of mobile sales force, call centers, websites, direct marketing channels and any other part of an enterprise that interact with the customers (Anderson & Stang, 2004). The main goals of CRM are to build long term and profitable relationships with chosen customers and getting closer to those customers with every point of contact with them. With growing time and increased penetration of web based tools CRM again transformed to web-based contact management.

LITERATURE REVIEW

Qureshi & Khan (2004), provided key marketing strategies such as place strategy, product strategy, promotion Strategy and price Strategy which play a significant role in the way competitive advantage is achieved and sustained. The Paper also highlighted the significance of internet in achieving superior performance in today's hi tech world. **Jayachandran et. al (2005)**, found that relational information processes play a vital role in enhancing an organization's customer relationship performance and technology used to implement CRM performs an important and supportive role. **Viljoen et. al (2005),** formulated the proposition that the customers of organizations that have a greater incorporation of technology in their CRM strategies will be more satisfied than those with a lower degree of technology. **Khare and Khare (2008),** explored that for sustaining relationships with customers, the management should develop systems that lead to build these relationships. Moreover, CRM will give results only if the organization is able to realign its processes according to the results it expects from the market. **Smith (2009)**, compared the more traditional vehicle manufacturers'/dealers', and customer relationship with the web enabled model. The study revealed that the people were using the internet with greater regularity to gain information about vehicle purchase. **Liang (2010)**, found that the sample automotive maintenance factory treated all customers with same strategies and thus resulting in cost–wastage and inefficiency. The study proposed promoting customer value strategies on the basis of customer segmentation. High the customer value more should be the spending amount on customer services in order to enhance loyalty. **Lin et. al (2010)**, found that computer manufacturers in Taiwan perform various levels of CRM and consequently display different levels of effect on each of five innovation capabilities and the statistical results provide managers with useful guidelines for implementing appropriate CRM practices to develop specific innovation capabilities to respond to enhanced

competitiveness. **Saxena (2010),** proposed a hybrid model and considered the business strategy perspective on CRM. Author concluded that, as the competition intensifies, organizations are trying every trick to retain existing customers and add new ones with a wide range of services. It helps them to design better customized products, improve service level and reduce operational costs which mean more quality business.

Therefore, covering the gaps in the existing literature the present Study is mainly focused to assess the perception of sales executives with regard to use of Technology and Innovation Measures for implementing CRM Practices by the automobile companies.

RESEARCH METHODOLOGY

The present study is based on primary as well as secondary data. The primary data is collected with the help of structured questionnaire using 5-Point Likert Scale ranging from strongly agree to strongly disagree which is prepared by interviewing customers and employees, reviewing existing literature etc. A total sample size of 150 sales executives of top ten automobile companies mentioned in table 1 is obtained keeping in mind the research objectives and constraints. Secondary data is collected from published reports, various books, journals, magazines, newspapers and various websites related to customer relationship management and automobile industry in India. Keeping the research objectives and time constraints in mind the extent of present research work is confined to the sales executives of below mentioned top ten companies of Punjab state only. Cronbach Alpha, Mean, Standard Deviation, T-test and ANOVA are used as statistical tools to analyze the data.

Table 1: List of top ten car manufacturing companies in India based on the market share in car segment for the year 2020

Name of the Company	Market Share (in %age)
Maruti Suzuki India Ltd.	51.22
Hyundai Motor India Limited	16.14
Mahindra & Mahindra Ltd.	7.53
Tata Motors Ltd	6.85
Honda Cars India Ltd	5.44
Toyota Kirloskar Motor Pvt. Ltd	4.46
Ford India Pvt. Ltd.	2.75
Renault India Pvt. Ltd.	2.36
Nissan India Pvt. Ltd.	1.08
Skoda Auto Volkswagen India Pvt. Ltd.	1.03

Source: www.indiancompanies.in

CRM TECHNOLOGY AND INNOVATION ADOPTION LEVELS

The CRM system is the automation of horizontally integrated business processes involving "front office" customer touch points –sales (contact management, product configuration), marketing (campaign management, telemarketing), and customer service (call center, field service)-via multiple, interconnected delivery channels (Popovich and Chen, 2003). Therefore, CRM system implementation is commonly used in functional areas such as customer support and services, sales and marketing. CRM life cycle includes three stages: Integration, Analysis and Action. In the first stage, the CRM lifecycle

begins with the integration of front office systems and the centralization of customer-related data. Second stage called Analysis is the most critical to CRM success. CRM analytics enable the effective management of customer relationships and make the organizations able to analyze customer behaviours, identify customer-buying patterns and discover casual relationships. The final phase, Action, is where the strategic decisions are carried out. Business processes and organizational structures are refined based on the improved customer understanding gained through analysis. This stage closes the CRM loop and allows organizations to cash in on the valuable insights gained through analysis. Systemic approaches to CRM help organizations coordinate and effectively maintain the growth of different customer contact points or communication channels. The systemic approach places CRM at the core of the organization, with customer-oriented business processes and the integration of CRM systems.

Innovation is the implementation of new ideas or practice that offers the introduction of new products and services or improvement in the existing products and services being offered. Implementation or the creation of the technology in order to apply to systems, programs, products, processes or any service is known as Innovation capabilities. There are five aspects of Innovation capabilities identified namely product innovation, process innovation, administrative innovation, marketing innovation and service innovation which determines the innovation capability of an organization (Lin et. al, 2009). Therefore, in today's era of vast technology and innovation, it becomes important to analyze the level of technology and innovation adopted by the automobile companies to implement CRM.

Analysis, Results and Findings of the Study

Perception of sales executives of top 10 car manufacturing companies has been analyzed to know about the level of adoption of new technology and innovative measures to implement the CRM solutions strategically. Prior to the analysis of the results, the research instrument was tested for its reliability. The internal consistency of the grouping of the items is estimated using a reliability co-efficient called cronbach's alpha and alpha value of 0.60 and .70 or above is considered to the criterion for demonstrating internal consistency of new scales and established scales respectively.

Table 2: Reliability Statistics

Factors	No. of Items	No. of Respondents	Cronbach's Alpha
Use of Technology Measures	11	150	.771
Use of Innovation Measures	5	150	.681

Table 2 shows that the alpha values for both the factors i.e. Use of Technology Measures and Use of Innovation Measures are .771 and .681 respectively which signifies the internal consistency of the data and can be used for the further analysis.

Table 3: Use of Technology and Innovation Measures on the basis of Gender

Particular	Male		Female		Mean diff.	t-value	p-value
	N = 108		N= 42				
	Mean	SD	Mean	SD			
Use of Technology Measures	3.798	0.440	3.842	0.463	0.044	0.542	0.589
Use of Innovation Measures	3.824	0.484	3.967	0.448	0.143	1.652	0.101

(Source: Results of primary survey)

** and ** significant at 5% and 1% level of significance respectively*

Table 4: Use of Technology and Innovation Measures on the basis of Income

Particular	Mean value for different categories of Income			F-value	p-value
	<Rs. 25000	Rs. 25000-50000	Rs. 50000-75000		
	N=71	N=62	N=17		
Use of Technology Measures	3.829	3.786	3.818	0.161	0.852
Use of Innovation Measures	3.890	3.842	3.835	0.201	0.818

(Source: Results of primary survey)
** and ** significant at 5% and 1% level of significance respectively*

Table 5: Use of Technology and Innovation Measures on the basis of Education

Particular	Mean value for different categories of Education				F-value	p-value
	UG	Graduate	PG	Professional		
	N=4	N=65	N=50	N=31		
Use of Technology Measures	3.341	3.813	3.798	3.886	1.817	0.147
Use of Innovation Measures	3.700	3.849	3.868	3.909	0.270	0.847

(Source: Results of primary survey)
** and ** significant at 5% and 1% level of significance respectively*

