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A STUDY OF VARIOUS TECHNOLOGY FRONTIERS USED FOR CREATING SMART FORESTS AND IMPACT ON INDIAN TOURISM SECTOR

Prof. Madhavi Shamkuwar[1] and Dr. Aniruddha Joshi[2]
[1]Assistant Professor, Zeal Education Society's, ZIBACAR, Narhe, Pune , India.
[2] Assistant Professor , PUMBA, Department of Manageemnt sciences , Savitribai Phule Pune University , Pune, India.

ABSTRACT:
        Tourism is one of the emerging and evolving sector in India. A major amount is contributed by Indian and world tourism. From this amount, there is a significant contribution for the wildlife tourism apart from other types of tourism. The wildlife tourism is a sector which involves number of business sectors including logistics, hotels, infrastructure, supply chain management, IT devices and equipment's are on boom. The government policies pertaining to tourism and support from other related and non-related sectors. The present study would enable to identify, recognize and discuss prospectus of the Indian wildlife tourism and contribution to the nation socio-economic as well as technology development. The opportunities for entrepreneurship and technology innovations are ample, the effective utilization of both of them will give new horizon of this emerging wildlife

KEYWORDS: Wireless Sensor Network, Internet of Things, Drones, Tourism, Wildlife monitoring.

INTRODUCTION

        Mankind had evolved to greater extend from the stone-age to the current technology age. Extensive use of technology in research is done to support humankind and make him more and more powerful and give him comfort, satisfaction, happiness. Wildlife tourism has contributed positively to development of the wildlife and generated revenue. In agri-tourism, the agricultural land and related products are the attention seeker. Plants being the prime source of energy they are too supported by technology in development of agriculture and horticulture. However, animals especially wild animals are the most neglected part of the eco-system. They are being killed for various purposes in rituals, food, medicines, smuggling etc. Thus, the revenue generated both for legal and illegal animal products is enough. Due to large profit in this money making business, earth is facing being biggest mass extinction and this time reason it is not nature but greed

of human beings. The world is witnessing the harsh implications of such decisions in form of imbalanced ecosystem in form of lower sustainability and lower productivity of every individual species on this planet. The business when combined with Technology has proven as a savior for all the organisms found on this earth viz human beings, plants and animals. If earth is chariot, then the Technology is the fast moving wheels of it. Initially, the term wild involved all those animals which are undomesticated in nature, but later, it was it involved fungi and plants which are more found in forests than human habitats. The wildlife needs

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to be conserved to save future generations of human beings. The sad part is that such wild animals need to be conserved by WILD mankind with use of TECHNOLOGY which is domesticated in nature. New technology frontiers must be invented so as to have a close track of wildlife and devise mechanism for conserving them. Unfortunately, though the technology is evolved but animals are not benefitted by it, instead with its use they are being targeted. The greater challenge is the in the thought process of every individual. For human beings, its "society", for wildlife, its "forests", when the terminology will change, that day there will be Wildlife revolution. Wildlife tourism have the potential to conserve the wildlife and contribute to the economy at one instant. The sector is mutli-segment which caters needs of various sectors and is consumes the services and products. However, the industry is quiet criticized when as the growth of animals is hampered by creating disturbance during breeding period, juvenile deaths, change in mating behaviours. Inspite of the several problems faced by this sector still due to tourists from distant places this sectors remains centre of attraction.

　　　Keywords: Wireless Sensor Network, Drones etc. The tourism contribution depends on the quality and the revenues of the offered by the tourism industry. Their is a significant growth in the International tourist arrivals rate to 4.6 % in 2015 to 1,184 million[1]. As per World Travel & Tourism Council (WTTC), India ranks seventh in the growth of country's GDP growth. In 2016, India tourism department generated INR14.1 trillion which is appropriately 9.6% of India's GDP. Apart from this a total of 40.3 million jobs were generated leading India at second rank in terms of tourism employment which is 9.3% of total employment. The major revenue is generated by the domestic travelling which contributes to 88% of sector revenue generated. In 2016, 9 million international tourists visits India, leading to a conclusion that more foreign visitors can be attracted to the Indian tourism sector. David Scowsill, President & CEO, WTTC, already there are number of initiatives such visa facilitation, development in infrastructure, is allows to the business development and contribute to the *tourism industry.[2]*

OBJECTIVES
1. To study various concepts, challenges and issues related to wildlife management
2. To give technology solutions to the wildlife management problems.
3. To project wildlife management for the development of techno-entrepreneurial society.

WILDLIFE: DEFINITION AND TYPES
　　　The prominence of wildlife management is same across geographies in the level of social, economic and financial development. There is large variance in the structure of eco system, stake holding in wild life management, behavior characteristics of the endangered species segments and also the context of recognition of the problem by the forests authorities and governments.

