


**THE ROLE OF SMART SYSTEMS IN ENHANCING THE PERFORMANCE OF KNOWLEDGE MANAGEMENT IN LIBRARIES BASED ON THE ADOPTION OF USING EXPERT SYSTEM AND ROBOTS**

Eissa Mohammed Ali Qhal<sup>A</sup>



ARTICLE INFO	ABSTRACT
<p><b>Article history:</b></p> <p>Received 05 December 2022</p> <p>Accepted 06 February 2023</p>	<p><b>Purpose:</b> This study aims to enhance the performance of Knowledge management (KM). Additionally, the advantages and the applications of this expert system and the smart systems are analyzed.</p> <p><b>Theoretical framework:</b> Selecting an algorithm isn't an easy process. With a deep exploration of techniques and algorithms, the appropriate algorithm should be chosen and implemented to ascertain the solution for the problems like analyzing the trend of the business, identifying the age group, and finding the most desired articles and publications.</p> <p><b>Design/methodology/approach:</b> Contented and Expressive review approaches are implemented to conduct the research. The investigators significantly studied the materials associated with robots and expert systems in the reference to knowledge management in libraries. The results are obtained using the data visualization tool tableau. the Genetic algorithm is also used to analyze the results.</p> <p><b>Findings:</b> Smart systems are not easy to implement in knowledge management because knowledge management contains a large number of datasets. It has to be categorized first, then needs to be analyzed and the decisions must be taken accordingly.</p> <p><b>Research, Practical &amp; Social implications:</b> The expert systems and the robots are to be implemented in the KM so the knowledge management will have enhanced performance with the help of the implementation of smart systems.</p> <p><b>Originality/value:</b> In the study, the Genetic algorithm is used to find the analysis results. This algorithm was chosen because it works well in a noisy environment and is also easy to understand along with this GA is compared with the neural network algorithm.</p>
<p><b>Keywords:</b></p> <p>Smart Systems; KM; Expert Systems; Robots; Genetic Algorithm; Artificial Neural Network.</p> <div data-bbox="172 1070 480 1317" style="text-align: center;">  </div>	<p>Doi: <a href="https://doi.org/10.26668/businessreview/2023.v8i2.1353">https://doi.org/10.26668/businessreview/2023.v8i2.1353</a></p>

**O PAPEL DOS SISTEMAS INTELIGENTES NO APRIMORAMENTO DO DESEMPENHO DA GESTÃO DO CONHECIMENTO EM BIBLIOTECAS COM BASE NA ADOÇÃO DO USO DE SISTEMAS ESPECIALISTAS E ROBÔS**

**RESUMO**

**Objetivo:** Este estudo visa aprimorar o desempenho da gestão do conhecimento (GC). Adicionalmente, são analisadas as vantagens e as aplicações deste sistema de exportação e dos sistemas inteligentes.

**Estrutura teórica:** Selecionar um algoritmo não é um processo fácil. Com uma exploração profunda de técnicas e algoritmos, o algoritmo adequado deve ser escolhido e implementado para determinar a solução de problemas como analisar a tendência do negócio, identificar a faixa etária e encontrar os artigos e publicações mais desejados.

**Desenho/metodologia/abordagem:** Abordagens de revisão de conteúdo e expressiva são implementadas para conduzir a pesquisa. Os investigadores estudaram significativamente os materiais associados a robôs e sistemas

<sup>A</sup> Jazan University Administration Department- Applied College, Jazan: 45142, Saudi Arabia,  
E-mail: [Egohal@jazanu.edu.sa](mailto:Egohal@jazanu.edu.sa) Orcid: <https://orcid.org/0000-0003-3192-062X>

especialistas no que se refere à gestão do conhecimento em bibliotecas. Os resultados são obtidos usando a ferramenta de visualização de dados tableau. o algoritmo genético também é usado para analisar os resultados.

**Resultados:** Sistemas inteligentes não são fáceis de implementar na gestão do conhecimento porque a gestão do conhecimento contém um grande número de conjuntos de dados. Tem que ser categorizado primeiro, depois precisa ser analisado e as decisões devem ser tomadas de acordo.

**Implicações de pesquisa, práticas e sociais:** Os sistemas especialistas e os robôs serão implementados no KM para que a gestão do conhecimento tenha um desempenho aprimorado com a ajuda da implementação de sistemas inteligentes.

**Originalidade/valor:** No estudo, o algoritmo genético é usado para encontrar os resultados da análise. Este algoritmo foi escolhido porque funciona bem em um ambiente ruidoso e também é fácil de entender junto com este AG é comparado com o algoritmo de rede neural.

**Palavras-chave:** Sistemas Inteligentes, GC, Sistemas Especialistas, Robôs, Algoritmo Genético, Rede Neural Artificial.

## EL PAPEL DE LOS SISTEMAS INTELIGENTES EN LA MEJORA DEL RENDIMIENTO DE LA GESTIÓN DEL CONOCIMIENTO EN LAS BIBLIOTECAS BASADO EN LA ADOPCIÓN DEL USO DE SISTEMAS EXPERTOS Y ROBOTS

### RESUMEN

**Propósito:** Este estudio tiene como objetivo mejorar el desempeño de la gestión del conocimiento (KM). Adicionalmente, se analizan las ventajas y las aplicaciones de este sistema de exportación y los sistemas inteligentes.

**Marco teórico:** Seleccionar un algoritmo no es un proceso fácil. Con una exploración profunda de técnicas y algoritmos, se debe elegir e implementar el algoritmo apropiado para determinar la solución a problemas como analizar la tendencia del negocio, identificar el grupo de edad y encontrar los artículos y publicaciones más deseados.

**Diseño/metodología/enfoque:** Se implementan enfoques de revisión contenta y expresiva para llevar a cabo la investigación. Los investigadores estudiaron significativamente los materiales asociados a robots y sistemas expertos en la referencia a la gestión del conocimiento en bibliotecas. Los resultados se obtienen utilizando la herramienta de visualización de datos tableau. el algoritmo genético también se utiliza para analizar los resultados.

**Hallazgos:** Los sistemas inteligentes no son fáciles de implementar en la gestión del conocimiento porque la gestión del conocimiento contiene una gran cantidad de conjuntos de datos. Primero debe categorizarse, luego debe analizarse y las decisiones deben tomarse en consecuencia.

**Implicaciones de investigación, prácticas y sociales:** los sistemas expertos y los robots se implementarán en el KM para que la gestión del conocimiento tenga un rendimiento mejorado con la ayuda de la implementación de sistemas inteligentes.

**Originalidad/valor:** en el estudio, se utiliza el algoritmo genético para encontrar los resultados del análisis. Se eligió este algoritmo porque funciona bien en un entorno ruidoso y también es fácil de entender, además de que este GA se compara con el algoritmo de la red neuronal.