Table 3 exhibits that out of total 150 respondents majority of them i.e 108 (72%) are male and 42 (28%) are female. The mean value of both male and female employees for both the factors is near to 4 which shows that both male and female employees agree that the company uses technology and innovative measure to implement CRM. However, Result shows mean score of female employees is higher i.e 3.842 and 3.967 than the male employees i.e 3.798 and 3.824 for use of technology and use of innovation respectively which indicates that female employees perceive more sense of agreement than male employees regarding technology adoption and innovative measures used to implement CRM. Further, table 4 reveals that the monthly income of 71 (47.3%) respondents is below Rs. 25,000 , 62(41.3 %) respondents is between Rs. 25000- Rs. 50000 and 17 (11.3%) respondents belong to income group between 50000-75000. Therefore, majority of the respondents i.e. 47.3% belong to income group below 25000. However, mean score regarding use of technology is highest for the employees with the income group up to Rs.25,000 (3.818) followed by income group 50,000-75000 (3.829) and 25,000-50000 (3.786) respectively while agreement level for the use of innovative measure is highest i.e 3.890 for the income group up to Rs. 25000 followed by employees under income group Rs. 25,000- 50,000 (3.842), and Rs. 50,000- 75,000 (3.835) respectively. This shows that high income group still expects more use of technology and innovations from the companies in order to improve their product and services being offered. Table 5 shows that 4 (2.7%) respondents are under graduate, 65 (43.3%) are graduate, 50 (33.3%) are post graduate and 31 (20.7%) are possessing professional degrees. Hence, majority of the respondents i.e 43.3 per cent are graduate. Result shows that all employees agree that the company use technology and innovative measure to implement CRM irrespective of their educational level. However, mean score of professionals (3.886) regarding use of technology is highest followed by graduates (3.813), post graduate (3.341) and under graduate (3.700) respectively while agreement level for the use of innovative measure is highest for professionals i.e 3.909 followed by post graduates (3.868), graduates (3.849) and under graduates respectively. Result shows that all employees agree that the company use technology and innovative measure to implement CRM irrespective of their different income level. To summarize the results of table 3, table 4 and table 5 it can be significantly found that

there is no significant difference found in the perception of Sales executives on the basis of gender, educational qualification and on the basis of their income level regarding the use of technology and innovative measures to implement CRM practices.

Table 6: Use of Technology and Innovation Measures on the basis of company

Company	Use of Technology Measures		Use of Innovation Measures	
	Mean	S.D.	Mean	S.D.
Maruti Suzuki	4.054	0.365	3.893	0.477
Hyundai	3.806	0.272	3.693	0.439
M&M	3.679	0.358	3.773	0.477
Tata	3.848	0.522	4.107	0.384
Honda	3.848	0.471	3.867	0.574
Toyota	3.509	0.438	3.547	0.547
Ford	3.909	0.469	3.960	0.497
Renault	3.909	0.398	3.987	0.424
Nissan	3.606	0.488	3.867	0.390
Volkswagen	3.933	0.458	3.947	0.417
F-value	**2.227**		**1.751**	
p-value	**0.024***		**0.083**	

(Source: Results of primary survey)

** and ** significant at 5% and 1% level of significance respectively*

Above Table shows that there exists significant difference at 5% level of significance (0.024) in the perception of sales executives regarding use of technology for implementing CRM practices. However, no significant difference has been found in the agreement level of sales executives towards the use of innovative measures to implement CRM across different companies. It can be clearly seen from table 6 that mean score of sales executives of Maruti Company (4.054) is highest for adopting latest technology which shows that employees of Maruti Company perceive more sense of agreement than other automobile companies regarding adoption of CRM technology by their company than the other companies. On the other hand, mean score of sales executives of Tata Company (4.107) is highest for adopting new innovative practices which shows that employees of Tata Company perceive more sense of agreement regarding use of more innovative strategies to implement CRM by their company than the other companies. Sales executives of other automobile companies agree that their company uses the new technology and innovative measures to implement CRM but the level of adoption of technology and innovative measures varies from company to company. Therefore, Organizations must realize that CRM implementations and changing effect of the Internet offer abundant research opportunities and they should focus on the delivering the highest value to customers through better communication, faster delivery, and personalized products and services.

Conclusion

It can be concluded that employees of the car manufacturing companies believe that their respective companies are adopting the new technology process to implement CRM. However, the perception of sales executives varies from company to company for the level of adoption of technology processes. Some companies are adopting CRM solutions aggressively while others are adopting the new technology and innovative measures moderately. The implementation and provision of interactive communication technologies enhance the quality and frequency of organization – customer communication, hence increases the success of the CRM strategy. Therefore, managing a successful CRM implementation requires an integrated and balanced approach to technology, process, and people.

The companies should redesign their business processes to enhance their competitiveness through more meaningful interaction with customers.

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APPENDIX…..

Technology Measure Items

- Automates routine activities such as providing promotional literature.
- Enables to track cross sell/ up sell opportunities
- Control sales through multiple dealer
- Allows relevant employees access to unified customer data
- Provides customers' access to a knowledge base of solutions to commonly occurring problems e.g. frequently asked questions
- Schedules and tracks service delivery
- Uses data warehousing and data mining to save customers' information for identifying which of the potential customers are more valuable

- Enables forecast of customer's preferences
- Measures Customer Loyalty
- Calculates Customer lifetime value
- Calculates Customer retention rates

Innovation Measure Items

- Products produced by automobile company are innovative and as per customers' tastes, needs and personality.
- Follows innovative procedure and processes for serving customers.
- Automobile company actively stresses on innovative customer loyalty or retention programs.
- Uses innovative marketing methods such as presence on social media such as Facebook, Youtube and Twitter etc.
- Uses service innovation such as provides customers with the facility of door step service van.

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Computer Vision Based Moving Object Detection and Tracking

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A B S T R A C T

To detect and track objects, some approaches of detecting and tracking moving objects in stationary scene are presented, including the detection methods of the time domain differential method, the background differential method, optical flow method and tracking methods of the Kalman filter and feature optical flow. Keywords-moving object detection and tracking; background model; Kalman filter; optical flow. Object tracking is an important task within the field of computer vision. It is a challenging problem. Many difficulties arises in tracking the objects due to abrupt object motion, changing appearance patterns of both the object and the scene, non-rigid object structures, object-to-object and object-to-scene occlusions, and camera motion. This paper selectively reviews the research papers with regard to tracking methods on the basis of the object, their motion representations and all detailed descriptions of representative methods in each category examining their advantages/disadvantages.

Keywords:- Object Representation, Object Tracking, Object Detection, Computer Vision

I. INTRODUCTION

To develop the real world computer vision system, tracking of moving objects is very important task. The proliferation of high-powered computers, the availability of high quality and inexpensive video cameras, and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms [1]. Applications are like automatic video surveillance, motion-based recognition, video indexing, human computer interaction, traffic monitoring, and vehicle navigation.

Real-time moving object detection and tracking [1][2] organically combines the image processing, automation and information science technology to form a kind of new technology that moving targets can be quickly detected in the images and target location can be extracted for tracking purpose. Moving picture sequence can provide more useful information for low signal to noise ratio (SNR) target detection, using image sequences can detect target which is difficult to detect in a single-frame image. Image sequences formed by the moving target can be categorized as two cases: one is the static background, the other is the varying background. The former case usually occurs in the camera which is in a relatively static state, produces moving image sequences with static background. Then we can use a temporal differencing algorithm or adaptive cancellation of the background method to remove the background interference, the calculation is simple; The latter case usually occurs in the target movement, while the camera is also in the relative movement state. Then it produces moving image sequences of changing background and leads that the changes of the moving target in the image are confused with the changes of the background itself. To deal with this case is complicated, if the cancellation of the background method [3] selected, it needs to do inter-frame image stabilization [2] and image registration [2]; else the prominent to an end method selected, it needs to do multi-frame energy accumulation and noise suppression.

2.RELATED WORK

There is much research work in the field of object tracking in videos over the past decades. Some of the work done has been discussed one by one below. Alexander Toshev, Ameesh Makadia et al. [5], Presented shape based object recognition in Videos Using 3D Synthetic Object Models. This paper sorted the problem of recognition of moving objects from the videos by synthetic 3D models. At first, from the video, the silhouette images of the moving object is extracted by feature tracking, motion grouping of tracks and co-segmentation of successive frames and then matched to 3D model silhouettes. As a result, the matching of every 3D model to the video. This approach can recognize objects in videos and estimate their rough pose by using only similar but not 3D models.

Mohammed Sayed and Wael Badawy [6], Presents a novel motion estimation method for mesh-based video motion tracking. The method called mesh-based square-matching (MB-SM) motion estimation method. This method is used in terms of computational cost reduction, efficiency and image quality. It is a modified version of the hexagonal matching motion estimation method. The MB-SM motion estimation is performed in two ways. First is the rough motion estimation using block-matching algorithm. Second is the fine motion estimation to refine the motion vectors generated from the first step. As result, MB-SM method has lower computation cost than the hexagonal matching motion estimation method while it produces almost the same PSNR values.

Minglun Gong [7], Proposed estimating 3D geometry and motion of dynamic scenes based on captured stereo sequences. A dynamic programming based technique is used for searching global optimal disparity maps and disparity flow maps under an energy minimization framework. As a result, both computations can benefit from each other and are capable of producing both 3D geometry and motion information for dynamic scenes in nearly real time.