　　　The conventional definition of wildlife includes undomesticated animals but now the definition is quiet extended to include plants, fungi and other living organisms. In 2012[3], International Union for Conservation of Nature (IUCN) had declared a list termed as "Red List, which categorizes the species into nine types:

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Figure 1.1: Categories of species
(Ref: International Union for Conservation of Nature (IUCN)
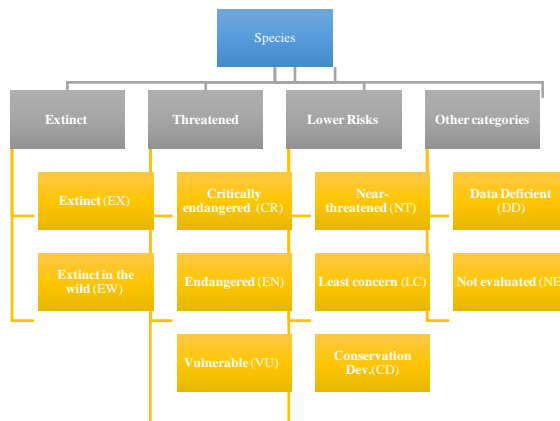
IUCN is an international organization working for the nature conservation and towards optimum use of natural resources.

TABLE I.　　TABLE STYLES

Category	Description	Number of species
LC	Involves those species who did not have immediate threat on their existence.	39385
NT	Involves those species who will face threat on their existence in the near future.	5445
VU	Involves those species which faces medium risk of endangerment in the near future.	11010
EN	Involves those species which has high risk of endangerment in the near future.	7597
CR	Involves those species which has high risk of extinction in the near future.	5101
EW	Involves those species which are Captive individuals survive, but do not exists in natural population	68
EX	Involves those species having no living members	844

WILDLIFE MANAGEMENT

Wildlife management covers a broad spectrum of basic and applied research and is applicable in the areas of ecology, management, education, takes help of the available science and includes game keeping, wildlife conservation and pest control[4]. The following ecological principles are taken into consideration:

i. carrying capacity of the habitat,
ii. preservation and control of habitat,
iii. reforestation, predator control,
iv. re-introduction of extinct species,
v. capture and reallocation of abundant species
vi. management of "desirable" or "undesirable" species.

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The Wildlife Management program focuses on the following:

Wildlife Conservation: Indian View
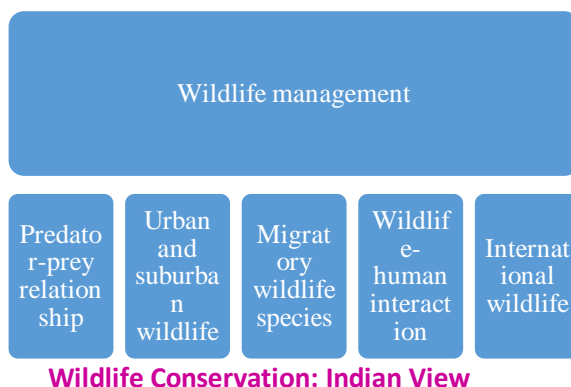
India is popular for its unity in diversity in its geographical dimension. The great heritage and culture are the reasons for gaining popularity and attract tourists from entire world. Wildlife conservation is an imperative priority of the Government of India. The objective of wildlife conservation in India is to extend manage the wildlife and provide conservation services to the large hitherto un-served animal population to unlock its growth potential. Moreover, objective strives towards a ban on various non-human activities in order to protect the wildlife from human intervention in natural resources.

To protect its wildlife, various acts have been passed from the British era to the current era. The protection act along with its brief description is given below:

Year	Act	Amendments
1927	Indian Forest Act	Focuses to regulate movement and transit of forest produce, and duty leviable on forest produce, the procedure to be followed for declaring an area to be a specified type of forests (Reserved, Protected or a Village Forest)
1972	Wild-life Act	Focuses on effectively controlling poaching and illegal trade in wildlife and its derivatives. The punishments and penalties are made more stringent.
1986	Environment Act	Focuses on the protection and improvement of environment and for matters connected with it along with improving the environment, controlling and abating environmental pollution.
2002	Biological Diversity Act	Focuses on the preservation of biological diversity and provides mechanism for equitable sharing of benefits arising out of the use of traditional biological resources and knowledge.
2006	Forest Rights Act	Focuses on giving ownership rights over forest land to traditional forest dwellers.