**Palabras clave:** Sistemas Inteligentes, KM, Sistemas Expertos, Robots, Algoritmo Genético, Red Neuronal Artificial.

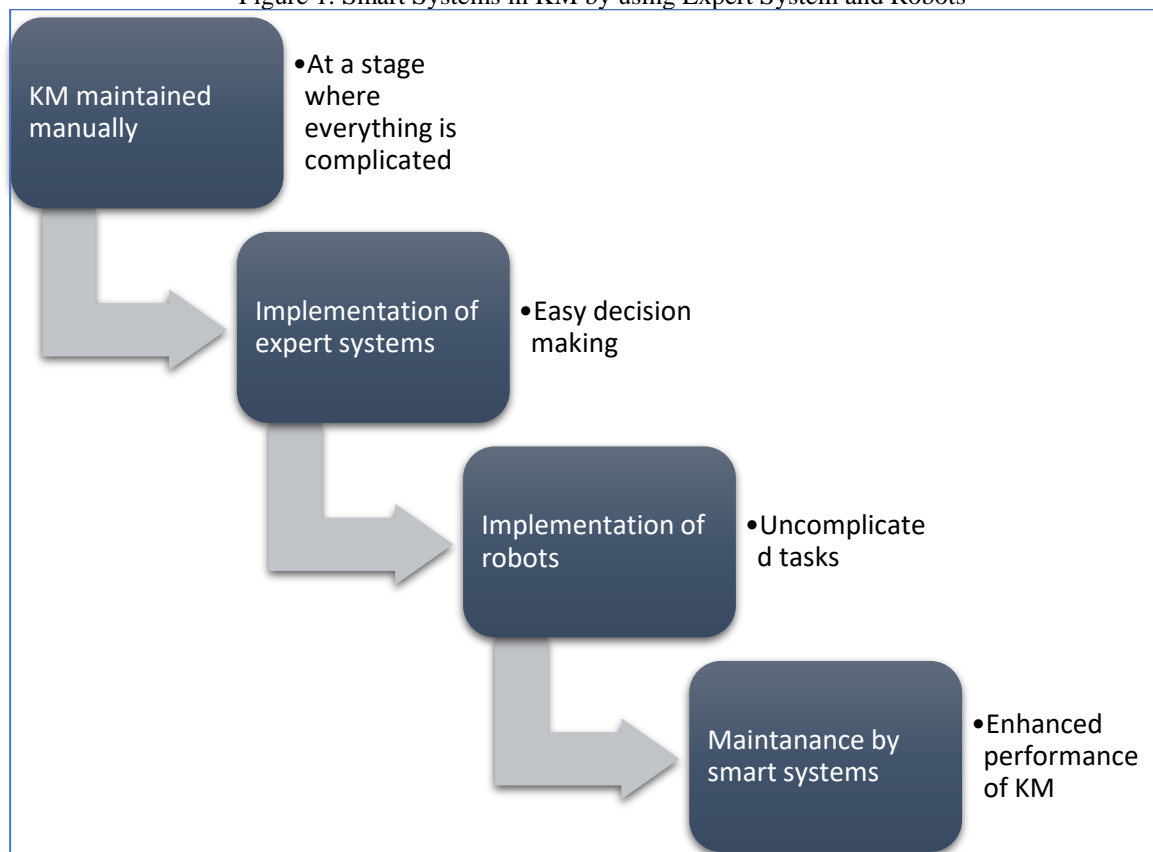
### INTRODUCTION

Smart Systems aside from combining a couple of technologies, may be designed to deal with the desires of sectors along with strength, transport, protection, healthcare and ICT, manufacturing, and safety. “Smart systems” incorporation can probably cope with societal, financial and environmental demanding situations like constrained resources, weather change, globalization, and general public ageing. These functions make Smart Systems vital in the direction of modern and agile use in the present societies (Gessner, 2008). The courting among

applications and Smart Systems sectors has been emphasized with inside the SRA (Strategic Research Agenda) of the “European Technology Platform” on Smart Systems Integration. In reality running in the grounds of this studies agenda, evolved SMAC, a “Smart Systems co-design platform”. The SMAC platform, reports the demanding situations of the combination of conflicting and heterogeneous domain names that emerge with inside the layout of Smart Systems (Gessner, 2008).

Some of the regions in which smart solutions may be carried out on consist of the usage of smart solutions for sustainable environment solutions along with strength control and distribution, smart control of smart logistics, electrical drives, or power-efficient facility control. In automobile industry, smart systems integration may be used for pre-cash systems and predictive driver helps the functions. Supplementary to these, smart systems are notion of as essential for sustainable and power-efficient mobility, e.g., electric powered traction and hybrid. One key region in which smart systems can make a contribution is the (IoT) Internet of Things, because of their smart functionalities for normal items (Wiig, 1994). These smart items which includes commercial ingredients or food merchandise should aid the aged and the disabled and develop the meals supply and high-satisfactory.

Figure 1. Smart Systems in KM by using Expert System and Robots



Smart systems era has a vital function to play in enhancing the healthcare region with real time monitoring, higher diagnostic tools, interactions, treatment and excellence of existence for sufferers with the aid of using decreasing charges of public healthcare structures. In conclusion, of the maximum modern solutions the usage of smart systems might be smart miniaturized gadgets and synthetic organs. Due to huge demand of services, there is a shortage in the working labours or the skilled workers (Atake, 1993). There is a huge shortage of skilled craftsmen. Why do the service providers need large number of skilled labourers? For an efficient service there exist a need of large number of labours. For example, in a construction site, it is impossible to build a huge building with few labours in a normal time period, because they might need more time (European Commission ICT Work Programme 2009-10).

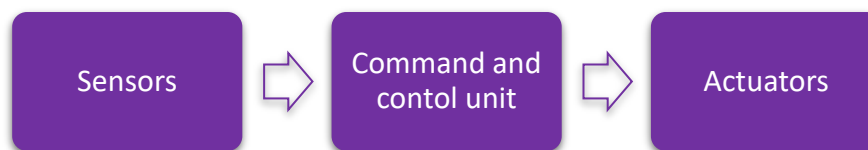
If there are many labours then the supervisor would assign certain number of labours for specific task for example, he would assign 50 members for loading and unloading the raw materials, at the same time for building the blocks he would assign another 50 members and so on. The “Shimizu Manufacturing System by Advanced Robotics Technology” (SMART) system of the “Shimizu Corporation” manages all stages of constructing structures for super structure work from underground work to concluding work. It also manages innumerable building management responsibilities for the automatic construction of high rise structures (European Commission, 2011). Thus, for building they might need 300 to 500 workers then what will be the number of workers needed for the development of a system. In the case of KM, there exists a large quantity of data and database. And knowledge management is a very big and a complicated task. Like it becomes really complicated for a human being to handle a huge library. First of all, the librarians must know about all the books available in the library, that person must be aware of the kinds of books, must have a slight knowledge on the summary of every book, he must be knowing that which book has been borrowed by a person and then will when will that person would return that book, and who all have borrowed the book, what is the time period of borrowing a book, what will happen if the person didn't return a book, there are many such queries and complications that must be dealt from the side of librarians similarly the knowledge management also come rising similar complications (Rai & Hong, 2013).

What will be changes or the impact if these situations are systemised? If this scenario is given to a smart system, there will be a great enhancement in the efficiency of the knowledge management. As all know that no machines get tired, especially it doesn't get tired of repeated tasks, can produce accurate results compared to human beings, no partial works, easy to find mistakes and lot more are the benefits of implementing smart systems, expert systems and robots to the KM.

## Smart systems

The smart systems can be defined as an integration of actuation, control, description, sensing and analyzing a situation to generate appropriate decisions depending upon the available data which can be in the form of adaptive or predictive. These are an act of performing smart actions. In almost every situation the smartness of the system can be credited to independent operations depending upon the energy efficiency, network capabilities and closed loop control. The cause of “smart systems” is to implant era into the manner the sector previously operates. People can perform in massive towns through the usage of sensors to abstract records about the traffic flows and application structures like energy and water. Analysing styles and developments then permit people to make predictions. Smart systems are the “stand-alone systems” or structures that assist customers to make choices integrating available records from unique sensing, in a manner to govern and make smart movements (Akhras, 2000).

Figure 2. Components of smart systems



For an example, the sensors will measure the temperature, after continuous measures the decision will be taken in the command and control unit, after the decision making then the actuators would perform the action.

The smart systems generally contain different components such as actuators, sensors, command and control units and so on. The senses are generally used for signal acquisition, the command and control units are the one who takes the control of making decisions and also, they provide instructions with the help of available data. The components are also used to transmit the instructions and make the appropriate decision. However, the actuators and sensors are meant to be the building block of the smart systems. The actuator can be termed as a component of a machine or a system which have a capability to control or move the systems (European Commission ICT Work Programme 2009-10). A sensor is a device which can sense the surroundings or the environment, it can also control the signals that are generated from the actuators based on the actions which are set to be performed or programmed earlier. The major difference between sensors and actuators are the actuator can change the electrical signal to the

physical action whereas sensors convert the physical attributes or the physical action do an electrical signal. This conveys actuators and sensors perform opposite processes.

Smart systems are a term used to explain special technological structure which are self-sufficient or collaborative and have integrated functionalities which includes the capability to, sense, actuate and control a specified scenario in an effort to analyse and designate it. These structures are able to supporting, determining or predicting to make “decisions” depending upon accessible data, in that way operating smart actions with the usage of incredibly sophisticated interfaces among users and systems. The evidence of ‘smartness’ of the machine derives from self-sufficient procedure which is primarily based totally at the factors of networking capabilities, power performance and closed loop control. The preceding result in distinctive capability and quality in adaptableness and self-reliance (Liao, 2004).