Ming-Yu Shih et al. [8], In this paper, a method of moving object detection on moving platforms is proposed. This method composed of moving blob detection and shape refinement phases to provide robust moving object detection result. By fusing motion field's information from three consecutive frames, positions of moving blobs were precisely detected. Next, using motion compensated background models in intensity, r, and g color spaces, shapes of objects are well refined in the fused background subtraction process. By combining moving blob and contextual background information, alignment errors could be eliminated effectively to prevent foreground pixels from being adapted into background models.

Sajjad Torkan, Alireza Behrad [9], proposed a new contour based tracking method using active contour. Original greedy snake as a parametric active contour has weak performance in tracking target with high velocity and large displacement between two successive frames. This is due to concave parts of target boundary, shrinkage of contour if it is far from target boundary and the lack of target motion information. To resolve this problem a greedy snake with adaptive curvature energy and additional field energy term as an external energy. Kalman filtering is used for handling large target displacement and contour concavities. Kalman filtering is also used for the estimation of target shape and centroid in current frame. Applied on wide variety of video sequences results showed that the algorithm capable of tracking target with high speed, large aspect change and contour concavities.

Baiyang Liu, Lin Yang et al. [10], proposed an adaptive tracking algorithm for lung tumors in fluoroscopy using online learned collaborative trackers. No shape or motion priors are required for this

tracking algorithm. This saves many expensive expert annotations. Accurate tracking of tumor movement in fluoroscopic video sequences is a clinically significant and challenging problem. This is due to blurred appearance, unclear deforming shape, complicate intra and inter- fractional motion, and other facts. Current offline tracking approaches are not adequate because they lack adaptivity and often require a large amount of manual labeling. Therefore this adaptive online learning algorithm is general to be extended to other medical tracking applications.

Pengwei LIU, Huiyuan WANG et al. [11], presented an approach for handling target detection and tracking in dynamic scenes, in which, motion compensation is generated by pyramidal optical flow. Because In most cases of target tracking in video sequences, the scene is dynamic due to the mobile cameras and causes problems. Main contribution in this system is that it separates the values of pyramidal optical flow into two groups: one represents background and the other foreground. Experiments show that the algorithm achieves motion compensation very effectively. It is only applied in two-dimensional motion cases such as that the camera moves only up and down.

Mark Ritch, Nishan Canagarajah [12], proposed a method to identify and track an object of interest within compressed MPEG-2 video using only motion information. The system is designed to detect interesting events taking place, such as moving object appearing and to track it without the need to decode the video. Iterative rejection is used as a basis for initial segmentation and those macro blocks whose motion vector is large than average are rejected. This is done by adopting a novel model based approach. Experimental results on a number of sequences demonstrate its effectiveness in identifying and tracking on object of interest from a compressed video stream without the need to fully decode each frame and that the system performed better than using iterative rejection alone as a segmentation method.

Huiqiong Chen, Derek Rivait and Qigang Gao [13], presents perceptual organization based method for real-time license plate identification and tracking. In this method, video content is described by Generic Edge Tokens (GETs), and an image is represented as a GET map. The structure provided by GETs allows edge detection to be performed faster. A MGET graph representation is proposed for coding motion content, in that a license plate is a sub-MGET-graph (SMG) which satisfies license plate model. The SMG representing the license plate is identified by perceptually grouping plate shape in the MGET graph. Experiments show that the method is able to effectively segment license plates from the video sequences. Whether the video clips were taken during the day or at night did not have a large impact on the program results. The application correctly identified 66 of these license plates, giving an accuracy of approximately 98.5%.

3.METHODOLOGY

Detection of objects in motion is the first step towards non-stationary object tracking. Object detection is the method of finding the non-stationary object in a video sequence. Some of the major and important methods of detecting the moving objects are Frame differencing, Optical flow, Background subtraction and Double difference etc. Object representation is the process of demonstrating the objects. Object representation can be categorized as shape representation, color representation, texture based representation and Motion oriented representation. Object tracking is the process determining the position of the moving entity in a sequence of video.

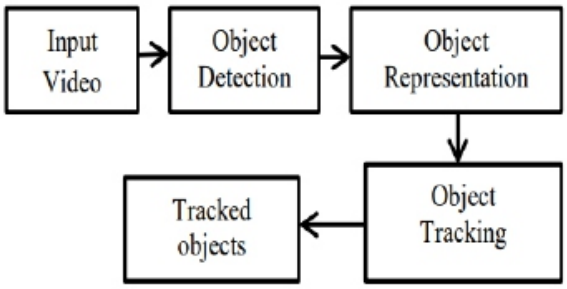

Figure 1: Phases of Moving Object Tracking

Certain types of tracking algorithms are point tracking, Motion tracking, Shape tracking, Feature tracking and Kernel based tracking. Step by step detail of the nonstationary object tracking is as shown in figure 1.

2.1) Object detection Object detection is the method for recognizing the nonstationary or moving object in a video sequence. This is the primary and main step towards moving object tracking

Different detection techniques are as despite in figure 2

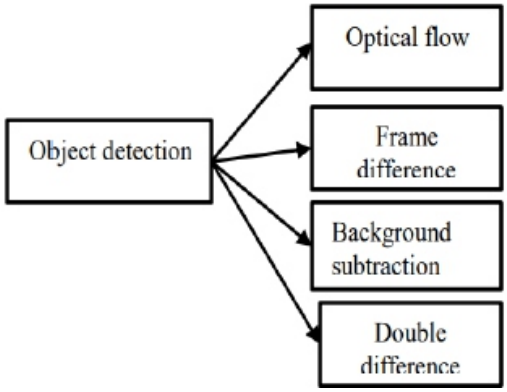

Figure 2: Object Detection techniques.

3.1 Optical Flow Optical flow is substitute standard from of object detection in which the optical flow arena of the image is calculated and grouping of those arenas is done rendering to appearances of the image. The motion among dual video frames occupied at time t and t+ δt at every single location is estimated in optical flow process. This technique gives the broad information regarding the movement of the object. And also detects the object accurately compared to that of background technique. This method is not widely used because of its huge calculation and it is very sensitive to noise. It is not good for real-time occlusion condition. 2.1.2) Background subtraction Background subtraction is the most widely used method for moving object detection. It can be of two types firstly by considering first frame as the reference frame or background image. Secondly by considering average of „n‟ frames as the background image. In this background subtraction method every pixel of on-going frame is subtracted with the pixels of the background image. The equation (1) and (2) shows the background subtraction method for first frame as the background image.

4.EXPERIMENTAL RESULTS

The algorithm can be implemented by Microsoft Visual Studio, test sequences use the 640×480 surveillance video. We do the experiment on a computer, and the experimental results are shown in Figure3.

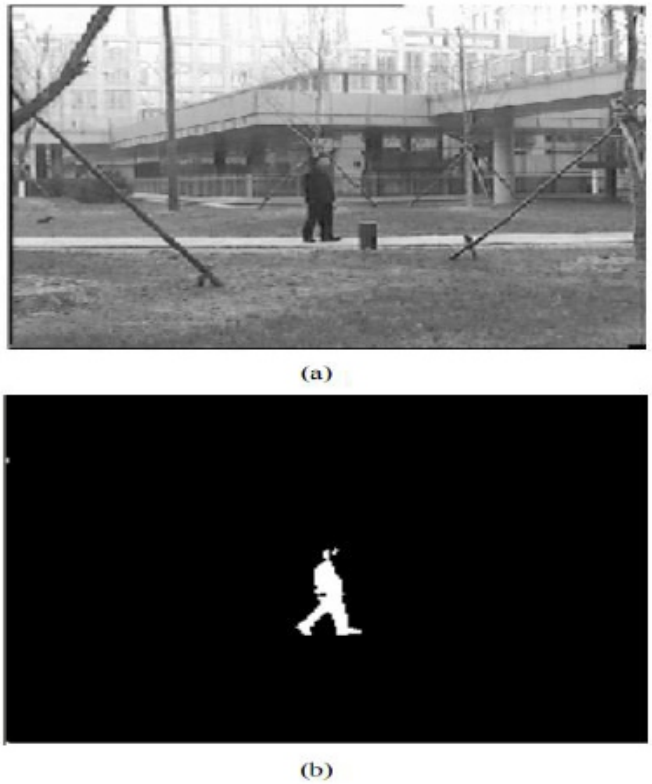

Figure 3. Results of moving target detection on static background:(a)original frame;(b)result frame

Experiment results show that the method proposed by this paper can effectively extract the moving target, especially when the velocity of target is not fast and the background is not very complicated, it can meet the requirements of real-time and accuracy.