Amongst all these act, the INDIAN WILDLIFE (PROTECTION) ACT, 1972[5] is most important statute that provides a powerful legal framework for various concerns. The act is broadly divided into seven chapters covering the following

Chapter 1	Preliminary definitions
Chapter 2	Authorities appointed or constituted under the Act
Chapter 3	Hunting of Wild Animals: prohibitions, hunting and special permissions
Chapter 3A	Protection of Specified Plants: prohibitions, cultivation and possession by Government

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Chapter 4	Declaration of Sanctuaries, National Parks, Closed Areas, Game reserves
Chapter 5	Central Zoo Authority and Recognition of Zoos
Chapter 5A	Prohibition of Trade or Commerce in Trophies, Animal Articles, etc.
Chapter 6	Prevention and Detection of Offences
Chapter 7	Miscellaneous

The WLPA provides for several categories of Protected Areas/Reserves:

Objectives of wildlife management in India
Indian government is focusing on wildlife conservation rural and semi-rural areas basically for three most important pressing needs, as:
1. To prohibit unauthorised hunting of the wild animals: the law states that no person shall hunt any wild animal specified in Schedule, I, II, III and IV except dangerous to human life, property or is so disabled or disease(as provided under section 11 and 12. 1)
2. To protect and manage wildlife habitats
3. To establish various protected areas Sanctuaries, National Parks, Closed Areas, Game reserves
4. To regulate and control trade in parts and products derived from wildlife

Indian wildlife kingdom is nature's rich and diverse and stands as seventeenth megadiverse country and holds 4 bio-diverse hotspots among 35 hotspots in this globe[6]. In India, the species treasure houses are in following forms and numbers:

The four hotspots in India includes the Western Ghats, the Eastern Himalayas, Indo-Burma and Nicobar islands in Sunderland.

TECHNOLOGY-SAVIORS AND WARRIORS
Technological innovations are the key drivers to monitor, treasure and conserve wildlife. These innovations will help achieve the goal of saving the slowest moving snail to fastest moving Cheetah. Ofcourse, the type of technology applied and device design depends on animals, its types, environment and habitat. Thus technology is proving as savior for animals for their conservation and warriors for anti-animals elements. Following technologies are used to track behavior, enhance sustainability and boost wildlife growth.

WIRELESS SENSOR NETWORK
Few decades ago, Wireless Sensor Network was introduced in this evolving world of technology and due to its large application domain it proved that this technology believes "I am here to stay". WSN is an emerging and promising technology which is gives many applications a third eye as it can sense many physical, chemical and biological aspects of things around.
Wireless Sensor Networks is a low costs, energy efficient and highly accurate network of sensors which senses temperature, sound, light, pressure, physical, environmental conditions etc[7]. The low costs of WSN attract many entrepreneurs to implement WSN for wildlife management[8]. The sensors are self-sufficient, autonomous nodes responsible for storage, processing and communication with other nodes. Any

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node in WSN is categorized as either a sensor or a sink node, the sensor nodes are responsible to store, process and communicate the conditions to the sink node which further send to the user computer via Internet. A wireless sensor node is composed of a micro-controller, transceiver, timer, memory and analog to digital converter. The standard protocols available for WSN are IEEE 802.15.4 or IEEE 802.11 (Wi-Fi) standard[9].

Their multiple operating system designed and developed especially for WSN, they are Tiny OS[10], Contiki, MANTIS, Nano-RK[11], LiteOS etc. OS for WSN should possess fowling technical capabilities Architecture, Programming Model, Scheduling, Memory Management and Protection, Communication Protocols, Resource Sharing. The architecture of WSN should influence the size of kernel so that it can provide loading of one required application in the nodes. The two programming model supported by OS event driven programming and multithreaded programming. There are two types of scheduling algorithm for requirements and for non-real time requirements which should be memory and energy efficient. OS further provides static and dynamic memory management features responsible for multiple threading program execution. In order to communicate program communication, OS is supported by an Application Programming Interface (API) which handles heterogeneity in the node type. WSN composed of multiple resources such as processors, memories, timers, disks, mouse, keyboard, network interfaces, resource sharing and its management becomes a challenging feature[12]. The number of expected capabilities are numerous and to restrict these, there energy source is a hindrance[13]. Energy is a scarce resource in WSN, it can be charged and recharged but the performance time suffers a lot. Also, as long as approaching to network deployed in zone with is prone to animal attacks involves lot of risk. Hence, we should have mechanism to conserve energy so that the sensor node stays for a longer period of time.

The network topologies followed by WSN[14][15], belongs to any of three topologies: Star, cluster tree and mesh topology. In a star topology, each individual node is connected directly to the gateway node. In a cluster tree topology, a hierarchical structure is being followed and nodes are connected to their parent node. Mesh topology is more nodes using mesh link, this topology makes the network more robust and reliable, ensuring the data security and prolonged lifetime a data collected over a period of life. There is pool of topologies we can opt for designing and development of WSN, but several parameters needs to be considered which includes the network must have Load balancing algorithm, shortest path algorithm connecting source and destination, congestion free algorithms etc.