There are mainly three generations of smart systems as follows:

- First generation: consist of driver status monitoring, multi-functional devices, object recognition devices and lot more lease there used for decreasing invasive surgery.
- Second generation: environmental sensor networks, advanced energy management systems, and active miniaturized artificial organs
- Third generation: integrate both cognitive functions and technical “intelligence”.

This technique is the proposal of an interface between the physical and the virtual world.

“Smart systems at most are an evolution of microsystems”. They integrate the components and the technologies from the Microsystems such as cognitive sciences, miniaturized electric, nanoscience, mechanical, chemistry, biology, fluid devices, optical devices, and other disciplines. Generally, the smart systems contain the variety of components such as sensors for signal acquisition, the decision making part is handled by command and control unit, the instructions and the decisions are passed to the components which has capacity for transmitting instructions and decisions and at the final stage the actuators would require action (Meyer et al., 2018).

The smart components illustrate the developed and efficient functionality and performance through repeated use of building blocks and Nano electronic processes. There are a number of examples in smart systems, smart control system is one of the best examples of smart systems. A smart control system has an ability to take control over the services through the monitor and optimized building. There are lots of optimized building services namely occupancy related system, audiovisual, access control, CCTV (closed-circuit television), security, electrical plug loads, HVAC (Heating, ventilation, and air conditioning), lightning lighting and so on.



## **KM and intelligence**

From the earlier days of robotics and artificial intelligence in the 20th century, the technology has developed at a higher rate, the world is in a state that “the promises of science fiction are quickly becoming workaday realities”. The incontrovertible developments and growth in usage of smart technologies and robots, have led to outstanding privileges. Developments in Artificial Intelligence have undoubtedly formed unbelievable results. It’s now mean that, tasks once seen as incredible to systematize are now well within the empire of supercomputers’ competences. Robotic technology is just like other troublemaking technologies like Virtual Reality, Augmented Reality, 3 D printer and Internet of Things, etc., has transformed Knowledge Management service transport in the libraries in diverse patterns. At a distance from automatic information storing and recovery, KM have installed robots for both public services and internal operations. For example, there are Chatbots, telepresence, as well as autonomous shelf reading robots, humanoid robots for reference facilities and maintenance of movement in accounts of the library (Gessner, 2007).

Robots are perfect for monotonous tasks in the knowledge management and confirming that these tasks are efficient. Robotics specifically influences KM and the larger social and informational atmosphere in which libraries managers and KM of all categories work. The occurrence of robots in KM manage to pay for libraries managers’ sufficient time to emphasis on other important information service distribution to the lively needs of today’s clients or the readers. Some of the parts where ranging from “robotic technologies” have been functional to knowledge management operations comprising of locating and shelving knowledge management resources, inquiries, security and responding of repetitive orientation and outreach, directional queries and PR through knowledge management excursion, and even for data illiteracy training. Additionally, robots are beneficial for ASRSs (automated storage and retrieval systems) which have facilitated in the zone of knowledge space management. By means of robots, numerous knowledge management user self-services are conceivable (Alma et al., 2014).

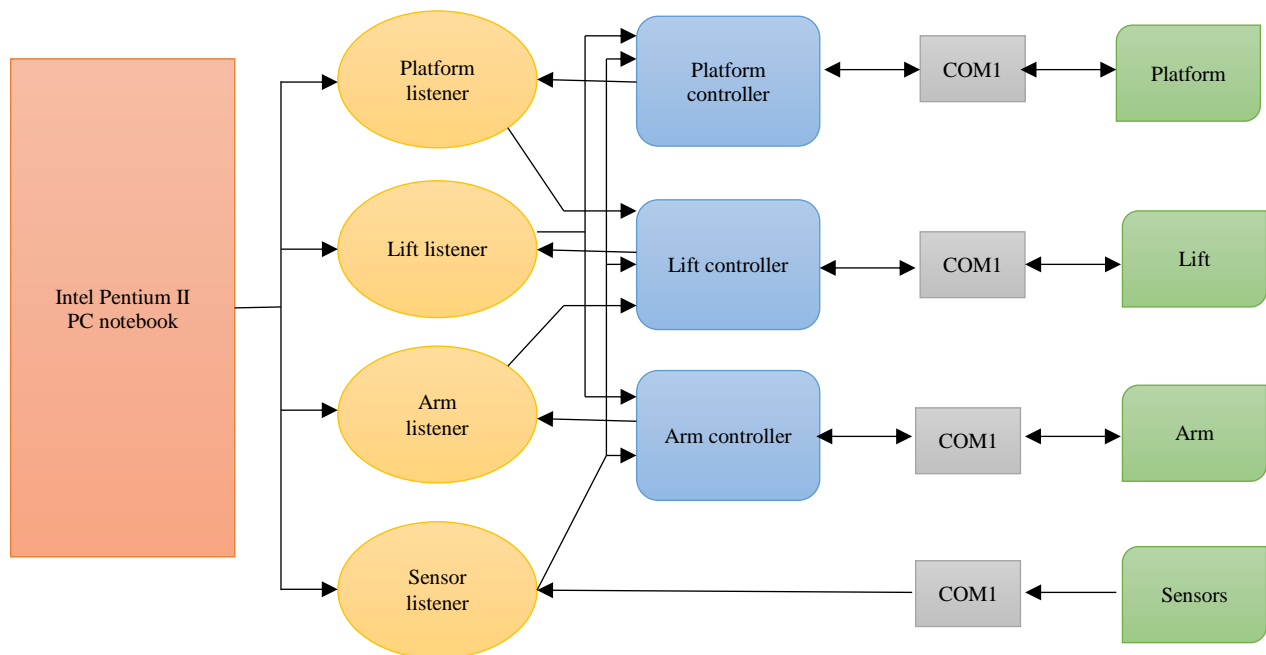
Robots can independently self-navigate and scan shelves through libraries even at night, scan Radio Frequency Identification (RFID) tags in books and provides information on books that are miss shelved or missing. Correspondingly, KM make use of robots to bring into line with their comforts in providing additional provision and outreach in Science, Technology Engineering, and Mathematics (STEM) education. Library maker spaces can manage a robotic club as well as train the children “how to code using robots?”. Robots are widely used in libraries for real-time searching of published material over a web interface. The client or the

reader will occupy the system, that in turn, will lead a robot that will recover the demanded article. The robot will distribute this article to other “robotic system” which will expose the article and turn the sheets mechanically and even lead scholars to the applicable records and can repossess newspapers from any date and time (Varadan, 2005).

**Robots**

The sector of robotics is mostly defined under the subset of artificial intelligence that is considered as motor task and perceptual task in a combination of machine learning. A robot can be defined as a machine which has the capability to carry out a complex sequence of procedures automatically, specifically one program by a computer (Zhuo et al., 2005). The robots are a mechanical device that can automate the tasks, these tasks are led by supervision of human beings or by predefined computer program and a set of instructions with the help of artificial intelligence techniques.

Figure 3. Block diagram of working of robots in knowledge management



Smart robotics is now not restricted to traditional sectors like manufacturing and computerization. As a technology, smart robot is present process a large alternate and is being organized for a numerous variety of programs throughout more than one industries like banking, logistics, agriculture, retail, and healthcare and even in Knowledge Management in libraries, amongst others. And the researchers and engineers are taking expansion of those enhancements to generate smart robots of the forthcoming generation.



Researchers have progressive “robot-picker” that “grasps” and “picks”. There is “an advanced a robot gadget which could would assist with this personal routine, in addition to help in different sorting and selecting tasks, from establishing merchandise in a warehouse for the clearance of the articles from a calamity zone.” They have advanced an “object-agnostic grasping algorithm” that allows the robots to evaluate a bin of arbitrary items and decide the excellent manner to suction or grip onto an object amongst the mess, while not having to recognize something approximately the item earlier than selecting it up.

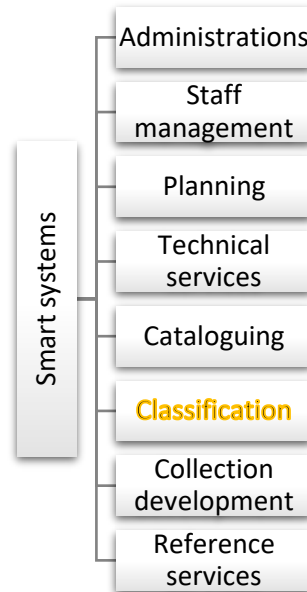
### **Role of smart systems in Knowledge Management in Libraries**

Smart systems have been used efficaciously in industrial and economic areas, and progressively they are being working in provision areas together with healthcare sector. In contradiction of this context, it is common that the LIS (library and information services) sector may also discover the possibilities of smart systems. Nowadays the technology can claim an extensive variety of application zones in the sector of LIS. Difficulties with accounting, staff, and preparation are just a few of the problems they experience every day (Mutambara & Litt, 1998).