5. CONCLUSIONS AND FUTURE WORK

We have presented the survey of object tracking methods and all categories of moving objects that is object representation, object tracking and object detection from any type of video. This will help us to significantly improve and facilitate the performance of certain computer vision tasks, such as tracking, video surveillance, motion-based recognition, video indexing, human-computer interaction, traffic monitoring, and vehicle navigation. Our future work will focus on:

1) Movement detection and capable of finding the objects which are in motion in every frame with respect to the previous frame. Till now in many proposed works, we have been plotting the movement of objects through videos but none of them is capable of plotting graph of the moving object if the background is changed at any instant.
2) The coordinates of tracked video in real time can import to any other software to work with the results calculated by our algorithm.
3) Our algorithm is capable of tracking the objects and making a 3d graph in mesh based scope in between any number of fps (frames per second) video.

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Does Routinely used Dental Luting Cement Effect the Mineralization of Osteoblast Cells in Cement-Retained Implant Prosthesis?

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ABSTRACT

Aim: *To evaluate and compare the direct and indirect effect of Zinc Phosphate (ZP) Cement(Harvard, Berlin, Germany), Glass Ionomer Cement (GIC) (GC Corporation, Tokyo, Japan),and Nano-Structurally Integrated Bioceramic Cement (NIB) (Ceramir, Doxa dental Inc,Sweden) on differentiated osteoblast mineralization obtained from dental pulp stem cells.*

Materials and Methods: *Dental pulp stem cells were differentiated into mineralized osteoblasts. A total of 72 samples of cement pellets were prepared. Control group consisted of mineralized osteoblasts with no exposure to cement pellets. In the test group1, mineralized osteoblasts were exposed to 36 cement pellets (12 pellets of each cement) to exhibit the direct effect. In test group 2, firstly,36 cement pellets (12 pellets of each cement) were immersed in gingival crevicular fluid for 24 hrs in a separate cell well. After 24 hrs, cement treated gingival crevicular fluid was transferred over the mineralized osteoblast for next 24 hours. Here the mineralized osteoblasts were exposed to cements dissolved in gingival crevicular fluid to exhibit the indirect effect. Both the groups were kept for 24 hrs in a CO2 incubator. To verify the effect of direct and indirect exposure of cements on the mineralization of osteoblast cells, after 24 hrs of exposure, the cells were stained with alizarin red stain and viewed under an inverted phase-contrast microscope. The stain was washed with ethanol, and readings were read in an Enzyme-linked immunosorbent assay (ELISA) reader.*

Results: *A statistically significant difference was seen with zinc phosphate cement, glass ionomer cement, and nano- structurally integrated bioceramic cement. ($p<0.005$) However, the mean values for the direct method indicated a greater negative effect on mineralization compared to the indirect method.ZP showed a moderate amount of harmful effects. GIChad severe harmful effects on the mineralization of osteoblast cells, and NIB cement showed positive results in both groups with the least negative effect on the mineralization of cells.*

Conclusion: *In boththe groups, the effect onmineralization of the osteoblastcells exposed to nano structurally integrated bioceramic cement was almost similar to that of their control groups, hence*

concluding, nano structurally integrated bioceramic cement had a favorableeffect on the mineralization of osteoblast cells.

Keywords: Dental luting cements, osteoblasts, mineralization

nature. [2] Dental cements are an essential component in cemented implant restoration and provide a passively fitting framework with the abutment crown interface. Several methods are employed to remove the residual cement-like floss, explorer, retraction cord, plastic,and metal scaler. [4] However, due to the low viscosity of the cement [6], the position of prosthesis margin and its association to the marginal gingiva, and the dissimilarity in the attachment of the sulcus around the implant, it is onerous to remove the residual cement from the implant sulcus without damaging the soft tissue or the implant surface. This, in turn, may alter the naturally forming oxide layer and, along with it, reduce osseointegration around the implant. [4] Traditionally prosthesis cementation of endo-osseous implants is done approximately at 14-16 weeks post-implantation in the mandible and maxilla, but the formation of compact lamellar bone takes about 25-54 weeks. Hence mineralization is still an ongoing process at 14-16 weeks at the time of cementation of the prosthesis. [6,7] Choice of dental luting cement for implant prosthesis should be based on its composition being biocompatible on the surrounding hard and soft tissue even after the final setting of the cement. Although the relationship between residual cement and peri-implantitis has been established, the impact of the routinely used dental luting cements on bone mineralization has not been elucidated. Hence, the study aimed to evaluate and compare the direct and indirect effects of zinc phosphate cement, glass ionomer cement, nano- structurally integrated bioceramic, and control group on differentiated osteoblast mineralization from dental pulp stem cells.

MATERIALS AND METHODS

The present study was approved by the Institutional Committee for Stem Cell Research(IC-SCR/RM18/12) and Institutional Ethics Committee. Dental pulp stem cells were procured from Regenerative Medicine Laboratory at Dr. D. Y. Patil Dental College & Hospital, Pimpri, Pune, India. The ingenuity of the stem cells was confirmed by assessing the differentiation abilities of the cells and Colony Forming Unit –f (CFU-f) assay of the cells.

Cell Culture and Mineralization

Dental pulp stem cells were placed in a cell culture plate and incubated for 24 hours in a CO_2 incubator at 37°C in a humidified environment with 5% CO_2. Dulbecco's Modified Eagles Medium (DMEM) along with 20% Fetal Bovine Serum (FBS) and antibioticantimycotic (AA) solution was used to help in the proliferation of the incubated cells. The cells were stored in a CO_2 incubator at 37°C in a humidified environment with 5% CO_2.The medium was changed every third day. The proliferation of the cells was observed at regular intervals. When around 80% confluency was observed, the cells were removed using 0.25% Trypsin-EDTA solution and transferred to 96 cell well culture plate containing osteogenic inducing medium. The proliferated cells were kept in an osteogenic-inducing medium for 28 days. The osteogenic inducing medium was changed every third day until 28 days. The cells showed differentiation into osteoblasts on the 14th day, and mineralization was noticed from the 21st day onwards as viewed under an inverted phase-contrast microscope. [8] These mineralized osteoblasts accounted for the hard tissue associated with the dental implant. Cement pellet sample Preparation Three commercially available dental luting cements, Zinc Phosphate Cement (ZP) (Harvard, Berlin, Germany), Glass Ionomer Cement (GIC) (GC Corporation, Tokyo, Japan), and Nano - structurally Integrated Bioceramic Cement (NIB)(Ceramir, Doxa Dental Inc., Sweden), were obtained in sealed

packages. Three commercially available dental luting cements were divided into direct and indirect groups. The powder and liquid of Zinc Phosphate cement and Glass Ionomer cement were dispensed and mixed according to the manufacturer's instructions in a bioseptic cabinet. Zinc Phosphate cement was hand-mixed using a metal spatula on a glass slab to obtain the desired consistency and molded into pellets using poly tetra fluoro ethylene molds. Glass Ionomer Cement was hand-mixed using a plastic spatula on an impervious pad to obtain the desired consistency and molded into pellets using poly tetra fluoro ethylene moldsin a bioseptic cabinet. Nano-structurally integrated bioceramic cement in the form of the capsule with pre-weighed powder and liquid was mixed in a rotating capsule mixer and molded into pellets using poly tetra fluoro ethylene molds. 54 cement pellets (18 pellets of each cement) of size 3x1mm (WxH) were prepared. The surface area of each cell well in the culture plate was 0.32cm.Each cement pellet should contact more than 10% of the surface area of each cell well in the culture plate. [2]

METHODOLOGY

Direct contact cell culture testing was performed according to the international organization for standardization (ISO) method 10993-5 and 10993-12. To simulate the clinical situation as closely as possible. 8µl of gingival crevicular fluid was diluted in8000 ml of phosphate-buffered saline. The 96 cell well culture plate was used for the study. 3 groups were demarcated on cell well culture plate Control group- 24 cell wells(12 cell wells for each test group) with mineralized osteoblasts and 1µl of gingival crevicular fluid as its medium in each cell well. In this group, the cells were not exposed to cements.

Test group 1, 36 cement pellets (12 pellets of each cement) were plated on the mineralized osteoblasts with 1 µl of diluted gingival crevicular fluid as its medium in 36 cell wells for 24 hours. In this test group, mineralized osteoblasts were directlyex posed to cement pellets to exhibit the direct effect.

In test group 2, firstly,36 cement pellets (12 pellets of each cement) were immersed in gingival crevicular fluid for 24 hrs in a separate cell well culture plate. After 24 hrs, cement dissolved gingival crevicular fluid was transferred over the mineralized osteoblast for the next 24 hours. Here the mineralized osteoblasts were exposed to cements dissolved in gingival crevicular fluid to exhibit the indirect effect. (Figure 1)

After 24 hrs, the cement and the GCF from test groups 1 and 2 were removed using a pipette. The osteoblast cells in the 96 cell well culture plate were stained with alizarin red stain for 2 minutes and viewed under an inverted phase-contrast microscope to assess the amount of mineralization. (Figure 2) The culture plate was washed with ethanol, and the readings of each group were obtained in an Enzyme-linked immunosorbent assay (ELISA) reader. These readings of test group 1 and test group 2 were compared with the readings of the control group. Each experiment was performed in quadriplate, and the entire experiment was performed in triplicate to validate the results.