The applications of WSN include fire detection, weather prediction, military application, transportation applications, industrial process monitoring etc. WSN can be effectively deployed in forests and wildlife can be easily monitored and conserved. The sensors are responsible to collect physical factors affecting wildlife such as temperature of forests, water quality, humidity, moisturizer, and track wildlife behavior. It further helps understand the behaviors of animal with the surrounding, the driving force for the physical movement, understand their mobility pattern and conserve them as against to conflict with human beings, physical infrastructure and conflict among animals.

Inspite of the greater advantage of using WSN in habitat monitoring the challenges include deployment of sensor nodes in remote forests regions, power consumption of sensor nodes, the integration of nodes, hierarchical organization of the nodes to be implemented, operating system functions, real-time monitoring etc. The database thus collected over a period of time will be eventually mined and proper decisions regarding wildlife conservation will be taken. Such data will give new directions in wildlife management. By taking into consideration the quality and quantity of data generated is of significant use for the wildlife monitoring programs all over the world.

INTERNET OF THINGS(IOT)

The 3 alphabets i.e. IoT, is the technology here to stay for 3 decades and more. Internet of Things (IoT) is the hottest buzzword spanning the business sector and technology world. Big data as a new technology frontier for business in diverse sectors and help to predict the next move of the probes under research so as to implement smarter business moves, improve productivity, improve performance and plan

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strategy more effectively[16]. IoT is a network of physical Things[17], apart from regular desktop, workstations, laptop. The IoT, term "things" refer to all those electronic devices which can be connected with each other. These Things share multiple information with each other, depending on its applications. IoT facilitates the machine-to-machine communication by collection of uniquely identifiable objects which are heterogeneous in nature. IoT requires for operating systems of various devices which are Zigbee and 6lowPAN (IEEE 802.15.4), Bluetooth and Wi-Fi[18]. IoT are equipped with cloud based technology so that the apps can be used anytime , anywhere.

As an analogy, IoT resembles a tree whose root extend to communication protocols viz lowpan, Zigbee, IPv6 and device technologies viz sensors, actuators, RFID tags[19]. The fruit are in form of various smart applications Smart health care solutions, Smart cities, Smart water management system, Smart houses and Smart transports. The trunk of the tree depicts Architectural Reference Model which includes Reference Model + Reference Architecture[20].

IoT when successfully implemented will serve many purposes such as location tracing, environment surveillance, and predicting behavior based on previous stored data[21]. The world is growing smarter, from smarter mobile to smart cities and hence the new success mantra is Smart jungles. This concept when used animals will supervised uninterruptly and as without disturbing their behavior unlike use of drones which influences negatively, which may even directly or indirectly harm the animals and their behavior. IoT will help achieve following things:

1. The cyber infrastructure will help to monitor large geographical spanning sites and suitable alerts will be generated for the stakeholders.
2. Environmentalists, researchers, scientists will use new data visualizations tools
3. A research correlation will be develop among local-regional-state-national-continental-global wildlife issues and change in trend will be analyzed further.
4. The devices will help to know human-animal conflict and rescue.
5. Poaching will be restrained, and if any poachers will be tracked easily
6. Tourism operators will provide wildlife safari without any fear
7. A wearable band will monitor the health of animals so that any fluctuations in his body temperature, BP, heart beats etc will be noticed and intimated soon.

The benefits derived from IoT are endless, the future will unfold the applications and consequences in different sector. What we imagine today will become reality tomorrow, we just at present need to technically strategize our moves so that IoT benefits be availed.

CONCLUSION

At present, India is witnessing digital revolution be it in form of cashless societies, digital economy, digital literacy, thus, it is very much important that such upgradation must be propagated to non-human living things. Government of India had initiated multiple "Projects" for saving animals in order to save those endangered species which plays a vital role in maintaining a balanced eco-system. There are number of laws enforced by government and man amendments are done into it so as to safeguard the interests of animals, humans and whole planet as a whole. Technology and Life must go hand in hand in order to safeguard interest of all stakeholders on this planet. The change in the thought process will be eventually done when one of the human core values will be "save animals". The Tourism sector being driver of the Indian economy needs to be given utmost importance so that it satisfies its all stakeholders. Various government initiatives such as Make in India and start up India will contribute to the rise in this business area.

ACKNOWLEDGMENT

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Prof. Madhavi Shamkuwar
Assistant Professor, Zeal Education Society's, ZIBACAR, Narhe, Pune , India.

Dr. Aniruddha Joshi
Assistant Professor , PUMBA, Department of Manageemnt sciences , Savitribai Phule Pune University , Pune, India.

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