Through the budget incisions, the manager must control what objects to cut and by how much? Should the number of staff be reduced? Should series be negated? Will there be any income to purchase records or apparatus? A smart system could be supporting in helping the administrator for making those decisions. An individual can create system which is composed of rules of thumb where the KM managers in libraries can make those decisions (Amin et al., 2017). While the staff management in hiring, promoting and placing, the smart system would help here and will be helpful during the recruitment process. With the help of some criteria such as qualifications of the experience and job.

A smart system can be created to determine that which staff members can be disciplined, receive raises and dismissals. In planning a smart system with the help of information from used material and patterns can help for remodeling the plan or to form new provisions. The smart system will support the administrator to identify the circulation desk location, the location where the copy machine is placed, the location of OPAC terminals, and so on. The focus of technical services is to develop smart applications to support the clients along with the service providers (Rai & Hong, 2013).

Figure 4. Smart systems in the KM



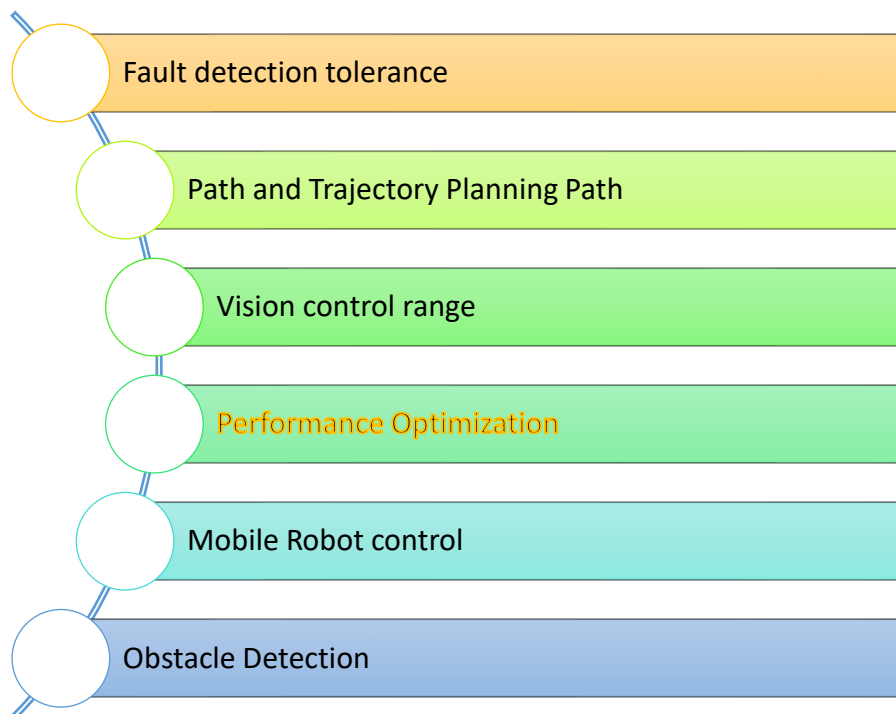
In this stage of cataloguing smart systems have been implemented to create Machine-Readable Cataloguing (MARC) record and implement some of the rules from Anglo-American Cataloguing Rules (AACR-2) for cataloguing. Once a researcher has developed a cataloguing smart system depending upon the role AACR-2, in which it was determined that the usefulness was incomplete because of the reason that the system has no interrupting rules. As a statement, For the employees the cataloguing problems are widely spread over the smart systems today. On the other hand, classification can also be considered as a crucial area for the smart systems.

At the same time there are references to identify the classification numbers and the headings of the subject, it is not mandatory to avail the rules, and the integration between classes and objects are unclear. There are many researchers in progress for the development of smart systems to help the class numbers and headings of the subjects. In the collection development, there exist two possible feedbacks, yes or no that is the acquisition are new materials or old materials for removal. It makes easier to develop the smart systems (European Commission ICT Work Programme 2007-08). The applied physics knowledge management had a successful attempt in building the smart system for collection development. “Reference Services Smart systems” would be beneficial for supporting clients in positioning information and materials. Smart systems might prompt the handler for the kind of information required and demonstrate the resources that might comprehend it.

### Applications of expert systems and robots

The expert system performs as an additional for human experts vile every situations and its actions are meant to be stored in the database so bad no one can hamper the overall efficiency of the organization. The expert system plays a vital role in robotics. It has been used by number of researchers in robotic applications like Fault detection tolerance, Path and Trajectory Planning Path, Vision control range, Performance Optimization, Mobile Robot control, Decision Migration in Distributed Robot, Obstacle Detection, Robot Designing and Kinematic and Welding Robot Control. Following figure illustrates such applications (Kishore & Thomas, 2016).

Figure 5. Applications of expert systems and robots



Fault Detection and Tolerance is the capability of a “robotic system” to be accomplished of sensing failures inside the organization or enterprise and to be capable to endure failures so with the external along with internal failures and remain carrying out all the obligation works deprived of in least human involvement. In a paper two researchers have developed and presented a “prototype” based on an expert systems for failures and faults finding in a robotic system (Salunkhe et al., 2016). They found a new method for combining this robotics with application area. Using expert systems was very supportive for planning “failure mode analysis”, to repair and detect errors, to reconfigure and tolerate failures in one framework.

Path and Trajectory Planning Path planning is the approach to predetermine and observe the route to attain aim function from its preliminary role without hitting any obstacle. There is a method to govern movement of a cellular robot using incorporated expert system and artificial neural network (ANN). This method includes modules: low level and high level. In the high level module, there may be a planner that's used to generate a motion plan and a direction finder that produces a route and the motion observe primarily based totally on a map. In the low level module, there may be a pilot who reveals behaviours: One is to keep away from obstacles and other is to attain the configuration (Giarratano & Riley, 2004). The expert system is applied to layout the navigator and planner, while the artificial neural network is used to enforce pilot module. And later designed a well-organized fuzzy expert system to govern robot's trajectory traversal through training it regulates thru an "adaptive neuro-fuzzy device".

Two people proposed a version for making plans and manage in cellular robot which designates that how a behavioural device is managed through a "rule-based expert system". To layout expert system, c language interface production system developed by NASA or CLIP is used. Later evolved, an expert system-based tele-operated cellular robots using ultrasonic sensors to enhance overall performance of robots in tele-operation applications. Primarily, expert system translates records the usage of joystick then the sensors to discover risky situations after which endorse secure path of motion to complete responsibilities rapidly (Grafflin et al., 2014). Vision control range estimation is to decide variety records for omnidirectional vision system in robots.

Researchers presented a fuzzy expert system for variety estimation. This expert system is constructed to appropriately estimate variety and role in an independent cellular robot. In this paper, new set of rules symmetry feature point extraction (SFP) is evolved which detects symmetry factors from a virtual picture. An omnidirectional system is used for you to capture the surroundings of the robot. A sophisticated expert systems technique which changed into capable of capture pictures, accurate it, and additionally reconfigure it to carry out programs with inside the discipline of stereo vision. Here, expert system is capable of regulate picture depth with different pictures with the aid of using automatically matching their histograms (Akhras, 2000). Expert system additionally reveals utility for self-sufficient direction finding of robots in business enterprises.

The performance optimization is designed and presented an expert system based control system to improve the transient operation of the robot. The total structure was proposed by them which consist of super laser based expert system that can enhance and optimize the efficiency and working of the robot. The mobile robot control provides step by step expert system which

have the capability to control the robots in the unstructured layout or the environment automatically centralised on the exception handling model. A proposed taxonomy based robot control expert system which works on fuzzy reasoning for choosing the appropriate control algorithm (Dunstan, 2008). A solution was demonstrated as joint position and joint rate controls the problem of an operator with the help of inverse kinematics and forward kinematics with supervisory expert system.