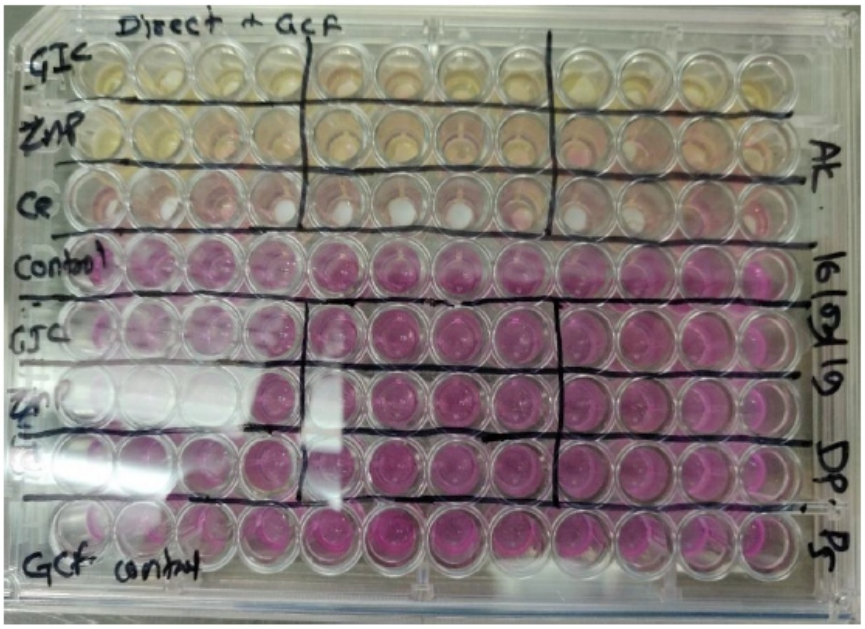

Figure 1: This figure shows a 96 cell well culture plate demarcated into control group, test group 1 and test group 2.

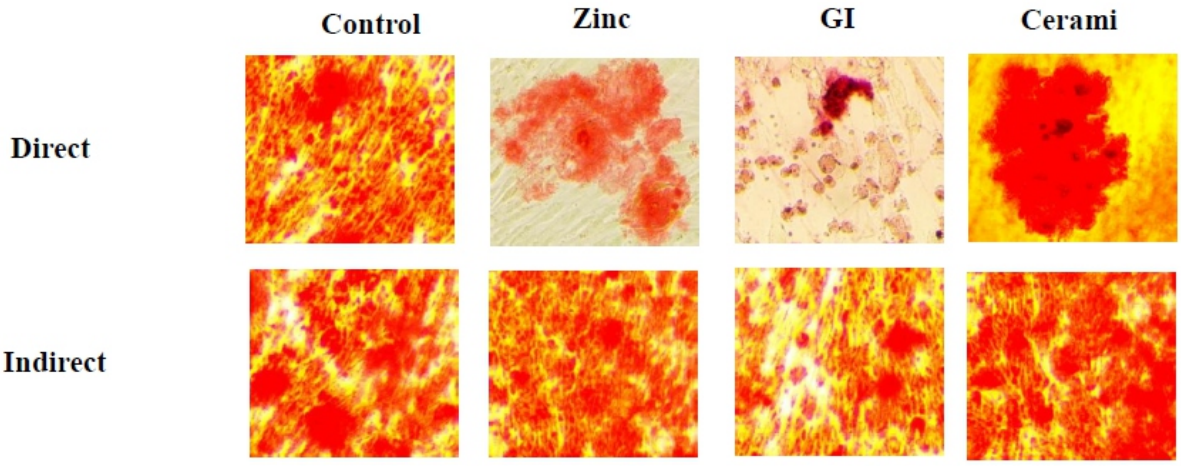

Figure 2: This figure shows the mineralization of osteoblast cells (in test group 1and test group2) when stained with alizarin red stain and viewed under an inverted phase contrast microscope.

Statistical Analysis

The data was entered and analyzed using the Statistical Package for Social Sciences (SPSS) for Windows 27.0. (SPSS, Inc. Chicago, Illinois) Confidence intervals were set at 95%, and a p-value ≤ of 0.05 was considered statistically significant. Independent t-test was applied to compare direct and indirect effects of zinc phosphate cement, glass ionomer cement, nano- structurally integrated bioceramic cement, and control group on the mineralization of osteoblasts derived from dental pulp stem cells.

Results

There was a statistically significant difference seen with zinc phosphate cement, glassionomer cement, and nano- structurally integrated bioceramic cement. (p<0.005) However, the mean values for the direct method indicated a greater negative effect on mineralization as compared to the indirect method.

ZP showed a moderate amount of harmful effect, GIC had severe harmful effects on the mineralization of osteoblast cells and NIB cement showed positive results in both groups with the least negative effect on mineralization of cells.

Discussion

In cement-retained implant prosthesis, the implant is routinely loaded at 14-16 weeks. The surrounding bone which is present at this duration is the woven bone which is partially mineralized. However, the most suitable bone for the support of implant prosthesis is completely mineralized woven bone,i.e., lamellar bone,a highly organized bone that takes about a year for complete mineralization. [7] The commonly seen drawback in the cement-retained prosthesis is the residual cement-retained in the gingival crevice, especially in the interproximal region of the implant. This drawback is most commonly associated with implant prosthesis than the natural tooth. [9] The primary reason being the association of the cervical margin to the prosthesis with the crestal bone and a distinct dissimilarity in the attachment of the sulcus. [10] Most clinicians consider the flare of the implant-abutment a prosthetic margin. This flare of the abutment is generally located near the crestal bone. The abutment has a greater diameter than the implant body dimensions and then gradually becomes narrower, creating an undercut. In cement-retained prosthesis, the excess cement after the prosthesis's cement extends beyond the flare into the undercut around the abutment. Since this prosthetic margin is a few millimeters below the free gingiva in an undercut, removal of excess cement is tough. [9] In a tooth-supported prosthesis, a 1mm layer of the sulcus, junctional epithelium aperture, and the connective tissue attachment are present between the tooth and the gingiva.[11]Hencethe excess cement will not flow beyond theconnective tissue attachmentdue to the fibers inserted into the tooth, and the excess cement can be easily removed with it coming in contact with the bone. In animplant-supported prosthesis, the space between the implant and gingiva does not have a connective tissue attachment zone. The soft tissue is present parallel to the surface;[12] thus, the excess cement that is extruded into the sulcus proceeds to the level of bone as there is no barrier to prevent the excess cement from extruding deeper many mm below the gingival margin of the implant crown. [9]

Dental luting cement used for tooth-supported prosthesis does not adhere to the titanium surface as it adheres chemically to the tooth surface. [9]As a result, a harder cement is used for the cementation of implant prosthesis. The harder the cement, the more difficult it to remove the residual cement without damaging the implant surface below the metal margin. Due to the hardness of the cement, scalers may be used to remove the excess cement, which again might lead to scratches to the implant abutment. [4]The amount of cement and its location in the implant sulcus determines the risk to the surrounding soft and hard tissue.

Accordingly, in this study, test group one simulates the situation where the effect of excess residual cement is checked on mineralization of osteoblasts when the cement comes in direct contact with the cells in the presence of gingival crevicular fluid. Test group two simulates the effects of the traces of cement left behind even if the clinician tries to remove the excess cement completely. This is shown by treating the gingival crevicular fluid with cement and treating gingival crevicular fluid on the osteoblast cells.The choice of the final cement for this implant prosthesis is based on the luting properties present in the cement. Apart from good retention and easy retrievability, cements must be biocompatible with the surrounding tissue. [13]

The cement tested in this study is glass ionomer cement, zinc phosphate cement, nano-structurally integrated bioceramic cement. These cements are commonly used for cementation of the crown, bridge, and implant prosthesis. It is mainly presumed that cement generally formulated as permanent luting cement would be at the top of the biocompatibility list. However, with this study, it was found that the rank order of the cement biocompatibility is different. When tested on mineralized osteoblast, glass ionomer cement shows a significant decrease in osteoblast mineralization due to an acidic component in its liquid-like tartaric acid, itaconic, and polyacrylic acid. [14] Zinc Phosphate cement which is often the cement of choice for definitive implant prosthesis, showed a significant decrease in the mineralization of the osteoblast due to the presence of phosphoric acid. During the early setting stage, the pH is nearly 2 or 3. Even after the final set, it does not cross 5 or 6 pH, which creates a highly acidic environment and unfavorable for the mineralization of osteoblasts. [15]NIB shows the same value as control as it contains mineral trioxide, calcium aluminate, and strontium fluoride, which has a positive effect on mineralization. [2]

Limitations of this study

Firstly the study is in vitro in nature. Secondly , the experiment does not simulate the exact intraoral environment as a human oralcavity. We have tried to recreate an environment as similar as possible by using human GCF as a medium Lastly, the mixing mechanism of the three cement is different. GIC and ZP is available as powder and liquid and is hand-mixed, whereas NIB is available as capsule. With GIC and ZP, since its manual mixing, there is a chance that the operator may change the powder liquid ratio to get the desired consistency. Since NIB is supplied as a capsule, it has pre weighed powder and liquid, therefore the clinician cannot modify the water liquidratio. [2]

CONCLUSION

Nano structurally integrated bioceramic cement showed the least negative effect on mineralization of osteoblast cells as compared to other routinely used test cements. Further study, on evaluation of osteoblast and osteoclast activity after exposure to routinely used cements in an in vivo environment is needed for better choice of dental luting cement for implant prosthesis.

Conflict of Interest: None

Funding: None

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Table 1: Comparison between the direct and indirect effect of the cements on mineralized osteoblasts

†- Glass Ionomer Cement. ‡- Zinc Phosphate Cement §- Nano-structurally integratedbioceramic cement.
Independent t-test, p-value <0.05, considered statistically significant.

Cements	Groups	Mean ± Std. Deviation	Mean Difference	t-value	p-value
GIC†	1	1.14 ± 0.49	-2.15	-13.038	0.001*
	2	3.30 ± 0.29			
ZP‡	1	2.04 ± 0.63	-1.71	-8.307	0.001*
	2	3.60 ± 0.33			
NIB§	1	4.05 ± 0.45	0.42	2.873	0.009*
	2	3.63 ± 0.22			
Control	1	4.01 ± 0.88	0.29	1.037	0.311
	2	3.72 ± 0.41			

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Characterization of Friction Stir Weld Joint for Aluminum Alloy (AA6061) coated with Mg Particles

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ABSTRACT

Friction stir welding (FSW) is a solid-state welding process which is having broad scope of joining materials which are relatively hard to be welded by fusion welding process. FSW process is highly energy-efficient and eco friendly as compared to the fusion welding. The purpose of this experimental work is to investigate and analyze the mechanical properties like Tensile Strength, Hardness and Impact strength by using Universal Testing Machine, Rockwell Hardness Tester and Charpy Impact Test Machine respectively on butt joint. Friction stir welding operation is performed on Aluminium alloy 6061 coated with magnesium particles. The optimum values were optimized by developing a Taguchi optimization technique. The experimental results have been analyzed by using ANOVA statistical technique to know the effect of process parameters. During this experimental work it is observed that AA 6061 has higher values of Tensile Strength and Hardness due to its strain hardening effect.

KEYWORDS : Friction Stir Welding (FSW), Aluminium Alloy 6061, Magnesium Particles, ANOVA, & Taguchi method.

I. INTRODUCTION

Joining of dissimilar materials has been under study since the past decades. Many applications require a combination of different metals to achieve better mechanical and metallurgical properties. The density of Aluminiumis 2.7 g/cm3.The use of Aluminium and steel in a structure can reduce the total weight drastically. These materials can be used for designing various structures for automobile, cryogenic and many other industries [1–4]. Aluminium alloys such as AA6061 possess good formability and light weight. Friction stir welding (FSW) is a solid-state joining process that uses a non-consumable tool to join two facing work pieces without melting the work piece material. This process is competent enough to weld materials which are relatively difficult to be welded or almost unweldable by fusion welding (FW) process. The major aspect of this process is that the temperature remains below the solidus temperature, i.e., melting of the material does not take place. As the welding takes place below the solidus temperature, various defects associated with the FW process are not present in FSW. FSW leads to fine grain structure in the stir region due to dynamic recrystallization owing to severe plastic deformation, resulting in substantial micro structural evolution [5-8]. Due to this fine microstructure, good mechanical properties are observed in FSW.

ThecompleteinformationabouttheprocessofFSWwasexplainedbymanyresearchersinthepastindif ferent publi-cations[8–12].The chemical percentage of AA 6061 is shown in table 1.1.The schematic representation of FSW is shown in figure 1.1.[13]

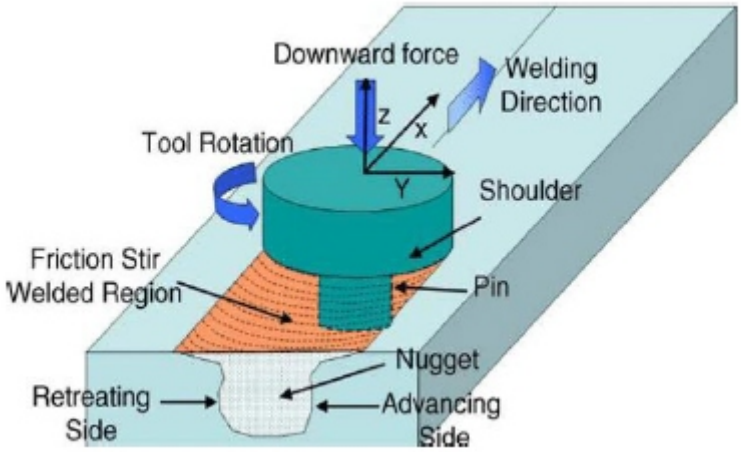


Fig. 1.1: Schematic representation of FSW process

Alloy	Cu	Si	Mn	Mg	Fe	Zn	Ti	Cr	Al
6061	0.15-0.4	0.4-0.8	0.15	0.8-1.2	0.7	0.25	0.15	0.04-0.35	Balance

Table1.1: Chemical composition of AA6061 in weight %.

FSW has been successful in joining many of the commercial aluminium alloys including 1xxx, 2xxx, 3xxx, 5xxx, 6xxx 7xxx, 8xxx and in 3xx and 4xx of cast aluminium alloys. It is also successfully employed in dissimilar welding. It is not only successful in dissimilar combinations of aluminium alloys but also in aluminium - steel, aluminium –copper and aluminium – magnesium alloys.

II. Literature Survey

The important aspect of formulating a problem in the research work with clear objective is to have a deep insight into the literature survey. M. A. Tashkandi, J. A. Al-Jarrah, M. Ibrahim[14]it has been reported that the volume fraction of alumina particles incorporated in this study were 2, 4, 6, 8 and 10% were added on both sides of welding line. Hema pothur, Gangadhar S.M. and Ravindranath.K [15], the investigation carried on "Influence of Friction Stir Welding Parameters on the Micro Structural and Mechanical Properties of Aluminium Alloy 6061. Krishnan K.N et al. [16] the solution and ageing treatments to produce high hardness resulted in failure in the bending. P Jagadeesh Chandra Prasad et al. [17] FSW Minimum defects were observed for the highest tool rotation speed. P. Ferro and F. Bonollo [18] Explains the fundamental unknown parameter, under the assumption of sticking between the tool/matrix interfaces, is the yield shear stress, which is temperature dependent.

III. Experimental Setup

Then the coating of magnesium particles is done on the welding line of the base aluminium metals that are to be welded. Then the plates were welded by using Friction Stir Butt Welding process with 18 different level combinations of welding parameters. The welded plates are cut to the dimensions to suit Tensile test, Hardness test and SEM analysis by following ASME code book and tests were performed accordingly.

III.1 Coating of Mg particles on Al

The magnesium slurry (0.25gm up to 1.5gms) in homogeneous form were mixed with n-methyl pyrrolidine and grinded again in order to increase the cohesiveness or bonding strength of the magnesium particles shown in the figure 3.1.1. Then this mixture is mixed with a chemical bonding agent polyvinylidene fluoride (pvdf) in order to increase the adhesiveness and to stick firmly on to the substrate material shown in the figure 3.1.2.

Figure: 3.1.1 Preparation of Mg slurry

Figure: 3.1.2 Coating of the magnesium slurry on the base metal

Then the coated material is allowed to dry under the solar lamp, until the dry coated layer forms on to the substrate material or base material as shown in the figure 3.1.3.

Figure: 3.1.3 drying of the magnesium coating under the solar lamp

The FSW is performed on the vertical milling machine with specifications of 10 Hp, and speed of 3000rpm as shown in figure 3.1.4. The Fixture setup on milling machine is shown in figure 3.1.4.