The forward kinematics is developed to make use of quantity which was obtained through the traditional wind up feedback and supervised expert system to obtain the ideal goal. To validate and test the obtainable operators task, the inverse kinematics is applied to calculate the subspace, constrained and available workspace. A fuzzy logic based expert system method was implemented for the navigation (Mutambara & Litt, 1998). The technique was applied to integrate data from angular sensors and position to accurately estimate the title and gradient of robot. A robotics architecture based on expert system might control “service operation” of portable robots. In this type of expert systems, instructions are vocalized to portable robots in the state of “rule-based system” that takes theoretical dependence illustration to achieve the instructions and makes pathway trailing problem of a robot relaxed to apply. Obstacle avoidance and obstacle detection, direction finding controller approach for portable robots was established with the method working measured a robotic system centred transversely mixed architecture expert system taking into deliberation setting stage fuzzified obstacle data as well as data to work on “optimal navigation” through complication (Wiig, 1994). Later on, a CAD-based expert system for the connected “obstacle detection” using a laser sensor was also invented.

The great advantage of expert systems is to originate understanding and data from the figures and facts which was obtained from human exports and other various sources like Internet. The trademark of expert system is to illustrate the statement or to make decisions to make decisions based on the gained resources. Expert systems have offline and online memory capacities that permits just study from the current cases and situations in the industries or the area based information and evidences for that the expert system would act as empty storage media to accommodate the knowledge and facts about the scenario. Expert system identifies the application in the robotics as it is provided from intangible and the tangible advantages of the organizations by decreasing the effort and time on finding the solution for the problem.

**Smart systems in raising the performance of KM in libraries based on the use of expert system and robots**

Any steady implementation of smart systems in the everyday lives does not come without demanding situations. One of the largest of those pertains to the huge quantity of various additives, enhanced and produced in various technology and sources. The number one goal is at the layout and production of latest services and products for programs which can be both specialised or aimed towards mass consumption. This integration of the useful and technical capabilities via mixture of various additives is stated as "smart systems integration". The time period defines the task of incorporating distinct technology, component, and substances into single interoperable system. Emerging smart systems consequently calls for compounding interdisciplinary solution and understanding. Therefore, demanding situations rise up in phrases of the equipment, skills, and tools had to investigate, manufacture and design incorporated smart systems (Edward, 1983).

There is various contribution from many research persons such as artificial intelligence in knowledge management or knowledge management automation, intelligent use of knowledge management, smart knowledge management, management information system, web content management system, electronic knowledge management, terminology registries, grid based knowledge acquisition approach add lot more. Other than these applications, online public access catalogue allows the user do search, retrieve the catalogue, on the basis of knowledge management software it proposes general framework to develop the movement of the knowledge management or to record the dynamic movement primitive's knowledge management from the unknown environment. Artificial intelligence or automation in knowledge management in libraries, provide the service to explore and focus on the working of knowledge management and automation of human work particularly it focuses on the future.

The most common innovative knowledge management is electronic knowledge management, it provides content of the knowledge management data, in the smart KM the robots are will behave like a KM manager, the robot will be working in a real knowledge management environment focusing on the major technologies and it would grow the recent technical talents. The electronic knowledge management provides context aware learning, and rule based metadata interoperation that is the electronic knowledge management will contain data about each and every record.



## LITERATURE REVIEW

The smart system is an incorporated computerized production device which mechanizes an extensive variety of creation procedures, together with the welding and erection of laying of concrete ground planks, metal frames, set up of outside and indoors wall boards, and the set-up of numerous different devices below its year-round protection cover. Over its application, a comfortable and secure operation site, unaffected via way of means of terrible weather, turned into a discount in labour prerequisite, removal of dangerous works and a discount in material waste. In the year of 2017 researcher named Philips, has put forward the idea of knowledge management automation and implementing artificial intelligence in libraries (Bombieri et al., 2015). The development of robots and artificial intelligence brought a greater potential in the applications which provide knowledge management services. This features explores the effects of automation of human work, this especially aims to the future of artificial intelligence and robotics and the impact of search services in the future. Asemi contributed MIS (Management Information System) in the year of 2012. This application was supportive tool for the KM to operate organized, this application can also provide suitable detailed reports in a consistent, timely and accurate manner. Before this management information system there was web content management system which was arrived in the year of 2011, this provides a large distributed content model which shares the content trial, that effectively includes the feedback of the technical experts.

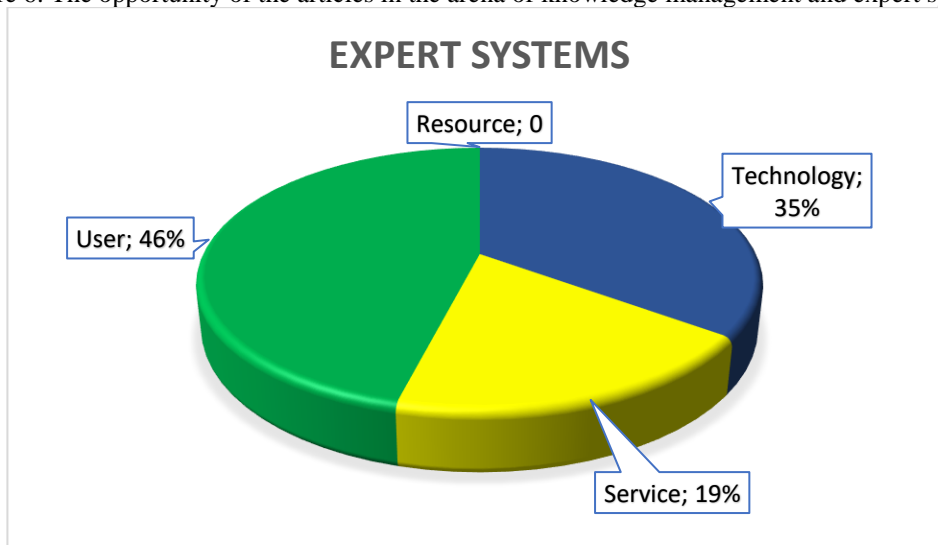
Such application has brought many advantages for KM in libraries such as supporting mastering actions carried out in global environments, provision of querying throughout allotted virtual KM formed in assorted metadata schemes, without needing the supply of a worldwide scheme, deliver the content material of KOS (knowledge organization systems) to be had each for human and system get access to, creating the robots like a KM managers in libraries , giving awareness on key technology to take robots into the actual knowledge management environment, and domesticate applicable technical capabilities, helping college students, research scholars to arrange and proportion understanding for distinguishing a hard and fast of mastering objectives primarily based totally on what they've located within the discipline (Strategy Paper “Smart Systems for the Full Electric Vehicle”, 2008). Automation Automating Reference, Storage, Technical Services, Circulation desk etc. Supporting information-seeking behaviour of novice researchers by specific research tools Providers users with personalized information and knowledge services Allowing a user to search online and retrieve records/catalogue and depending on the underlying knowledge management software/online reservation, circulation and so on (Wadhawan, 2005).

## RESEARCH METHODOLOGY

Contented and Expressive review approaches are implemented to the research. The investigators significantly studied the materials associated to robots and expert systems in the reference knowledge management in libraries (Dunstan, 2008). Consulting to this evaluation, the application of robots and expert systems categorised as the following:

- **Technology:** The materials evaluated and measured the data management systems in the knowledge management or in the electronic knowledge management fit in to this cluster. These materials relay to implementation and usability. They do not recommend or recommend an information model or system.
- **Service:** The materials in this cluster have planned an expert system or related methods and strategies that can be included and associated in expert system to provide technical or public facilities. The public facilities provided to users to accomplish their technical services and information needs existing to the professional user or KM managers any in knowledge management actions.
- **User:** Prevailing knowledge systems and information are typically at work depending upon the estimation of users and experts behaviour. Consequently, implementing expert system knowledge such as implication engine and rule or fact base will expand the accuracy and performance of measured structures.
- **Resource:** These materials related to “information resources”. This grouping might contain the use, selection and acquisition of “information resources” (Grafflin et al., 2014).