Fig. 3.1.4: Vertical Milling Machine (Make HMT)

Fig. 3.1.5: Fixture setup on milling machine

III.2 Tool Design

A Non-consumable tool of H13 tool steel is used for the joints. The tool is shown in Figure. 3.2.1. Theprocess parameters of Friction stir welding is shown in table 3.2.1

Figure: 3.2.1 FSW circular pin profile

Parameter	Effects
Tool Rotational Speed	Frictional heat, "stirring", oxide layer breaking and mixing of material
Welding Speed	Appearance, heat control.
Tool profile	Frictional heat, maintaining contact conditions.

Table: 3.2.1 Main Process Parameters in FSW with their Effects

III.3 Mechanical testing

3.3.1 Tensile testing

The tensile tests provide information about the materials under uniaxial tensile stresses on the strength in terms of ultimate tensile strength (UTS), yield strength (YS) and ductility in terms of percentage of elongation (% E). This information helps to compare the material and quality of the joint. The tensile specimens are machined to a standard dimension as per the standard from the selected portions of the welded part as shown in Figure 3.6. The results of the tensile tests may not represent the strength and ductility properties of the entire product or its service behavior under different environments but are accepted as satisfactory under standard testing conditions. The tensile tests are evaluated for each welding condition. The tensile tests are conducted for two set of welding conditions. The Universal Testing Machine (UTM) is shown in figure 3.3.1.1.

Figure: 3.3.1.1Universal Testing Machine (TUE-C-200)

3.3.2 Specimen Preparation

The testing procedure involves Hardness test and Impact test accordingly the specimen is prepared as shown in the figure 3.3.2.1. The figure below shows a typical Tensile Test specimen. Tensile testing of butt welds has been the major method used for evaluating strength of FSB welds in literature. This test method was adopted in this study. Test samples, 20 mm wide, perpendicular to the welding direction were machined from theweld plates.

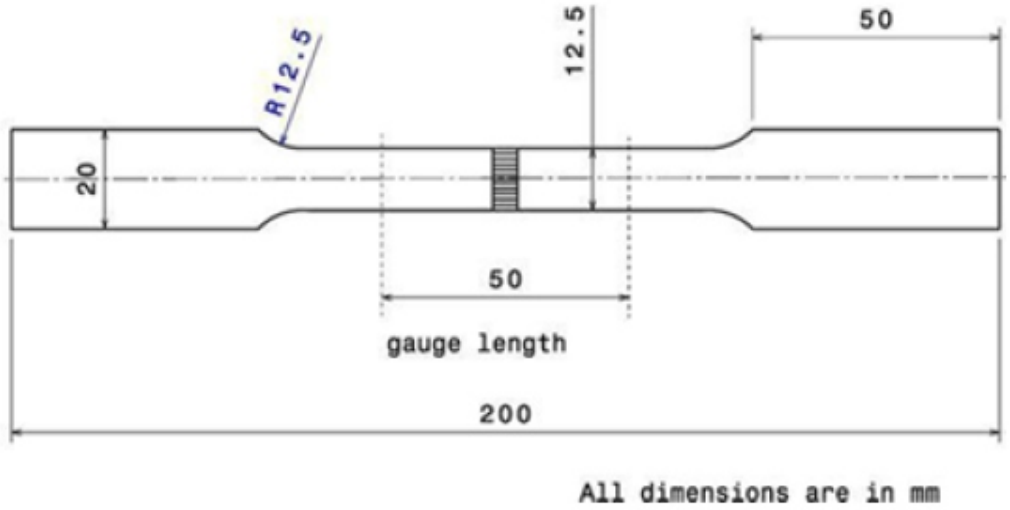


Figure: 3.3.2.1Test Specimen

The specimen was prepared by cutting the base metal sheet of dimensions 100mm x 100mm x6.00mm by using wire EDM. The methodology for joint considered in FSW process consist 6061 Al Alloy of 6.00mm thickness plates (100mm x 100 mm) length plate are prepared for the similar joint configuration is shown in Figure 3.3.2.2. The tool made of H13 has Cylindrical Pin with flat shoulder was used to fabricate the joints. The initial joint configuration was obtained by securing plates in position using proper clamps. Based on the literature coupled with availability of speeds on the machine, three different Tool Rotational Speeds and Welding Speeds and with and without magnesium were selected to carry out the experiment. Then the testing of the specimen enhanced to evaluate the impact strength by conducting impact test on Charpy impact testing machine as shown in the figure 3.3.2.3.Testing of specimen for tensile test on UTM illustrated in figure 3.3.2.4.The figure 3.3.2.5(a) and figure 3.3.2.5(b) show the specimen before testing and after testing.

Figure: 3.3.2.2Welded Specimen

Figure: 3.3.2.3 Charpy impact testing machine

Figure: 3.3.2.4: Testing of Specimen in UTM

Figure: 3.3.2.5(a &b): specimen before & after testing

IV. RESULTS AND DISCUSSION

The below table 4.1 shows the experimental results for Tensile test, Hardness test and impact test of AA6061.

S No	Magnesium	Speed (Rpm)	Feed (Mm/Min)	Tensile Strength (N/Mm2)	Hardness	Impact Strength (Joules)
1	0.25	1000	40	95.008	63.2	2
2	0.25	1200	50	83.14	63.8	4
3	0.25	1400	60	71.192	64.9	2
4	0.5	1000	40	91.32	59.9	2.5
5	0.5	1200	50	73.96	61.0	2
6	0.5	1400	60	75.93	62.8	4
7	0.75	1200	40	68.96	63.1	4.5
8	0.75	1400	50	70.43	63.5	3
9	0.75	1000	60	66.93	62.4	2.5
10	1	1400	40	78.13	62.1	4.5
11	1	1000	50	67.39	61.3	3
12	1	1200	60	70.62	60.2	3
13	1.25	1200	40	75.36	61.9	4
14	1.25	1400	50	71.05	63.4	3
15	1.25	1000	60	19.19	62.0	2.5
16	1.5	1400	40	89.52	61.9	4
17	1.5	1000	50	22.34	64.2	2.5
18	1.5	1200	60	25.53	63.2	2

Table: 4.1 Experimental Results of Tensile strength, hardness and impact test of Aa6061.

4.1 ANOVA Analysis

ANOVA is employed to optimize the Tensile Strength, Hardness and Impact strength of the AA6061 material for Friction Stir Butt Welding. The testing results were analyzed with their presses parameter individually. The tables4.2 given below shows the process parameters and their design levels. These values are considered for carrying the project work, such as Tool Rotational Speed (N), Welding Speed (F) and with and without Magnesium, different joint profiles.

Process Parameters	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Tool Rotational	1000	1200	1400			
Welding Speed	40	50	60			
Magnesium in gms	0.25	0.5	0.75	1	1.25	1.5

Table: 4.2 Process Parameters and their design levels used in FSBW

From the experiment it can be concluded that experiment number 1is having highest tensile strength the parameters are with 0.25gm of magnesium, speed 1000 rpm, feed 40mm/min. From the above graph we can say that by adding magnesium particles to the weld pool, the tensile strength of weld join is increased. ANOVA results for Tensile test, Hardness test & Impact test are shown in tables 4.3,4.4 and 4.5 respectively. And the S/N Ratio of Tensile test , hardness and impact test are shown in the graph 4.1,4.2 & 4.3 respectively.

Factor	Degrees of Freedom DOF	Sum of Squares SS	Mean Squares MS	Percentage of Contribution
Mg	5	3164.6	632.9	37.1
Speed	2	2449.9	1224.9	28.7
Feed	2	752.6	376.3	8.8
Error	8	2155.8	269.5	
Total	17	8522.9	-----	

Table: 4.3 ANOVA Results of tensile Strength for AA 6061

From the Table 4.3, the Percentage of Contribution values for Magnesium in gms (37.1%), Tool Rotational Speed (28.7%), Welding Speed (8.8%) is obtained. It is observed that the with Magnesium coating have great influence. Since this analysis is a parameter-based optimization design, from the above values with Magnesium coating is the Major Factor to be selected effectively to get the good Tensile strength.

Factor	Degrees of Freedom	Sum of Squares	Mean Squares MS	Percentage of Contribution
Mg	5	45.73	9.147	28.93
Speed (rpm)	2	16.99	8.405	10.75
Feed	2	27.61	13.807	17.47
Error	8	67.70	8.463	
Total	17	158.04		

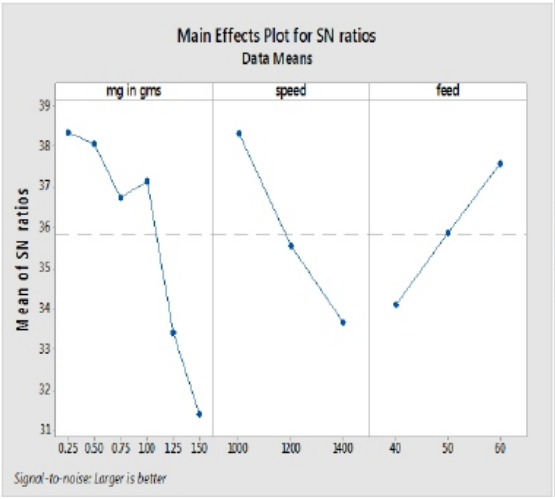
Table:4.4 ANOVA Results of Hardness for Aa6061

From the ANOVA Table 4.4, the Percentage of Contribution values for With Magnesium (28.93%) Tool Rotational Speed (10.75%), Welding Speed (17.47%) is obtained. It is observed that the Magnesium in gms have great influence on Hardness. Since this analysis is a parameter-based optimization design, from the above values Magnesium in gms is the Major Factor to be selected effectively to get the good Hardness.

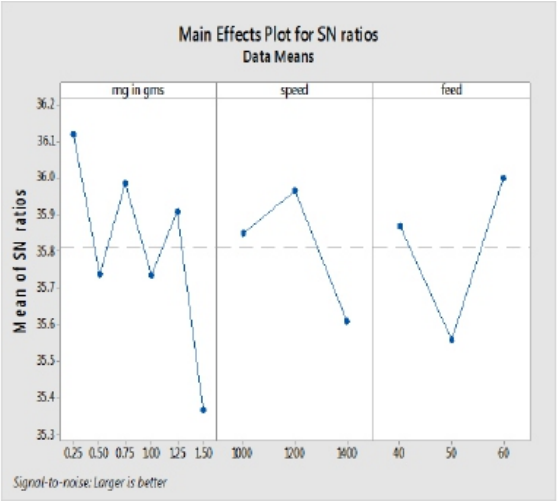
Factor	Degrees of Freedom	Sum of Squares	Mean Squares MS	Percentage of Contribution
Mg	5	1.611	0.322	11.98
Speed	2	2.694	1.3472	20.38
Feed	2	2.861	1.4306	21.28
Error	8	6.278	0.7847	
Total	17	13.444		

Table: 4.5 ANOVA Results of Impact strength for Aa6061

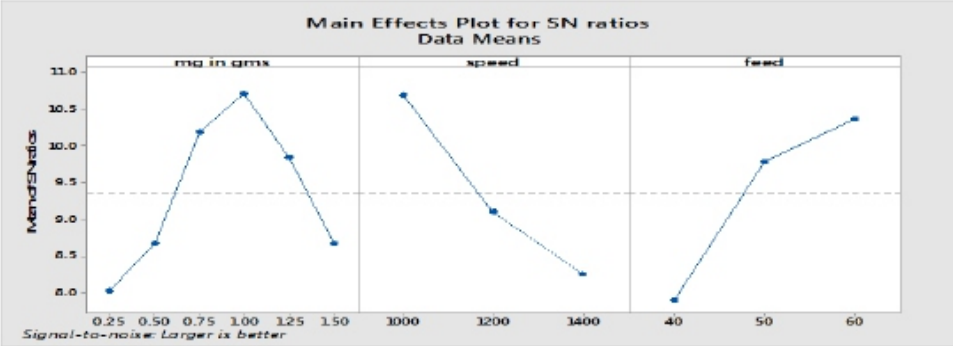
From the ANOVA Table 5.6, the Percentage of Contribution values for Magnesium in gms(11.98%) Tool Rotational Speed (20.38%), Welding Speed (21.28%) is obtained. It is observed that the Welding speed have great influence on Impact strength. Since this analysis is a parameter-based optimization design, from the above values Welding speed is the Major Factor to be selected effectively to get the good Hardness.



Graph: 4.1S/N ratios for Tensile strength of AA 6061



Graph: 4.2 S/N ratios for Hardness of AA 6061

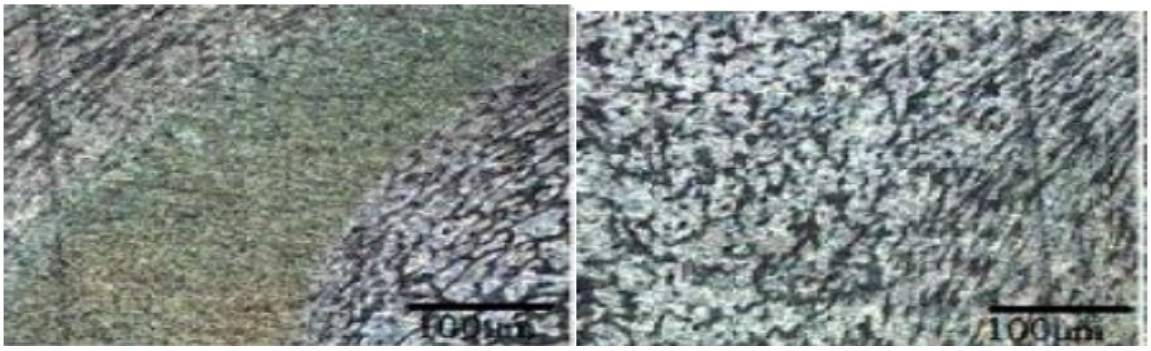


Graph: 4.3 S/N ratios for Impact Strength ofAA 6061

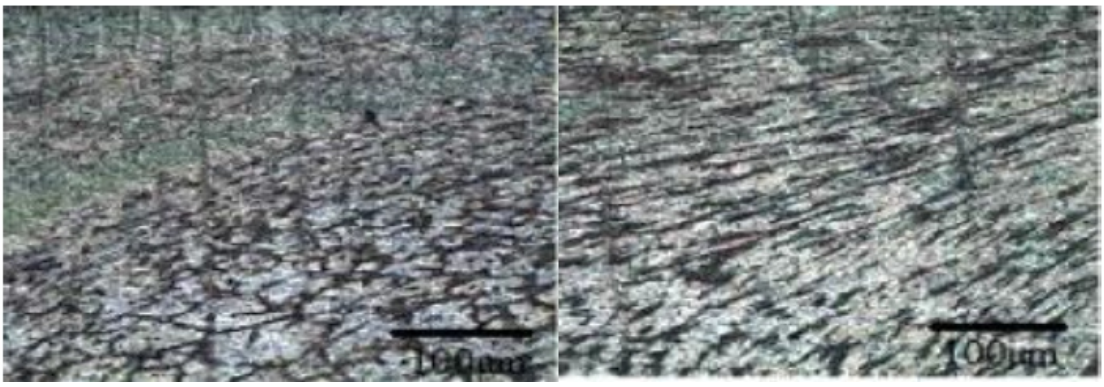
The aim is to identify the most influencing significant parameters and percentage contribution of each parameter on responses of FSBW joints by conducting minimum number of experiments using TAGUCHI.

4.2 SEM Analysis

A scanning electron microscope (SEM) analysis is carried during this work in order to observe the Specimen high vacuum in conventional SEM or in low vacuum or wet conditions in variable pressure or environmental SEM and at a wide range of cryogenic or elevated temperatures with specialized instruments. The images captured of the specimen at different speed and feed parameters are shown in figures in figure 4.2.1.



(a) Micro structure (b) Microstructure
(0.25gm of mg, 40 mm/min Feed, 1000 RPM)(0.5 gm of mg, 60 mm/min Feed, 1400 RPM)



© Microstructure (d) Microstructure
(1gm of mg, 60 mm/min Feed, 1200 RPM)(1.5gm of mg, 40 mm/min Feed, 1000) Figure: 4.2.1
Scanning Electron Microscope Images

V. CONCLUSIONS

The present work, friction stir Butt welding was conducted to join AA 6061. The Analysis of Taguchi for orthogonal array shows that, for the Tensile Strength, Magnesium is most influence parameter while the Feed (welding speed) is the least influence parameter. The remaining parameters have a moderate effect.For Hardness, Magnesium is highly influenced while speed least influence. The remaining parameters have a moderate effect.For Impact strength, the high influenced parameter is feed and least influence parameter is Magnesium by weight and also concluded that magnesium coating along the weld line has a great influence in the joint strength of friction stir welding.It was observed that at first as the percentage of magnesium is increased the tensile strength is decreased, this is because it requires more heat input in order to completely stir the magnesium particles along with the aluminium base metal (alloying).The complete alloying of Magnesium coating with the aluminium base metal was happening due to the higher heat input.AA 6061 has higher values of Tensile Strength and Hardness due to its strain hardening effect and magnesium particles on AA6061.With the increase of Tool Rotation Speed, the Hardness increases first and then decreases, but as the Welding Speed increases, the Hardness also increases with the addition of magnesium. With the increase of Tool Rotation Speed, the Impact strength decreases first and then increases, but as the Welding Speed increases and at lower feed, due to the higher heat input the impact strength increases even with the increase in the weight of magnesium.

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