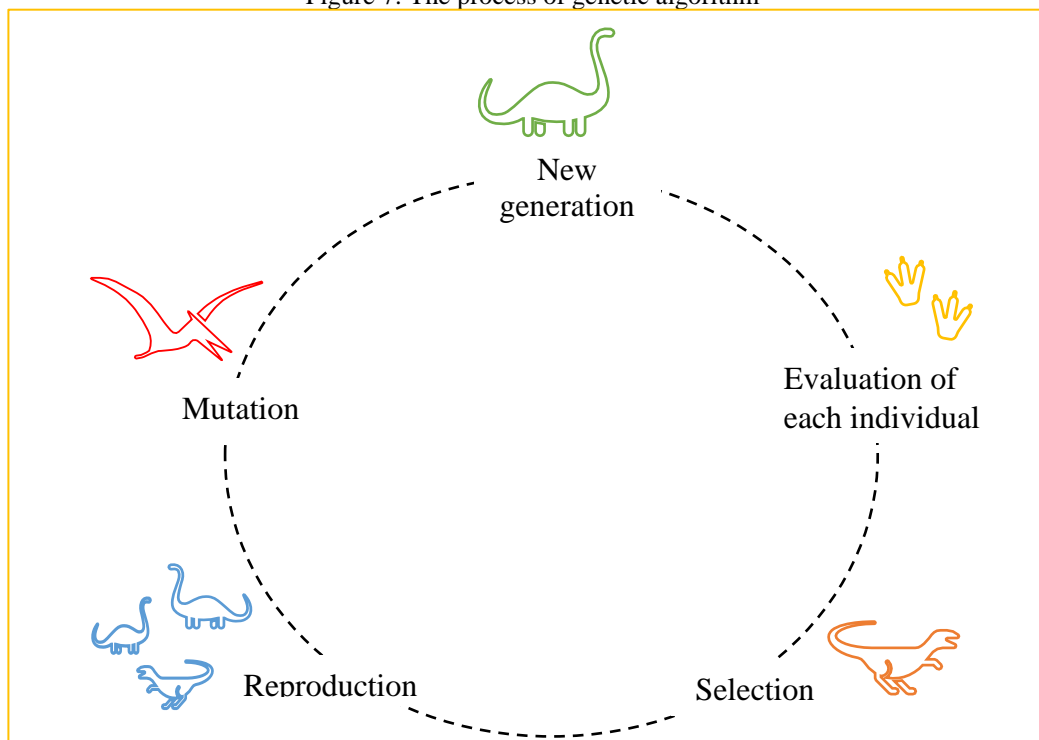
Figure 6. The opportunity of the articles in the arena of knowledge management and expert systems



## Used Algorithm

Genetic algorithm can enhance the KM manager's robots in libraries to bring better impact on mental patterns of human beings. Here the genetic algorithm is necessary because a library without a reader is like a data without a use. That is knowledge management might have a large collection, but if it doesn't have readers then the knowledge management is useless, so first of all the KM managers must find out their consumers that is readers, to find their interest they need some smart systems and algorithms (Omran et al., 2005). The genetic algorithm is a machine learning algorithm in which the service providers can find out the interest and the categories of the readers and also, they can have a foresight of an upcoming trend too. The following figure would give a brief on the genetic algorithm.

Figure 7. The process of genetic algorithm



Genetic algorithms are a sort of optimization procedure, which means they're used to discover the most beneficial resolution to a certain computational hassle that minimizes or maximizes a selected function. Genetic algorithms constitute one department of the sector of observation known as “evolutionary computation”, in that they reproduce the organic techniques of natural selection and reproduction to resolve for the ‘fittest’ resolutions. Corresponding in evolution, a lot of a genetic algorithm’s strategies are arbitrary, though this optimization method permits one to set the extent of control and the extent of making random. These procedures are far greater effective and well-organized than arbitrary examination and

exhaustive search algorithms, but need no more records around the specified hassle. This function lets in them to discover resolutions to issues that various optimization techniques can't deal with because of a loss of derivatives, linearity, continuity, or other features (Zhuo et al., 2005).

The mathematical formula of genetic algorithm are as follows:

$$F_p = \frac{F_i}{\sum_{i=1}^{n=6} F_i}$$

Where,  $F_p$  denotes the fitness probability and  $F_i$  denotes fitness value.

### Advantage of used algorithm

- Genetic algorithm has a good efficiency while working with mixed continuous and discrete problem.
- It uses objective function information.
- It can support multi objective optimization.
- It works well on noisy environments.
- It can perform on various representation.
- The genetic algorithm implements probabilistic transition rules.
- It is easier to understand.

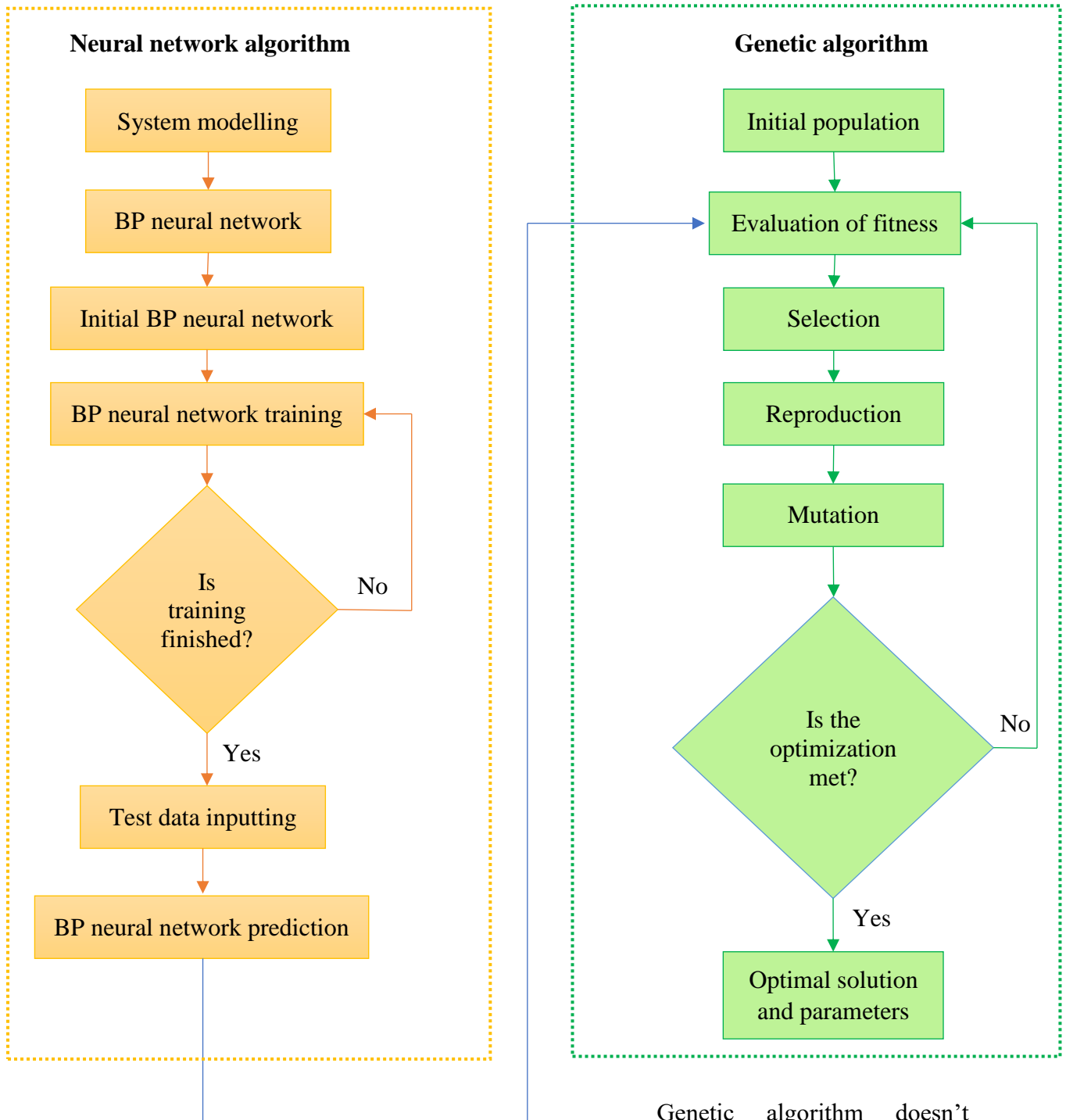
### Comparison of algorithm with other methodology

Genetic algorithms generally accomplish best on “discrete data”, while neural networks typically execute proficiently on “continuous data”. Genetic algorithms can prepare new patterns, although neural networks implement training data to categorize a network. Initially, a genetic algorithm is “search-based optimization” algorithm applied to discover near-optimal or optimal resolutions for optimization problems and search problems (ECSEL, 2015).

On the other hand, Neural networks are mathematical representations that chart amongst complex outputs and inputs. They can categorize data that are not formerly recognized. Genetic algorithms service the impression of natural selection and genetics to deliver resolutions to complications. These algorithms have improved intellect than arbitrary search algorithm since they use historic data to take the quest to the top execution region in the resolution area. Genetic algorithms are normally taken to produce first-rate resolutions to search and optimization

complications by depend on “bio-inspired” operatives such as selection, reproduction and mutation (Morales & Savage, 1994).

Figure 8. Comparison of neural network algorithm and genetic algorithm



Genetic algorithm doesn't continuously necessitate derived information to resolve an issue. It also computes the fitness function frequently to get a respectable resolution. That's why it takes a countable volume of

time to compute an explainable resolution. Neural networks accept considerably a smaller amount of time for the cataloguing of new input.

### Implementation

The implementation part in a program or research evaluates the program reasonably and to study what the program features are essential in providing intended results. It also involves the process of putting the research inputs and research results into the real time practice. The plan for implementation is addressed as a work plan which conducts the research completely. Without implementation fees the research remains incomplete and becomes the theoretical proof, the implementation is the process where the research put into action (Mutambara & Litt, 1998). The table – 1 contains the data points used in the analysis.

Table 1. Publisher and number of books

Publisher	HarperCollins Publishers	1,700
29th Street Press	Houghton Mifflin	672
AA Publishing	Jove Books	1,553
Ace Books	Leisure Books	1,099
Alfred A. Knopf	New Amer Library (Mm)	676
Alyson Publications	Oxford University Press	1,503
Avon	Penguin Books	2,844
Ballantine Books	Penguin USA	2,717
Bantam	Perennial	1,257
Bantam Books	Pocket	3,905
Bantam Dell Pub Group	Puffin Books	1,081
Berkley Publishing Gro..	Random House Inc	2,045
Dell Publishing Compa..	Scholastic	3,177
Dover Publications	Signet Book	2,070
Fawcett Books	Silhouette	4,220
Goldencraft	Simon & Schuster	2,971
Goldmann	St Martins Pr	1,953
Harcourt	St. Martin's Press	1,783
Harlequin	Tor Books	1,704
Harper Mass Market Pa..	Vintage Books USA	1,538
Harpercollins	Warner Books	2,727
HarperCollins Publishers	Zebra Books	1,694

The table contains two different attributes of the books. This provides an overview of the publisher and the count of their books. That is, it will produce number of books or articles published by each publisher. According to the given table the least number of counts is obtained by two publishers; 29<sup>th</sup> street pass and AA publishing. And the maximum number of books are published by Harlequin – 7536 books which is a huge number among them. This is not a way

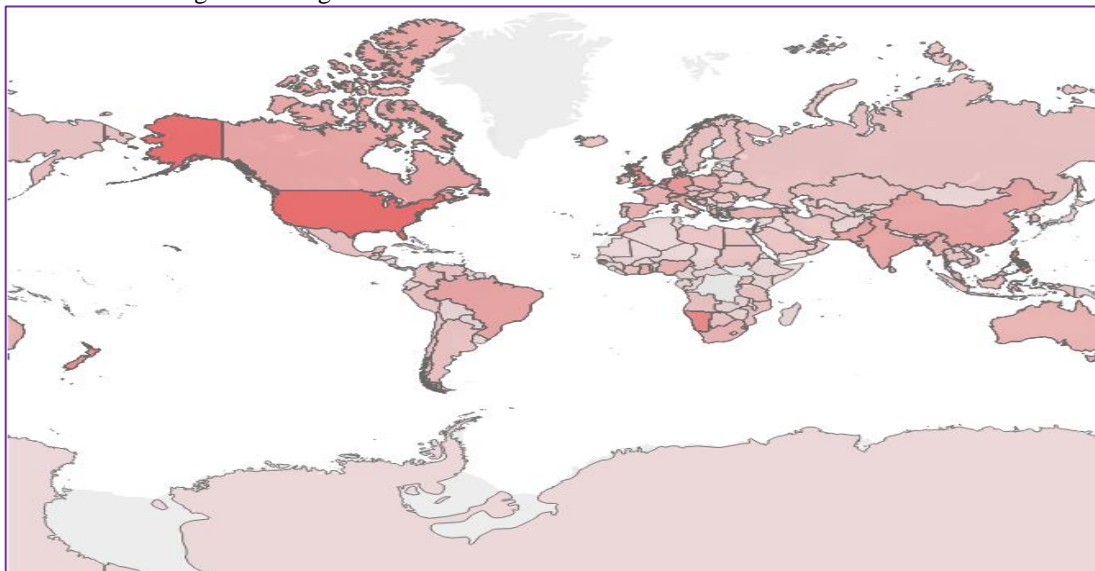


how a library would contain the list of books, but it is a possible table existing in the database of an electronic library or e-library (Amin et al., 2017).

## RESULTS

This section of research contains the greatest number of figures and charts. The conclusion or the results, plays a vital role in a study. In this study the result contains the findings of the complete study and the analysis. The analysis is represented in the form of charts, diagrams, maps and so on. In this research paper, there are four different world map and three other charts (Meyer et al., 2009).

Figure 9. Longitudinal and latitudinal view of readers around the world



This map illustrates the readers around the world, the map contains the continents where some part of them is shaded darker and some are lighter. The darker portions describe that those countries possess larger number of readers as compared to other countries or other regions. USA and Namibia are the areas with large number of readers, but almost all nations are having library users still the hierarchy moves like USA, Namibia, Canada, Brazil, China, India, Pakistan, Australia and even so, Mongolia, South Sudan, Greenland (Khattak et al., 2016).

Figure 10. The countries using expert systems

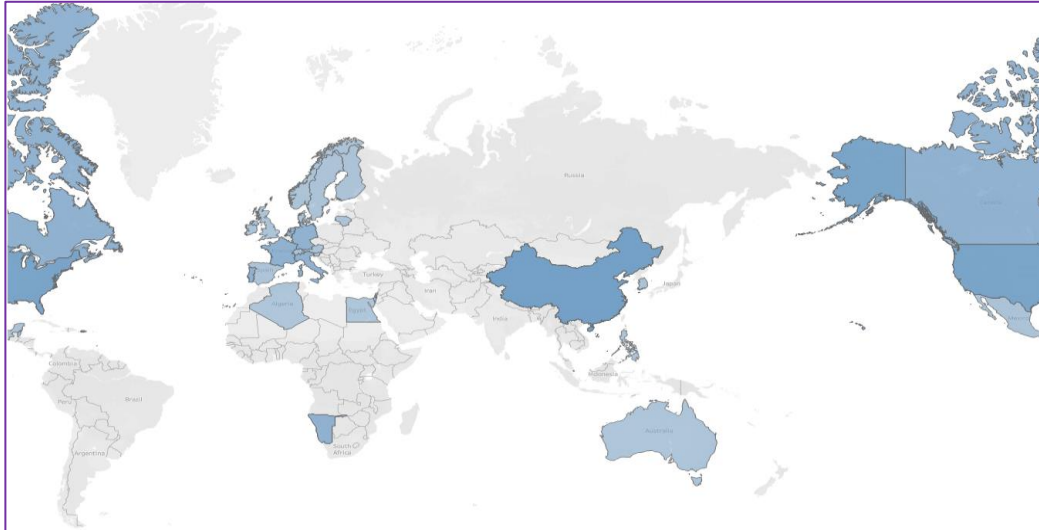
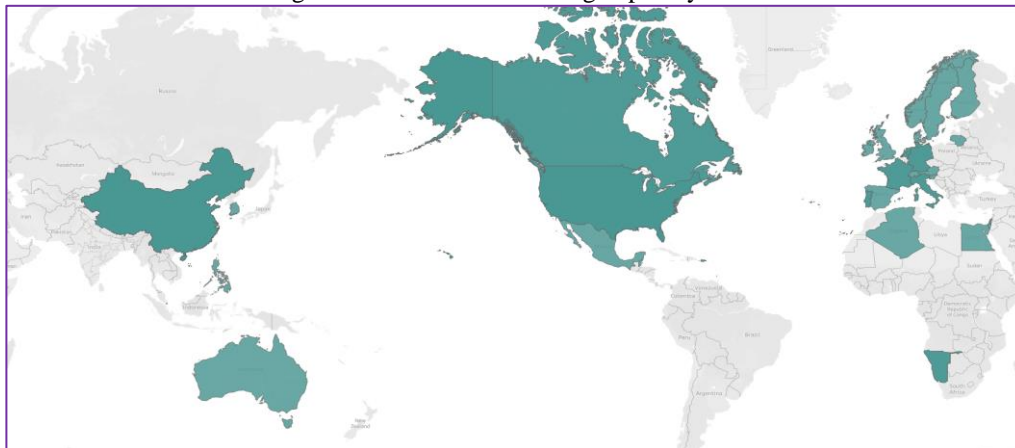


Figure 11. The countries using expert systems



The Figure 9 and 10 illustrates the map of regions where these smart systems are implemented in the KM in libraries. In one glance an individual can identify the regions which are most using the smart systems, in Figure 9 the China and some regions of North America are widely using this is system because those areas are having doc shaded blue. On the other hand, figure 11 contains the same but just changed the color shade for deeper look (Kishan et al., 2012).

Figure 12. Longitudinal and latitudinal view of regions; each region is shaded different

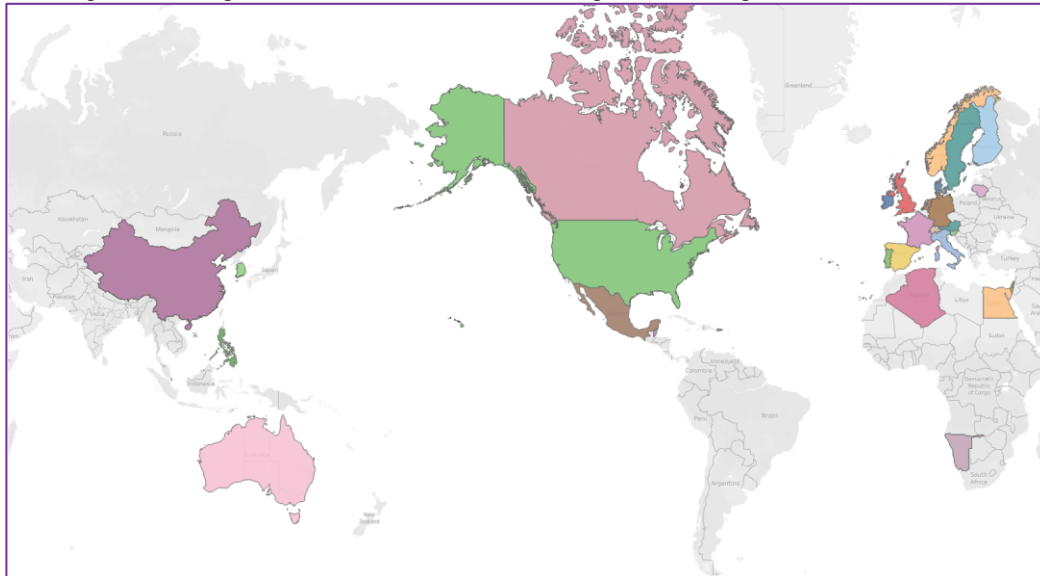
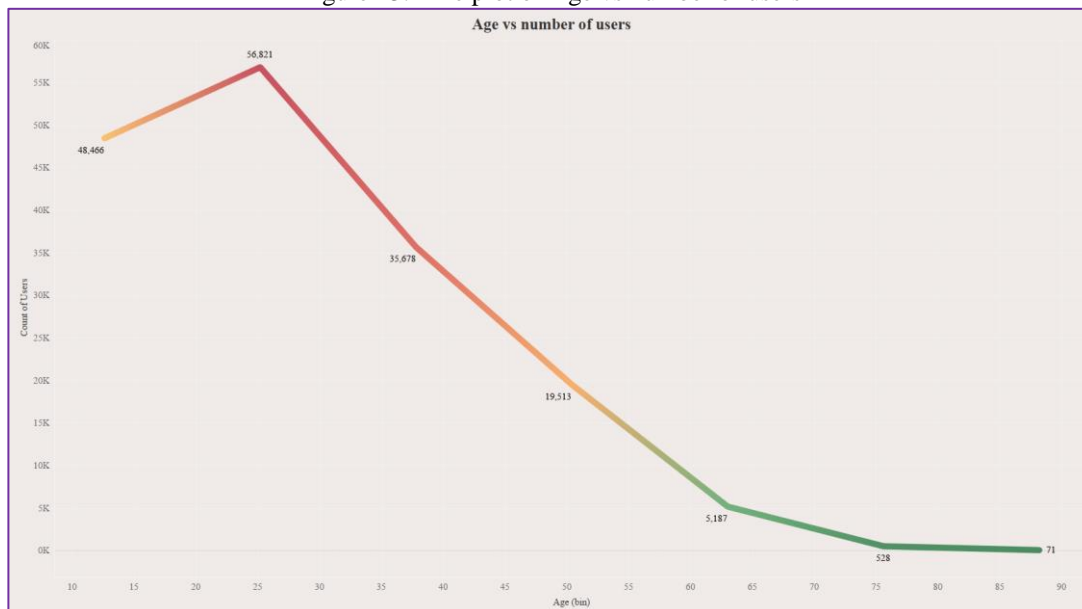


Figure 13. Line plot of Age vs number of users



The age group is plotted on the X axis and the number of users or the readers are plotted on the Y axis. The least number of readers comes under the age group of 60 and 90. The peak number of readers are from the age group of 20 to 25 that region is shaded in red colour while other regions are varying as yellow and green colour (Salunkhe et al., 2016). The peak value is 56,821 and the lowest value is 71 which is obtained by the age of 88. The moderate number of readers are from the age group of 30 to 50 they are shaded dark orange in color. According to the plot, the red color contains extrem value and green contain minimal value similarly the between values are shaded in orange colour (Gessner, 2013).



countries like Canada, UK, Germany, Australia, Italy, France will improve their systems (Internet-of-Things in 2020 – A roadmap for the future, 2008).

## **DISCUSSION**

Integration of expert systems with robots is a step in the direction of Knowledge Management automation in library that's the need of the period. expert systems give smooth and general solution of the trouble through considering all of the elements of the trouble and takes vital movement as that of the human professional (Varadan, 2005). Implementation of expert systems is likewise vital due to the fact formerly applied tools and strategies had been costly and wanted greater time to expand and extra assets for data garage and handing even when it is simple to software expert systems each online and offline. In the discussion, the results produced using the genetic algorithm conveys that the export systems can do lot more in KM (Liao, 2004).

For an example let it be a site of library website of library, if the person or the owner wants to improve the number of visitors on the site then he must have a proper analysis of the books, authors, ratings, age group demands, kinds and categories of the books, the size of the book etc., enrolls as a vital component in enhancement of the library working (Meijer et al., 1991).

To enhance the library there are some important analysis has been performed such as:

- Identifying the weak area where the KM are not in use
- Finding the authors whose articles have more demand
- Categorising the strategies according to the age group
- Analysing the region where the smart systems implementation is limited.

## **CONCLUSION AND FUTURE WORKS**

Expert systems additionally are afflicted by positive obstacles and gaps that are to be considered earlier than imposing them for any software area. Expert systems be afflicted by the hassle of challenge of generation due to the fact that the preliminary setup is expensive and complex, there are a few troubles with understanding acquisition even as feeding facts into its database as all of the facts must be arrived and any corrupt or loss report will provide misguided result (Giarratano & Riley, 2004). Although expert systems serve to be an alternative of a human professional, it can't update human beings due to the fact human knowledge is vital for it to run easily and for an extended length with consistency (Gardone & Ragade, 1990).

The following questions can be sorted in future analysis, which can be added in future with more effective algorithm and large dataset.

- What are the types of strategies for particular age group?
- Which is the favourite font style and size?
- What kind of strategies would have a greater demand in future?
- Which sector uses more strategies? And what kind of strategies?
- Which algorithm is the best in next generation?

These days, advances in virtual generation and new communication have essential suggestions for smart systems in Knowledge Management combinations, taking into consideration new competencies with the aid of using associating the space among products and additives (European Commission ICT Work Programme 2007-08). The intention must be the improvement of competitive “eco-system” of smart incorporated structures, to come to be constructing blocks of the virtual Knowledge economy (Kishore & Thomas, 2016).

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